United States Department of the Interior

FISH AND WILDLIFE SERVICE

Washington Fish and Wildlife Office
510 Desmond Dr. SE, Suite 102
Lacey, Washington 98503

AUG 10 2009

In Reply Refer to:
13410-2007-F-0004

Mr. Daniel Mathis
U.S. Department of Transportation
Federal Highway Administration
711 Capital Way South, Suite 501
MS 40943
Olympia, Washington 98501-1284

Subject: Washington State Department of Transportation Programmatic Biological Assessment for the Western Washington Regions – Biological Opinion

Dear Mr. Mathis:

This document transmits the U.S. Fish and Wildlife Service's (Service) Programmatic Biological Opinion (PBO) on our review of the proposed projects described in the Washington State Department of Transportation (WSDOT) Programmatic Biological Assessment (PBA) for the Western Washington Regions (Northwest, Southwest, and Olympic Regions) located all western Washington counties west of the Cascades, and portions of Yakima and Klickitat counties, Washington, in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*). The PBA addresses the following nine programs that may be funded by Federal Highway Administration, permitted by the U.S. Army Corps of Engineers, or occur on lands administered by the National Park Service (Mount Rainier, Olympic, North Cascades), and U.S Forest Service (Mount Baker-Snoqualmie, Olympic, Gifford-Pinchot). All projects are carried out by WSDOT.

1. Pavement Preservation
2. Slide Abatement and Repair
3. Bank Stabilization and Flood Damage Repair

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4. Bridge Repair, Retrofit, Replacement, and Maintenance
5. Mobility Improvement
6. Safety Improvement
7. Facilities Preservation and Construction
8. Environmental Retrofit and Enhancement
9. Drainage System Maintenance and Repair

A detailed description of the activities that may be carried out under each of these programs can be found in the PBO.

The PBA addresses effects of the nine separate programs on the following listed species: grizzly bear (*Ursus arctos horribilis),*gray wolf (*Canis lupus*), Canada lynx (*Lynx canadensis*), Columbia white-tailed deer, (*Odocoileus virginianus leucurus*), California brown pelican (*Pelecanus occidentalis*), bald eagle (*Haliaeetus leucocephalus*), western snowy plover (*Charadrius alexandrinus nivosus*), marbled murrelet (murrelet) (*Brachyramphus marmoratus marmoratus*), northern spotted owl (*Strix occidentalis caurina*), green sea turtle (*Chelonia mydas*), loggerhead sea turtle (*Caretta caretta*), Olive Ridley sea turtle (*Lepidochelys olivacea*), leatherback sea turtle (*Dermochelys coriacea*), bull trout (*Salvelinus confluentus*), Oregon silverspot butterfly (*Speyeria zerene hippolyta*), marsh sandwort (*Arenaria paludicola*), Bradshaw's desert-parsley (*Lomatium bradshawii*), golden paintbrush (*Castilleja levisecta*), water howellia (*Howellia aquatilis*), Nelson's checker-mallow (*Sidalcea nelsoniana*), Ute ladies' tresses (*Spiranthes diluvialis*), and Kincaid's lupine (*Lupinus sulphureus kincaidii*). Also considered in this PBA are project effects to designated critical habitat for bull trout, western snowy plover, murrelet, and northern spotted owls.

Your December 1, 2005, request for formal consultation and conference was received in this office on December 1, 2005. We received additional information via email on April 27 and May 2, 2007 regarding brown pelican and Canada lynx, respectively. Initially, FHWA was the only Federal agency requesting consultation using the proposed programmatic. However, due to the Federal nexus provided through Federal permitting by the U.S. Army Corps of Engineers, National Park Service, and U.S. Forest Service, these other agencies provided letters to WSDOT stating that they would accept the proposed programmatic for activities that required permits for the proposed WSDOT activities. The Olympic and North Cascades National Parks also included additional conservation measures for lands under their authority as part of the proposed action. These conditions have been incorporated into the programmatic. Mount Rainier National Park requires that they first review the proposed WSDOT projects, annually, and will respond to the Service regarding their concurrence before projects under this Programmatic are approved within the boundaries of this park.

The bald eagle was removed from the Federal List of Threatened and Endangered Wildlife, effective August 8, 2007. Given that the proposed action is being implemented after this date, consultation under section 7(a)(2) of the Act is not required. We have therefore not provided concurrence on your effect determination for the bald eagle.

Although the bald eagle is no longer listed under the Act, it is still provided protection under the Bald and Golden Eagle Protection Act (BGEPA) and the Migratory Bird Treaty Act. The BGEPA prohibits activities that "disturb" bald eagles. The definition for "disturb" under BGEPA is very similar to definitions for harm and harass under the Endangered Species Act. The definition for "disturb" under the BGEPA is as follows:

> *Disturb*: to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with its breeding, feeding, or sheltering behavior, or 3) nest abandonment by substantially interfering with its breeding, feeding, or sheltering behavior.
>
> In addition to immediate impacts, this definition also covers impacts that result from human-caused alterations initiated around a previously used nest site during a time when eagles are not present, if, upon the eagle's return, such alterations, agitate or bother an eagle to a degree that injures an eagle or substantially interferes with normal breeding, feeding, or sheltering habits and causes, or is likely to cause, a loss of productivity or nest abandonment (USFWS 2007a; , US Army Corps of Engineers, *in litt*. 2009, p. 117).

The Service has published national bald eagle management guidelines that assist in compliance with BGEPA. These guidelines also state that more or less restrictive measures may be necessary based on site-specific information. At this time in Western Washington, we recommend that the guidelines set forth by the Washington Department of Fish and Wildlife be considered as "best available science" for bald eagles west of the Cascades to avoid disturbance and "take" of bald eagles under the BGEPA. We recommend that you continue to condition permits for activities that might result in disturbance of bald eagles to assist applicants in complying with the BGEPA.

The FHWA and WSDOT determined that activities covered under the nine programs as described in the PBA would have no effect on short-tailed albatross and western snowy plover critical habitat. There is no requirement for U.S. Fish and Wildlife Service concurrence. Your determination that theses projects and activities will have "no effect" on these species and critical habitat rests with the action agency. In addition, based on information provided by the Service to WSDOT (Cindy Callahan, Washington Department of Transportation, Consultant, *in litt*. March 20, 2007), several other species were included in this list. The list of species that have been determined by WSDOT and FHWA to have "no effect" from the proposed action includes the following:

- Leatherback sea turtle
- Green sea turtle
- Ridley sea turtle
- Ute ladies tresses

Concurrence by the Service is not required when an action is determined to have "no effect" on listed species by the action agency. Therefore, we will not address these species or critical habitat further.

For the following species, FHWA and WSDOT determined that the activities covered under the nine programs as described in the PBA "may affect, but are not be likely to adversely affect" the following species: grizzly bear, gray wolf, Canada lynx, Columbia white-tailed deer, short-tailed albatross, California brown pelican, western snowy plover, Oregon silverspot butterfly, marsh sandwort, Bradshaw's desert-parsley, golden paintbrush, water howellia, Nelson's checker-mallow, and Kincaid's lupine (Table 1). The Service concurs with the "not likely to adversely affect" determinations for these species, provided the projects' activities being proposed are consistent with the parameters specified in the PBA and are implemented with these parameters. The rationale for our concurrence for each of these species is provided in the enclosed document. Any activity or project that does not meet the parameters described in the PBA, including the conditions and conservation measures provided, or that would cause an adverse effect to the species named in this paragraph, will require a separate individual consultation outside of this programmatic consultation.

Table 1. Species proposed for "may affect, not likely to adversely affect" determination.

Endangered Species	
California Brown Pelican	***Pelecanus occidentalis***
Columbia White-tailed Deer	***Odocoileus virginianus leucurus***
Arenaria paludicola	**Marsh Sandwort**
Lomatium bradshawii	**Bradshaw's Lomatium**
Threatened Species	
Canada Lynx	***Lynx canadensis***
Gray Wolf	***Canis lupus***
Grizzly Bear	***Ursus arctos horribilis***
Oregon Silverspot Butterfly	***Speyeria zerene hippolyta***
Western Snowy Plover	***Charadrius alexandrinus nivosus***
Castilleja levisecta	**Golden Paintbrush**
Howellia aquatilis	**Water Howellia**
Lupinus sulphureua kincaidii	**Kincaid's Lupine**
Sidalcea nelsoniana	**Nelson's Checker-mallow**

The Service agrees with the FHWA and WSDOT that certain activities or projects addressed in the PBA may adversely affect murrelets, northern spotted owls, and bull trout, or may cause adverse effects to designated or proposed critical habitat for murrelets, northern spotted owls or bull trout. The PBO analyzes and quantifies those effects and the proposed means of avoiding and minimizing them, provides a statement authorizing limited incidental take of individual animals or habitats, and provides conservation measures and terms and conditions to further avoid adverse effects.

We would also like to thank the agencies, especially WSDOT, for their patience and assistance in the development and review of the PBO. We anticipate that as it is used, WSDOT and the

Service will find areas that may need to be modified to further improve on the PBO and its use. We look forward to working with you on this and other actions in the future.

If you have any comments or questions regarding this Programmatic Biological Opinion, please contact Nancy Brennan-Dubbs at (360) 753-5835 or John Grettenberger at (360) 753-5835.

Sincerely,

Ken S. Berg, Manager
Washington Fish and Wildlife Office

cc:
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Mount Rainier National Park, Ashford, WA (R. Andrascik)
Olympic National Park, Port Angeles, WA (N. Hendricks)
North Cascades National Park, Sedro-Woolley, WA (C. Jones Winings)
Olympic National Forest Olympia, WA (S. Piper)
Olympic National Forest Olympia, WA (B. Metzger)
Mount Baker-Snoqualmie National Forest, Everett, WA (G. Ketcheson
Mount Baker-Snoqualmie National Forest, Everett, WA (J. Plumage)
U.S. Army Corps of Engineers, Seattle, WA (M. Baird)

LITERATURE CITED

USFWS (U.S. Fish and Wildlife Service). 2007. Protection of eagles; definition of "disturb." Federal Register 72(107):31132-40.

In Litteris REFERENCES

Cindy Callahan, Washington Department of Transportation, Consultant, *in litt.* March 20, 2007.

Endangered Species Act – Section 7 Consultation

Programmatic Biological Opinion Western Washington Regions of the Washington State Department of Transportation

U.S. Fish and Wildlife Service Reference #
13410-2007-F-0004

Action Agency: Federal Highway Administration,
Army Corps of Engineers, Seattle District

Consultation Conducted By:
U.S. Fish and Wildlife Service
Washington Fish and Wildlife Office

August 2009

Ken S. Berg, Manager
Washington Fish and Wildlife Office

8/10/09
Date

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Acynoms and Abbreviations

BMP	best management practices
BST	bituminous surface treatment
CHU	Critical Habitat Unit
Corps	U.S. Army Corps of Engineers
CWA	Clean Water Act
EMJ	Expert Judgment Model
ESA	Endangered Species Act
FHWA	Federal Highways Administration
FMO	Foraging, Migrating and Overwintering
GHPA	General Hydraulic Permit Approval
GIS	Geographic Information System
HCP	Habitat Conservation Plan
HOV	high-occupancy vehicle
HPA	Hydraulic Permit Approval
HRM	Highway Runoff Manual
IRU	Interim Recovery Unit (bull trout)
ISPG	Integrated Stream bank Protection Guidelines
LWD	large woody debris
Murrelet	Marbled Murrelet
NOEC	no observed effect concentration
NPDS	National Pollutant Discharge Elimination System
OHWM	Ordinary High Water Mark
PBA	Programmatic biological assessment
PBO	Programmatic biological opinion
PGIS	pollutant-generating impervious surface
RPM	reasonable and prudent measures
Service	U.S. Fish and Wildlife Service
SOSEA	spotted owl special emphasis areas
SPCC	Spill Prevention Control and Countermeasures
SPL	Sound Pressure Levels
SR	State Route
TDA	Threshold Discharge Area
TESC	Temporary Erosion and Sediment
TL	Transmission Loss
TTS	Temporary Threshold Shift
WDNR	Washington Department of Natural Resources
WDOE	Washington Department of Ecology
WFPR	Washington Forest Practices Rules
WSDA	Washington State Department of Agriculture
WSDOT	Washington Department of Transportation

CONSULTATION HISTORY

The Programmatic Biological Assessment (PBA) was originally submitted by Federal Highway Administration (FHWA) to the U.S. Fish and Wildlife Service (Service) Division of Consultation and Technical Assistance in August 2005. A revised PBA, dated December 1, 2005, was received on December 2, 2005.

Initially, the PBA was developed to only address projects[1] to be carried out by the Washington State Department of Transportation (WSDOT) that receive funding from the FHWA. The Seattle District, Army Corps of Engineers (Corps) subsequently provided a letter to WSDOT dated and received on June 4, 2007, accepting the use of the PBA for completing Endangered Species Act consultations when the Corps is the action agency (i.e., issues a section 10 of the Rivers and Harbors Act or section 404 of the Clean Water Act (CWA) permit for the proposed action). In some cases, an activity proposed by WSDOT does not receive funding from FHWA, and the Federal nexus is the Corps permit. Additionally, the U.S. Forest Service (Olympic, Mount Baker-Snoqualmie, and Gifford Pinchot) and National Park Service (Olympic, North Cascades, and Mount Rainier) also submitted letters to WSDOT. These letters document their acceptance of the PBA for WSDOT/FHWA activities conducted under the PBA on lands administered by these agencies and include specific conditions, as stated under the section on Procedures for Using the PBA. These Federal agencies require permits for activities that occur on lands they administer. The National Park Service and National Forest Service have requested that additional conditions be included for activities conducted under this programmatic on their lands. Those conditions related to federally listed species and critical habitat have been incorporated as part of the proposed action.

The Service met regularly with WSDOT to modify the scope of the PBA and develop a mutually agreeable project that addresses regularly occurring projects undertaken by WSDOT. Through this collaborative process impacts to listed species have been minimized while allowing for a more expedited consultation process for FHWA and WSDOT.

This Programmatic Biological Opinion (PBO) is based on information provided in the revised Programmatic Biological Assessment and numerous email correspondence and meetings. A complete record of this consultation is on file at the Washington Fish and Wildlife Office, in Lacey, Washington.

[1] The PBO addresses both individual and multiple activities within a project. Therefore, these terms are used interchangably within this document. The action refers to the programmatic consultation as a whole.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

Action Area

The action area is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR § 402.02). In delineating the action area, we evaluated the farthest reaching physical, chemical, and biotic effects of the action on the environment.

The action area generally includes all of Washington west of the Cascade crest. It also includes two small areas east of the Cascade crest. Specifically, the action area includes all areas where airborne and in-water disturbance and/or effects may exceed ambient conditions as a result of the proposed activities associated with state routes within WSDOT's three western regions: the Olympic Region, Northwest Region, and Southwest Region. The action area includes activities in the following counties: Clallam, Clark, Cowlitz, Grays Harbor, Island, Jefferson, King, Kitsap, Klickitat, Lewis, Mason, Pacific, Pierce, Skagit, Skamania, Snohomish, Thurston, Wahkiakum, and Whatcom Counties, and a small portion of Yakima County.

For determining the extent of airborne impacts, a 1 mile distance measured from approximately the centerline of both sides of the state route is used for determining the extent of airborne sound disturbance that may result from blasting and/or pile driving (Figure 1). Blasting and pile driving are anticipated to have the greatest potential airborne effects associated with the proposed activities.

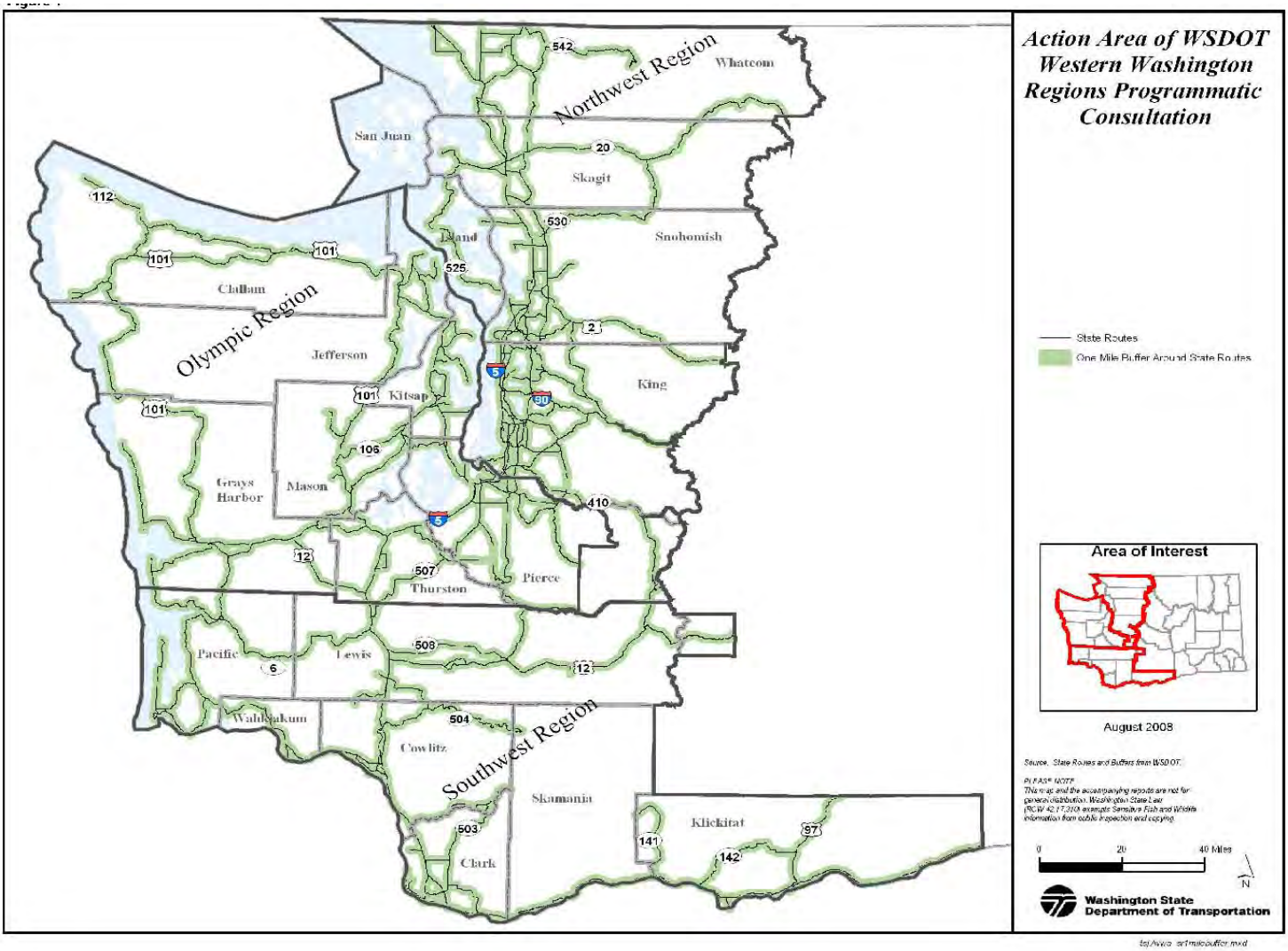

Figure 1. Action area of WSDOT Western Washington Regions programmatic consultation.

In-water sound effects from pile driving can extend beyond 1 mile. In-water pile driving is only proposed within freshwater environments such as streams and rivers. Pile driving in the marine or estuarine environment is not included in this consultation. The Service expects that in-water sound pressure levels are constrained by adjacent land masses. For this PBO we expect that the meanders associated with affected waterbodies will limit the extent of in-water sound pressure levels to the area between the banks and extending on average up to 1 mile upstream and downstream. Other impacts to in-water environments (for example, sediment impacts) are not expected to extend beyond this distance.

Proposed Activities Covered Under this Programmatic Consultation

The PBO covers routine projects carried out by WSDOT's three western regions: the Olympic Region, the Northwest Region, and the Southwest Region in Washington State.

The FHWA will fund or the Corps, National Park Service, or U.S. Forest Service will permit and WSDOT will carry out activities included in the nine programs listed below and specifically addressed in this PBO.

1. Pavement Preservation
2. Slide Abatement and Repair
3. Bank Stabilization and Flood Damage Repair
4. Bridge Repair, Retrofit, Replacement, and Maintenance
5. Mobility Improvement
6. Safety Improvement
7. Facilities Preservation and Construction
8. Environmental Retrofit and Enhancement
9. Drainage System Maintenance and Repair

The following is a list of the nine programs and associated activities that are included as part of this programmatic consultation (Table 1). Additionally, the activities funded by these programs are not program specific. For example, a culvert replacement could be performed under several of the listed programs. Unless otherwise specified, the description of the activity and its effects are independent of the funded program and will only be described in detail once. Activities that occur under multiple programs are described under "Description of Activities Common to Multiple Programs" to avoid excessive duplication in the document.

Please note that other activities may occur within these nine programs. However, only those activities that are specifically described in this PBO have been analyzed and are covered by this document pursuant to compliance with section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq*.).

Table 1. WSDOT programs and activities covered under this programmatic consultation.

ACTIVITIES	PROGRAMS								
	Pavement Preservation	Slide Abatement and Repair	Bank Stabilization and Flood Damage Repair	Bridge Repair, Retrofit, Replacement and Maintenance	Mobility Improvement Program	Safety Improvement	Facilities Preservation and Construction	Environmental Retrofit and Enhancement	Drainage System Maintenance and Repair
Culvert replacement and/or installation	X	X	X	X	X	X		X	X
Culvert extension	X				X	X			X
Culvert repair	X	X	X		X	X		X	X
Culvert cleaning	X	X	X	X	X	X			X
Subsurface and hazardous waste sampling (includes drilling in wetlands, uplands, and in-water, and disposal of drilling muds)	X	X	X	X	X	X	X	X	X
Repairing and stabilizing streambanks		X	X	X	X	X		X	X
Temporary or permanent retaining walls/shoring walls in uplands and in-water (H piles with sheet pile, wood or concrete as shoring)		X	X	X	X	X			

ACTIVITIES	PROGRAMS								
	Pavement Preservation	Slide Abatement and Repair	Bank Stabilization and Flood Damage Repair	Bridge Repair, Retrofit, Replacement and Maintenance	Mobility Improvement Program	Safety Improvement	Facilities Preservation and Construction	Environmental Retrofit and Enhancement	Drainage System Maintenance and Repair
Repair and maintenance of roadside ditch, channels and/or slope repair (including minor grading along ditches)	X	X	X	X	X	X		X	X
Installing buttresses		X							
Installation of earth berms/fixed barrier during blasting		X							
Removal of material and debris (including sediment) from flowing waterbody or lake		X	X	X				X	X
Removal of debris from roadway		X	X						
Disposal of debris and material into approved, existing upland disposal sites	X	X	X	X	X	X	X	X	X
Placement of slide material (LWD only) into waterways (stream)		X							

ACTIVITIES	PROGRAMS								
	Pavement Preservation	Slide Abatement and Repair	Bank Stabilization and Flood Damage Repair	Bridge Repair, Retrofit, Replacement and Maintenance	Mobility Improvement Program	Safety Improvement	Facilities Preservation and Construction	Environmental Retrofit and Enhancement	Drainage System Maintenance and Repair
Stabilization of slide areas		X	X	X					
Slope flattening/shaping		X			X	X			
Road repair (patching, replacing road bed material)	X	X	X		X	X		X	
Alignment modifications		X	X	X	X	X		X	
Grinding old pavement	X			X	X	X	X		
Paving	X	X	X	X	X	X	X	X	
Repaving	X	X	X	X	X	X	X	X	
Asphalt plants	X				X	X	X		
Use of gravel pits	X	X	X	X	X	X		X	
Use of detour routes (existing roadways used)	X	X	X	X	X	X		X	
Creation of new impervious surface	X	X	X	X	X	X	X		
Expansion of buildings and parking					X		X		
Installation of signs, guideposts	X	X	X	X	X	X	X		
Raised channelization					X	X			
Signal improvements					X	X			

ACTIVITIES	PROGRAMS								
	Pavement Preservation	Slide Abatement and Repair	Bank Stabilization and Flood Damage Repair	Bridge Repair, Retrofit, Replacement and Maintenance	Mobility Improvement Program	Safety Improvement	Facilities Preservation and Construction	Environmental Retrofit and Enhancement	Drainage System Maintenance and Repair
Pavement markers	X	X	X	X	X	X	X		
Striping (new and maintenance), sweeping	X	X	X	X	X	X	X	X	
Installation of guardrails (new and upgrading)	X	X	X	X	X	X		X	
Installation of concrete jersey barriers		X	X	X	X	X			
Installation of impact attenuators					X	X			
Bridge removal, replacement, and/or reconstruction				X	X				
Temporary bridge				X	X	X			
Bridge widening				X	X	X			
Bridge scour repair			X	X	X				
Barge use			X	X	X				
Temporary work platform			X	X	X				
Bridge painting and washing				X					
Rivet replacement and crack stabilization on bridges				X					

ACTIVITIES	PROGRAMS								
	Pavement Preservation	Slide Abatement and Repair	Bank Stabilization and Flood Damage Repair	Bridge Repair, Retrofit, Replacement and Maintenance	Mobility Improvement Program	Safety Improvement	Facilities Preservation and Construction	Environmental Retrofit and Enhancement	Drainage System Maintenance and Repair
Repair/replacement of floating bridge cables				X					
New sidewalks				X	X	X	X		
Seismic retrofit				X	X				
Temporary access fill		X	X	X	X	X		X	
Blasting		X			X	X			
Pile driving		X	X	X	X	X		X	
Pile removal			X	X	X			X	
Vegetation removal	X	X	X	X	X	X	X	X	X
Re-vegetation	X	X	X	X	X	X	X	X	X
Placement of instream structures – riprap, barbs, groins			X	X				X	
Herbicide use		X	X	X	X	X	X	X	
Wetland enhancement			X	X	X	X	X	X	
Fish capture and handling (herding, seining, minnow traps, dip nets, electroshocking)/ exclusion and isolation (block nets)		X	X	X	X	X		X	X

	PROGRAMS								
ACTIVITIES	Pavement Preservation	Slide Abatement and Repair	Bank Stabilization and Flood Damage Repair	Bridge Repair, Retrofit, Replacement and Maintenance	Mobility Improvement Program	Safety Improvement	Facilities Preservation and Construction	Environmental Retrofit and Enhancement	Drainage System Maintenance and Repair
Fish habitat improvement, including fish ladders and fishways, removal of derelict fishing nets, replacement of culverts that create partial or complete fish barriers			X	X	X	X		X	X
Installation and/or maintenance of stormwater treatment facilities, including detention and retention basins				X	X	X	X	X	
Maintenance only of stormwater treatment facilities		X	X						X
Installation of stormwater outfalls			X	X	X	X	X	X	
Maintenance and/or installation of cross culverts and maintenance of catch basins	X	X	X		X	X	X		X
Beaver dam removal				X					X

	PROGRAMS								
ACTIVITIES	Pavement Preservation	Slide Abatement and Repair	Bank Stabilization and Flood Damage Repair	Bridge Repair, Retrofit, Replacement and Maintenance	Mobility Improvement Program	Safety Improvement	Facilities Preservation and Construction	Environmental Retrofit and Enhancement	Drainage System Maintenance and Repair
Fish habitat improvement, including fish ladders and fishways, removal of derelict fishing nets, culvert replacements			X	X	X	X		X	X
Lighting/Illumination	X	X	X	X	X	X	X		
Installation of noise walls in urban areas					X			X	
Installation of temporary fencing (around work areas)	X	X	X	X	X	X	X	X	X
Installation of drains in slopes to funnel off water/seepage		X							

The following provides a more detailed description of the proposed programs and activities included within these programs. In addition to the nine programs, minimization measures are proposed for these activities to minimize impacts to listed species. These measures are provided following the description of the proposed programs.

Pavement Preservation

Description of Program Activities

Activities conducted under this program include patch, repair, or replacement of pavement. WSDOT uses three types of pavement: (1) asphalt concrete (including hotmix asphalt), (2) chip seal [alternately termed bituminous surface treatment (BST)], and (3) Portland cement concrete. WSDOT may also include the following activities in pavement preservation projects: installation of roadside signs, guide posts, and raised pavement markers; guardrail improvements; paint striping; the raising of manholes, inlets, and guardrails; the repair of ditches and slopes; and the cleaning, repair, extension, and replacement of culverts. If minor maintenance and repair of bridges (such as expansion joint and rivet repair) is proposed within the same section of road, this may occur concurrently. Slope and ditch repair and culvert replacement activities are described in the section Activities Common to Multiple Programs.

WSDOT either overlays new asphalt concrete onto the existing pavement or grinds the existing pavement (cold-milling) prior to overlaying it with new asphalt. Cold milling creates dry pavement grounds that are hauled to a dumpsite, spread along the road shoulders, or recycled into new pavement. Profile grinding is another method of removing the pavement surface. Profile-grinding uses a series of diamond saws cooled by water that cut away the pavement. This creates a pavement slurry that requires disposal at a dumpsite. All asphalt paving projects use an asphalt plant area where asphalt is mixed with crushed rock to produce the new hotmix asphalt. WSDOT may use existing asphalt plants, or the contractor may establish a portable plant at an existing WSDOT or contractor-owned aggregate source.

BST is the application of hot liquid asphalt and a layer of crushed rock on an existing asphalt surface. The application of BST is also temperature and weather sensitive. WSDOT may also use a rock crushing operation to produce the necessary aggregate for hotmix asphalt and BST projects. Typically in western Washington, rock crushing operations are conducted at existing quarry or pit sites, rather than at the project site. We assume that for the purposes of this consultation, all rock crushing will occur at an existing permitted facility that is in compliance with the ESA.

WSDOT preserves Portland Cement Concrete Pavement by removing and replacing the existing pavement, placing additional dowel bars into the existing pavement, or only grinding the existing surface (profile-grinding).

Paint striping is performed using a moving vehicle and may be completed with oil based or latex based paints, self-adhesive strips, or inset durable lane strips. Painting must be initiated and completed in dry weather.

Guardrail improvements include either the complete replacement of the guardrail or replacement of only the posts. WSDOT uses post drivers or "guardrail punch" to install the guardrail posts.

Repair or replacement of worn or damaged culverts prevents damage to the roadbed from water saturating the roadbed fill material. Typically, the culvert work for paving projects occurs in non-fish bearing streams. Any culvert work in streams that may be used by bull trout will meet the minimization measures required and described in the *Culvert Replacement and/or Installation* section below.

Equipment

WSDOT uses the following types of equipment/facilities to construct pavement preservation projects: heavy trucks, asphalt grinders, pavers, chip spreaders, rock crushing operations, asphalt plants, front end loaders, compactive rollers or tampers (both vibrating and static), small trucks, backhoes, guardrail post drivers, and traffic control devices.

Timing and Duration

WSDOT constructs most pavement preservation projects between May and September due to dry weather. If weather allows (dry conditions), pavement preservation projects may occur at any time of the year. Project activities may occur 7 days a week, during daylight hours only, night time only, and/or 24 hours per day. Existing traffic volumes determine the project schedule. These projects take from 1 to 120 working days to complete.

Anticipated Activities

The three WSDOT Regions within the PBO coverage area include approximately 8,932 lane-miles of pavement. WSDOT must repave each section of highway every 10 to 14 years. WSDOT planned to construct 182 pavement preservation projects between June 2005 and May 2007, and plans to construct 90 projects between June 2007 and May 2009 if sufficient funds are available. The anticipated lane-miles of roadway that may be paved during the life of the programmatic are unknown. We anticipate approximately 750 lane-miles per year total based on the lane-miles of pavement within the action area and frequency of repavement or approximately 250 lane-miles per WSDOT Region per year. Therefore, over the life of the programmatic, we anticipate 3,750 lane-miles of repavement.

<u>Slide Abatement and Repair</u>

Description of Program Activities

The activities proposed typically remove slide debris (e.g., mud, rock, snow, debris) from the roadway, stabilize the slide areas, and repair roads damaged by slides. Permanent slide stabilization measures are usually taken once the underlying cause of the slide is determined. However, under emergency conditions, permanent slide stabilization typically occurs immediately following the event. Non-emergency slide repair typically occurs during summer months. WSDOT determines the underlying cause of the slide before a long-term stabilization project is developed, often utilizing subsurface sampling and testing. The following are the

different unstable slope categories addressed in this program: landslides, debris flows, rockfalls, slope erosion, and settlement. Please see the "Definitions" section (Appendix A) for details regarding each of these categories.

WSDOT uses the following methods to stabilize or control the slide: buttresses/berms/shear keys, retaining walls, scaling, anchored rock dowels, rockfall catchments and fencing, draped wire mesh, contouring the slope, terracing the slope, installing drains to collect and funnel water away from the slope, and installing plantings. WSDOT may also use blasting to stabilize rockfalls or to break up fallen rock. Earth berms or fixed barriers may be installed to protect sensitive areas (primarily waterbodies such as wetlands, lakes, and streams) or as a safety measure to reduce the extent of flying debris. Additional information on blasting is addressed under Activities Common to Multiple Programs - Blasting. Permanent repairs of unstable slopes typically are conducted outside of waterbodies. However, rebuilding of the slope and placement of riprap and retaining walls may occur below the ordinary high water mark. No more than 300 cy of riprap or other bank hardening material (approximately 750 ft^2) may be placed below ordinary high water as part of a proposed project or within a stream reach. Additionally, no more than 2,000 ft^2 (100 lineal ft) of riprap may be place along the streambank per proposed project or stream reach.

Small temporary access roads may be constructed to allow a drill rig to reach the blasting location. Temporary roads and impacted areas would be restored when work in completed. Road widening may also occur as part of this program to provide landings for rock slides in the Cascades within the WSDOT Southwest and Northwest regions. Small amounts of impervious surface are created for rockfall landing areas; these are not considered pollution generating.

Slide material may be removed from a stream or river if it is interfering with the water flow. This may result in mechanized equipment entering the stream system. However, material is left in the creek if it would create more impact to remove it. Fish handling and exclusion are not anticipated as part of the slide material removal effort.

WSDOT usually disposes slide materials at existing gravel pits and waste depositories. This may include WSDOT or privately-owned sites. WSDOT may use suitable material from slides for other maintenance or construction activities. Material deposited at privately-owned sites is also available for construction activities. Slide material is never disposed of within freshwater waterbodies. However, large woody debris (LWD) may be removed from slide material and placed into the waterbody. This is typically at the direction of the Washington Department of Fish and Wildlife as mitigation for instream impacts. LWD must be free of sediments prior to placement. The LWD may be anchored using cables or bolts or excavated into the streambank to stay in place; however, anchoring is not always required.

Vegetation removal may also occur as part of Slide Repair and Abatement activities. This activity will be addressed under Activities Common to Multiple Programs – *Vegetation Removal* below.

Equipment

WSDOT may use the following equipment: dump trucks, front-end loaders, excavators, track or pneumatic drill, bulldozers, rock crusher (if blasting is used for on-site fill), pile driver, explosives, chainsaws, traffic control devices, air compressor, cranes, and other heavy equipment.

Timing and Duration

Most slides occur during the winter or during periods of heavy rainfall; however, work may occur at any time of year. Work may occur at any time of day or night. The duration of work is variable. Some work is completed at high elevations and is therefore weather-sensitive. Projects may take from 14 to 120 working days, depending on the magnitude of the slide.

Anticipated Activities

Thirty-eight slide abatement and repair projects were planned in the 05-07 Biennium. Twenty-four slide abatement and repair projects are planned between May 2007 and June 2009. These projects are also completed on an as needed or emergency basis. Therefore, additional slide abatement and repair projects will likely occur during this time period. The WSDOT Chronic Environmental Deficiencies program defines locations requiring repeated repair. It identifies a need for slide abatement and repair projects at approximately 1,358 unstable slope areas in the three WSDOT Regions (Table 2). WSDOT (2006) identifies the most problematic areas. WSDOT has ranked these areas based on soil and rock type, average daily traffic, maintenance costs, failure frequency, and several other factors. As funding is available, the highest priority unstable slopes will be repaired. From now through 2010, approximately eight of these projects are funded for construction within the action area.

Table 2. Slide Abatement and Repair Program 2003 to 2009 WSDOT Chronic Deficiency Unstable Slopes (approximate.)

Project Type	**NW**	**SW**	**OLY**	**Total**
Landslide	101	56	202	359
Rock fall	156	175	45	376
Debris Flow	30	2	60	92
Slope Erosion	39	41	180	260
Settlement	114	27	130	271
Total	**440**	**301**	**617**	**1,358**
Total per Year (based on 6 year average)	**73**	**50**	**103**	**226**

WSDOT proposes up to two projects within this program per year for each region over the life of the programmatic that may have adverse effects to bull trout and bull trout critical habitat. These projects may result in the installation of LWD into streams. No adverse effects to bull trout or bull trout critical habitat are permitted under this programmatic for projects in the Lower Columbia Basin Interim Recovery Unit (IRU). Also, up to one blast each per marbled murrelet (murrelet) conservation zone (Conservation Zones 1 and 2) and northern spotted owl provinces (Eastern Washington Cascades and Olympic Peninsula Provinces only) may occur over the life

of the programmatic during the nesting season adjacent to suitable nesting habitat, if needed, as part of an emergency slide removal project.

Bank Stabilization and Flood Damage Repair

Description of Program Activities

High flows during floods, spring run off, or high tides can cause bank erosion and undermine the roadway. Bank stabilization projects protect the embankments at bridges, culverts, and roadway sections from erosion. Immediate repairs normally involve protection or reconstruction of the road prism and associated infrastructure such as culverts and utilities. WSDOT will clean clogged culverts or replace them with larger culverts if necessary, remove material from a stream or lake, and clear flood debris from the roadway. Vegetation may also be removed. Fish handling and fish exclusion devices are proposed as part of this proposed program. Culvert replacement, fish handling, and vegetation removal activities are described in the section Activities Common to Multiple Programs below. WSDOT disposes of flood debris removed from roads at existing designated disposal sites.

Bank stabilization techniques include the following: riprap armoring, barbs, groins, J-hook vanes, drop structures, turning rocks, porous weirs, "W" weirs, cross vanes, engineered log jams, and bioengineered technique. Please see Appendix A ("Definitions") for a description of each of these techniques. Emergency repairs typically involve the placement of riprap by an excavator or end dumping if conditions are unsafe for an excavator. Bioengineering techniques are primarily used for non-emergency or post-emergency bank stabilization. Integrated Stream bank Protection Guidelines (ISPG) recommendations are incorporated where practicable (See MM - 71). No more than 300 cy of material (750 ft^2), such as riprap, may be placed below the ordinary high water line per project or stream reach. Bank stabilization may permanently impact up to 2,000 ft^2 of stream bank (no more than 100 linear ft) per project or stream reach.

Installation of bank stabilization (including riprap) within or adjacent to marine and estuarine waters is limited to Willapa Bay (StateRoute 101) (SR), Grays Harbor (SR 105), Hood Canal (SR 101 and SR 106), the Strait of Juan de Fuca (SR 112), and the mouth of the Columbia River (SR 401). All work within these areas will occur only where there is pre-existing bank hardening. Only one project per highway segment within these areas is permitted over the 5 year consultation period (Table 3). No more than 500 cy of riprap or other bank hardening material (approximately 1,200 ft^2) may be placed below mean lower low water as part of a proposed project. No more than 3,200 ft^2 (160 lineal ft) of riprap may be place along the bank per proposed project. In-water work would occur during allowable in-water work windows to minimize impacts to bull trout and bull trout forage fish, except for emergency actions. Placement of bank material may occur during low tide, when all placement would occur in the dry, and would not be subject to the timing window. No bank hardening would occur adjacent to known forage fish spawning beaches. Placement of bank hardening material will not affect eelgrass.

Table 3. Potential bank stabilization in marine waters - approximate (+/- 1 mile) locations by highway segment.

WSDOT Southwest Region Highway Segments	WSDOT Olympic Region Highway Segments
SR 101: MP 45 to MP 46	SR 101: MP 305.5 to MP 306
SR 101: MP 0.0 to MP 3.5	SR 101: MP 313.5 to MP 321.5
SR 105: MP 8.5 to MP 17.0	SR 101: MP 325.5 to MP 328.5
SR 105: MP 20 to MP 21	SR 101: MP 335 to MP 335.5
SR 401: MP 0.0 to MP 4.0	SR 106: MP 3.5 to MP 5.0
	SR 112: MP 5.0 to MP 10.5
	SR 112: MP 34.5 to MP 35)
	SR 112: MP 38.5 to MP 39.0

Several of methods described above use logs (LWD) as part of their structure. WSDOT uses three techniques to anchor LWD: wood or steel piling, earth or rock ("deadman") anchors, or rock overburden. Piling holds LWD in place and can be combined with cable or rebar. Earth anchors are plates driven into the streambed and attached to the LWD with cable. Earth anchors can only be used at sites with a soft substrate. When the substrate is too rocky for earth anchors or piling, WSDOT may use rock overburden (riprap). WSDOT may use these techniques in combination and/or with bank keying.

The following are common practices that WSDOT implements during the construction of bank stabilization and flood damage repair projects, where feasible: accessing sites from barges if waterbody is navigable; operating equipment from stream banks, bridges, or temporary work platforms; and using an aquatic spider excavator within small streams to minimize substrate disturbance.

Equipment

WSDOT uses backhoes, barges, bulldozers, excavators, aquatic spiders, dewatering equipment, pile drivers, dump trucks, front-end loaders, cranes, chainsaws, generators, traffic control devices, and other heavy equipment to construct these projects.

Timing and Duration

Emergency work can occur throughout the year as soon as possible after or during the storm event. Non-emergency repairs are normally scheduled during appropriate fish windows, usually during low instream flows, from mid-June to late September, depending on the weather and water body and July 16 to February 15 for marine waters when bull trout are less likely to be exposed to in-water work in the marine nearshore. Additional timing restrictions may apply due to potential impacts within forage fish spawning areas. Projects take 1 to 120 working days to complete.

Anticipated Activities

WSDOT proposes two projects per region per year, or approximately 30 projects over the life of the programmatic. Five bank stabilization and flood damage repair projects were planned for the 05-07 Biennium. No repairs are proposed in the 07-09 Biennium. However, future flood events and high stream flows could result in the need to complete more projects.

Bridge Repair, Retrofit, Replacement, and Maintenance

Description of Program Activities

There are 2,380 bridges in the area covered under this PBO, 1,149 of which are over water. Approximately 30 percent of over-water bridges (349 bridges) are in urban areas. There are nine common types of bridges[2]: concrete slab, concrete arch, concrete box girder, concrete T beam, steel beam, pre-tensioned concrete beam, post tensioned concrete beam, steel truss, and timber trestle. Some bridges span the waterbodies they are crossing, while others have piers in the water. The number of piers in the rivers varies by bridge. Most new bridges are designed to span as much of the river as possible and to provide the least amount of constriction of the stream that is practicable. Most bridge piers are now drilled shafts filled with concrete and rebar, eliminating shallow footings that are susceptible to scour. WSDOT usually uses driven piles to widen existing bridges and for temporary structures such as work platforms, cofferdams, and detour bridges during construction.

This program includes a large number of activities that may also occur as part of other programs (see Table 1). The following activities/projects are specific to the bridge repair, retrofit, replacement, and maintenance program:

- Bridge Painting Projects**:** There are 340 steel bridges maintained by WSDOT in the PBO coverage area. Steel bridges are painted on a 10- to 12-year cycle. Bridge painting requires washing the bridge, abrasive blasting to remove all corrosion, and applying a number of coats of paint. During pressure washing, wash-water will be contained and pass through at least a #100 sieve to improve contaminant removal. Only specific areas proposed for painting will be washed. Paint must be applied in dry weather when temperatures are above 40 °F. Only bridge painting projects that meet the conditions of the general National Pollutant Discharge Elimination System (NPDES) (0039039) (Appendix B) and the General Hydraulic Permit Approval (GHPA) (111325-1) (Appendix C) permits or the most recent version are covered under this PBO. WSDOT often includes rivet replacement and crack stabilization in bridge painting projects.

[2] Bridges are defined as structures that are over 20 ft in diameter. This program, thus, excludes work on culverts that are typically less than 20 ft in roadway length. Culvert replacement and installation is described later in this document.

- Floating Bridge Projects**:** Floating bridges and bridges with moving spans have special maintenance requirements. Floating bridges are anchored by large cables that require regular adjustment and replacement. In addition, the pontoons may need to be replaced or repaired. Pontoons to be replaced are assembled and outfitted at an existing off-site facility then barged to the project site. We assume for this programmatic that these facilities are in compliance with the ESA. The existing pontoon is floated out and the new pontoon is floated into place and secured. Both types of bridges may have dolphins in place to help protect the support structures. Existing dolphins are typically constructed of treated wood piles. The dolphins may require replacement, typically with steel piles. Impact or vibratory hammers may be used, depending on if the structure is load bearing. Only the Duwamish Bridge (First Avenue Bridge) has load bearing dolphins. Dolphins may also be floating, and are anchored into place.

- Seismic Retrofit Projects**:** Many of the bridges in the WSDOT Regions are undergoing seismic retrofits. Retrofits can involve any of the following:

    - Replacing bolts and rivets with high strength connections.
    - Installing concrete catcher blocks at piers. These are constructed using steel reinforced forms filled with concrete, which is poured on-site.
    - Installing pier sleeves (collars). These collars are placed around existing columns, welded, and then filled with pumped grout. Water that may be displaced while being filled will be pumped out and contained. Installation in water may involve minor excavation.
    - Installing longitudinal restrainers, transverse girder restrainers, and/or transverse deck restrainers. These are typically installed under the bridge as looped steel cables or bolts. No fill or pile driving is required for their installation.

- Scour repair and prevention techniques may include installation of river training techniques identified in the ISPG and proposed in the Bank Stabilization and Flood Damage Repair program.

  There are over 200 scour critical bridges and culverts in the action area. Repair of scoured bridge piers can include construction of temporary cofferdams around affected piers to isolate work areas, concrete or gabion repair to footing, columns or abutments, placement of rip rap at scour locations, placement of concrete mattresses along bridge piers, or installation of concrete armor tetrapods (also known as A-JACKS). Concrete mattresses, gabions, or A-JACKS are used as direct bridge scour repair techniques, especially where there is a low bridge with a limited hydraulic opening and when hauling rock is cost prohibitive. Four previous bridge scour repair projects in western Washington covered 0 ft^2 to 1,687 ft^2, with an average of 750 ft^2, with riprap. The volume of riprap ranged between 0 and 500 cy for these projects. Some of this riprap is placed above the ordinary high water mark.

To install a concrete mattress, the streambed must be excavated at the leading and trailing edge to avoid the undermining of the device. The mattress is placed on geotextile or filter fabric with an excavator, and earth anchors are often used to secure it.

Construction of temporary access fills may be required to provide a working platform for machinery. Working platforms are usually constructed of light, loose riprap matched to the material necessary for the repair. The platform material is then repositioned as the machinery backs from the work site.

In addition to the above, other common activities occur under this program. Descriptions of these activities are below.

- In-Water Debris Removal: WSDOT removes debris from bridges by hand or by using chainsaws, winches, and heavy equipment, which is more common. Debris may include bedload, wood, and/or anthropogenic material. All debris removal activities must comply with the conditions of the Washington Department of Fish and Wildlife (WDFW) GHPA Large Woody Material/ Debris Removal, relocation, from WSDOT bridges permit (# 00000F3591-2) for debris removal from bridges and GHPA Beaver Dam Removal or Modification (#112548-1) (Appendix C). No fish handling or exclusion are anticipated as a result of debris removal. Beaver dams are typically removed from culverts in lowland streams and all material is removed by hand. Debris is disposed of at a regulatory approved site, except for large woody material. This material will be repositioned below the ordinary high water mark downstream of the bridge to provide function fish habitat. If in-water replacement is not feasible due to safety concerns, large woody material may be used for offsite restoration efforts. The majority of large woody material removed, however, is returned to the same waterbody.

- Structural Rehabilitation: Structural rehabilitation may include replacement or repair of degraded steel superstructure (e.g., steel girders), repair to bridge approaches, adding supports to columns, or repair or replacement of bridge rail.

- Bridge Deck Repair and Replacement Projects: Bridge deck repair and replacement occurs regularly. Deck removal may involve jackhammers, concrete saws, cold-milling (grinding), and hydro-milling (high-pressure water). Longer bridges have finger joints that must be repaired and replaced.

- Bridge Replacement Projects**:** Bridge replacements can be stand alone projects, or they can be part of a mobility improvement project. Bridge replacement construction activities may include the following:

    - Pile driving and removal
    - Construction of a detour bridge
    - Temporary bridges for work platforms
    - Bridge removal
    - Clearing and grubbing of existing streamside vegetation
    - Excavation for new bridge abutments

- Concrete pouring
- Construction of bridge abutments
- Construction of bridge columns
- Rip rap placement
- Clearing and grading for road widening
- Construction of stormwater facilities
- Paving with asphalt concrete

Bridges can be removed using several methods. Under the PBA, bridges may only be removed in the four ways listed in Table 4.

Table 4. Bridge Removal Alternatives Allowed Under the PBO

Type of Structure	Construction Method	Access Method
Steel or Timber	(a) Remove structure in segments without dropping pieces into water.	(a) Work from shore via crane arm or other heavy equipment.
		(b) Work from adjacent bridge deck or bridge approach.
		(c) Work from temporary platform or false work erected within the water.
		(d) Lower structure or segments onto barge. Barge material to shore.
Concrete	(a) Remove structure by segments without dropping into the water. Frequently concrete slabs may be removed via saw cutting	(a) Work from shore via crane arm or other heavy equipment.
		(b) Work from adjacent bridge deck or bridge approach.
		(c) Work from temporary platform or false work erected within the water.
		(d) Lower structure or segments onto barge. Barge material to shore.
Piers	(a) Leave the piers in place	N/A
	(b) Piers located out of water – cut at ground level and remove cut portion only.	(a) Work from shore via heavy equipment.
	(c) Piers located out of water – removed with hoe ram.	(a) Work from shore via heavy equipment.
	(d) Piers located in water – construct cofferdam around and remove pier.	(a) Work from shore via crane arm or other heavy equipment. (b) Work from adjacent bridge deck or bridge approach. (c) Work from temporary platform or false work erected within the water. (d) Lower structure or segments onto barge. Barge material to shore.
	(e) Piers located in water – use vibratory hammer to lift and remove.	(a) Work from shore via crane arm or other heavy equipment. (b) Work from adjacent bridge deck or bridge approach. (c) Work from temporary platform or false work erected within the water. (d) Lower structure or segments onto barge. Barge material to shore.
	(f) Piers located in water – cut or break off at or below surface level (dependent upon substrate).	(a) Work from shore via crane arm or other heavy equipment. (b) Work from adjacent bridge deck or bridge approach. (c) Work from temporary platform or false work erected within the water. (d) Lower structure or segments onto barge. Barge material to shore.

Bridge replacement projects often require column construction within stream channels. Column construction typically includes the isolation of the column location through the use of a large diameter steel sleeve that is driven into the stream substrate. All work, including excavation for the footing, placement of forms, and pouring of the concrete, is completed within the sleeve at each column location.

Equipment

WSDOT uses backhoes, bulldozers, excavators, barges, dump trucks, front-end loaders, scaffolding, drapes, generators, cranes, impact and vibratory pile drivers, drilling rigs, concrete saws, traffic control devices, and other heavy equipment for projects under this program. Most of the bridge repair, painting, and retrofit projects involve hanging scaffolding and containment devices under and around the bridge. Other access methods include access of the bridge deck on foot or via a bucket suspended from a truck on the bridge deck.

Timing and Duration

Bridge painting may only occur late spring through fall when temperatures are high enough to allow the paint to dry properly. Seismic retrofits are not temperature and/or time sensitive and may occur throughout the year, while joint replacement and bridge deck replacement are temperature dependent activities, limited to the warmer months. Bridge scour repairs tend to occur during the low water times of year. Bridge replacements may require two construction seasons to complete, as in-water work is limited to the fish windows for the season. Out-of-water work may occur year round. Bridge maintenance projects take between 1 to 400 working days to complete.

Proposed Activities

In the 05-07 Biennium, there were a total of 95 projects proposed under this program. Approximately 70 percent of these projects were proposed in urban areas. The following projects were proposed during the 05-07 Biennium:

- Scour repairs: Sixteen in-water scour repairs on a bridge pier
- Structural rehabilitation: Thirty general bridge repairs (electrical, approaches, rail, etc.) (28 are over water)
- Seismic retrofits: Eighteen (three are over water)
- Bridge Deck Repair and Replacement Projects: Four deck repair/replacements (three are over water)
- Bridge replacement projects**:** Eighteen bridge replacements and one bridge removal (all are over water)
- Culvert replacement: One (in-water)
- Bridge paintings: Seven (six are over water)

There are approximately 84 additional unfunded bridge projects planned for 2008 to 2015. Bridges on the scour critical list are repaired as funding is available.

WSDOT has proposed up to five bridge scour repair and seismic retrofit projects per region per year over the life of the programmatic that may result in adverse effects to bull trout and bull trout critical habitat. Up to 500 cy of riprap or other material (such as a concrete mattress, A-Jacks, or gabions) may be placed on up to 750 ft^2 of stream bed per project or stream reach. Up to 2,000 ft^2 of riprap may be placed on the stream bank (no more than 100 lineal ft) per project or stream reach. No adverse effects to bull trout or bull trout critical habitat are permitted under this programmatic for projects in the Lower Columbia Basin IRU.

Mobility Improvement Program

Description of Program Activities

Projects in this program improve traffic flow and operations on existing roadways. This PBO will not cover all of the projects included in this program. For example, projects, including new general purpose lanes, new interchanges, or new lanes from interchange to interchange, which result in or contribute to increased traffic capacity or other land use changes that result in effects, including indirect effects, not consider in this PBO. Minor improvements to adjacent non-Federal or state roadways (up to 300 ft) are included as indirect effects of the proposed action. These modifications may be necessary to provide a transition (such as a turn lane) from federally funded or permitted mobility improvement projects to locally funded and permitted lane modifications.

Typical projects that may be covered by the PBO include passing or truck climbing lanes; merge or auxiliary lanes, new high-occupancy vehicle (HOV) lanes, conversion of existing lanes to HOV lanes; installation of traffic monitoring devices, motorist information signs, traffic signs, weather stations, and traffic cameras; reconstructing existing interchanges; replacing aging state route bridges; and culvert cleaning, extension, replacement, and construction; installation and enhancement of drainage systems; construction of stormwater treatment facilities; paving; painting; and illumination. Interchange reconstruction can involve vegetation removal, grading, filling, bridge reconstruction or new bridge construction, drainage system installation and enhancements, stormwater treatment facility construction, culvert replacements, paving, painting, illumination, and signing. The previous section describes bridge replacements projects and the performance standards they will need to meet to be covered under the PBO.

Equipment

The following equipment is used for mobility projects: dump trucks, front-end loaders, cranes, asphalt grinders, paving machines, compactive rollers, bulldozers, chainsaws, explosives, excavators, rock crusher (if blasting is used to generate on-site fill) track or pneumatic drill, air compressor, traffic control devices, generators, and other heavy equipment.

Timing and Duration

WSDOT constructs mobility projects year-round. Mobility projects may take from 10 to 600 working days to complete.

Anticipated Activities

There are 45 mobility projects planned in the 07-09 Biennium. According to the current six-year plan (2007 to 2012), the majority (approximately 48 percent) of mobility projects are either road widenings or HOV lane additions. Approximately 26 percent of mobility projects consist of adding travel lanes, passing lanes, turn lanes, or truck climbing lanes. These lane additions range between 1 and 5.0 miles in length. Interchange and alignment improvements comprise approximately 15 percent of planned mobility improvements. The remaining 11 percent of the projects consist of transit, park and ride, pedestrian, bicycle, and driver information improvements. Approximately 75 percent of the planned mobility improvement projects are in urban areas.

Safety Improvement

Description of Program Activities

These projects include raised channelization, sign installation, installation of sidewalks, slope flattening/shaping (which often require culvert extensions), tree removal, brushing road prisms, cleaning culverts, guard rail installation, impact attenuators (barrels filled with sand, etc.), installation of concrete jersey barrier, installation of re-directional earth berms, rumble strips, cable guardrail installation, culvert installations, alignment modifications, and Information Technology System projects. Blasting may be required for some slope flattening or sight distance improvement projects. Slope flattening and/or shaping occurs on the upland side of roadways only; it is not associated with any work to modify a streambank. WSDOT may combine safety projects with pavement preservation or complete them as a separate project. Projects creating new interchanges or new lanes from interchange to interchange, which result in or contribute to increased traffic capacity or other land use changes that result in effects (including indirect effects not addressed in this PBO), are not covered by the PBO. The following is a description of those activities covered by the PBO.

Raised channelization often includes sloping curbed medians, often at intersections. Raised channelizations are typically constructed on existing impervious surfaces.

Brushing road prisms is the mechanical removal of vegetation adjacent to the roadway. Brushing typically removes small woody vegetation and small branches from adjacent trees.

Alignment modifications may include truck climbing and acceleration lanes, turn lanes, ramp extensions, and intersection realignments. If a new lane is added, an alignment modification of the adjacent road may be necessary to maintain the continuity of the roadway. The alignment modifications may also straighten curves or approaches to bridges. Alignment modifications could range in length from a few hundred feet to a couple thousand feet for curve realignments or up to a few miles for realigning a major section of roadway. Truck, turn, and acceleration lanes typically average between 10 and 12 ft wide.

Information Technology System projects include re-striping the roadway to provide a left turn lane, installing traffic cameras, channelization islands, curbs, illumination, signs, signal improvements, installing fiber optic cables, traffic cameras, variable message signs, weather stations, and state route advisory radio systems.

Equipment

The following equipment is used for safety projects: dump trucks, front-end loaders, asphalt grinders, pavers, chainsaws, explosives, excavators, bulldozers, rock crusher (if blasting is used for on-site fill), track or pneumatic drill, air compressor, traffic control devices, generators, and other heavy equipment.

Timing and Duration

WSDOT constructs safety projects year-round. Safety projects may last from 1 to 120 working days.

Anticipated Activities

A total of 139 safety improvement projects were planned for the 05-07 Biennium. According to the current six-year plan, the majority (approximately 53 percent) of safety projects are channelization or channelization/signal improvement projects. Channelization projects are typically less than 1 mile long. Road realignments and widenings comprise approximately 25 percent of planned safety projects and range between 1.0 mile and 5.0 miles in length. New interchanges and interchange improvements each total approximately 6 percent of planned safety projects. Slope flattenings, guardrail improvements, and communication systems make up the remaining safety projects. The majority of planned safety improvement projects (73 percent) are in urban areas.

Facilities Preservation and Construction

Description of Program Activities

Projects in this category consist of the preservation and maintenance of weigh stations, rest areas, and maintenance facilities**.** Activities at these facilities may include paving, expansion of buildings and parking areas, septic system expansion or alteration, and vegetation alteration and removal (including trees). Improvements to existing facilities rarely involve expanding the building footprint. The PBO only applies to activities conducted at existing facility locations. No in-water work is anticipated with this program. Currently there are 19 rest areas, 33 weigh stations, and 49 maintenance facilities in the PBO coverage area.

Equipment

The following equipment is typically used for the proposed activities: dump trucks, front-end loaders, asphalt grinders, paving machines, generators, traffic control devices, and other heavy equipment.

Timing and Duration

WSDOT performs facilities projects year-round. Facilities projects may take from 10 to 180 working days to complete.

Anticipated Activities

Approximately one project in this category is completed every four years in western Washington. However, there are 15 facilities projects planned for the 07-09 Biennium or approximately seven per year.

Environmental Retrofit and Enhancement

Description of Program Activities

These projects complete environmental mitigation or fix existing, deficient infrastructure. All projects in this program, with the exception of the noise walls, are proposed to have potential long-term benefits for wildlife and fish.

WSDOT funds the following types of projects with this program: installation of stormwater treatment facilities, correction of fish barriers, installation of new culverts, fishways, installation of fish habitat enhancement features, wetland mitigation, removal of old pilings, and installation of noise walls. Noise wall installation will occur only in urban areas, while the other projects will occur in both urban and rural areas.

WSDOT designates funding for fish barrier removal projects, removes fish barriers as part of larger road improvement projects, and corrects fish barriers as part of routine maintenance. WSDOT and WDFW inventory and prioritize fish passage barriers are part of a joint effort. Fish passage barrier removal projects can include but may not be limited to culvert replacements, bridge construction, and fishway modifications. The bridge repair section described bridge construction activities. Culvert replacement activities are described in the section Activities Common to Multiple Programs.

Fish habitat enhancement may also include the removal of derelict fishing nets. This activity may occur at the Hood Canal Bridge. Nets are cut by divers and then removed using a lift bag operated by a motorized sailing vessel.

WSDOT owns and maintains 143 fishways statewide. Fishways are modified culverts that have baffles or weirs downstream of the culvert to improve fish passage. Weirs created backwater at the culvert which provides a resting area for fish. Baffles reduce stream velocities. WSDOT usually constructs baffles with steel or concrete. Baffle installation involves diverting flow around the culvert. WSDOT also constructs small fish ladders in some locations.

Projects may clear from 100 ft^2 for a vegetated swale or small storm water pond, to 20 acres or more for a wetland mitigation site. Fish projects will occur in water bodies during low flow months. These projects may also remove riparian vegetation.

Herbicide application associated with activities included in the PBA includes weed control at environmental mitigation sites. WSDOT typically uses herbicides in conjunction with mechanical weed removal (such as mowing) and biological weed control[3] (to more effectively control nuisance and noxious vegetation at mitigation sites). A description on the use of herbicides is found in the *Herbicide Use* section below.

Equipment

WSDOT uses the following equipment for these activities: dump trucks, front-end loaders, backhoes, bulldozers, chainsaws, traffic control devices, generators, and other heavy equipment. Limited use of water craft may be used for work associated with the removal of derelict fishing nets. Hand tools, including back pack sprayers, are also used.

Timing and Duration

WSDOT constructs environmental retrofit projects year-round. Environmental retrofit projects may last from 3 to 90 working days. Fishway modification projects can typically be completed in 3 to 4 days.

Anticipated Activities

WSDOT has identified 47 fishways that need replacement and 5 that require maintenance. Of these, 38 fish passage projects have been identified for the next 6 years within the PBO coverage area. There were 17 environmental retrofit projects planned for the 05-07 Biennium and 31 environmental retrofit projects planned for the 07-09 Biennium. These environmental retrofit projects include culverts and fishways, as well as other activities.

WSDOT has proposed up to 10 fish habitat and passageway projects per region per year that may result in adverse affects for bull trout and bull trout critical habitat over the life of the programmatic. No adverse affects are permitted for bull trout within the Lower Columbia Basin IRU.

<u>Drainage System Maintenance and Repair</u>

Description of Program Activities

Activities in this category include all work necessary to maintain roadside ditches and channels, cross culverts, catch basins and inlets, and detention/retention basins to keep roadways free from excess water that would create a safety hazard. The repair of damaged culverts, including replacement of cross culverts, may also occur as part of this program. The following is a description of the activities performed under this program:

[3] The cinnabar moth is an example of a species used by WSDOT for biological weed control. The Integrated Vegetation Management for Roadsides (USFWS 2006a) provides additional information regarding biological weed control.

- Debris, sediment, and vegetation will be removed regularly at cross culverts.
- Replacement and/or repair of cross culverts.
- Drainage systems are regularly maintained by removing accumulated sediments, debris, and blockages and re-grading ditches.
- Beaver dams may be removed if the dams impact the effectiveness of cross culvert drainage facilities. The project must comply with WDFW GHPA Beaver Dam Removal or Modification (#112548-1).
- Material is removed from the drainage systems manually, by vacuum truck, backhoe, or other large machinery. Sediment and debris are used as fill if possible or disposed of it at existing permitted disposal sites that are in compliance with the ESA. Liquids that are removed are decanted at a permitted decant facility that is in compliance with the ESA.

Equipment

WSDOT usually maintains drainage systems during the summer, and uses the following equipment: dump trucks, front-end loaders, backhoes, bulldozers, double drum dragline, vacuum truck, culvert rodder, water tank truck, truck-mounted attenuator, other heavy equipment, and hand tools.

Timing and Duration

Drainage system maintenance and repair activities may occur at any time of year and are weather dependent. Most work is scheduled to occur during the summer, during low flow or dry conditions. Work may occur at any time of day or night, seven days a week. Most activities are completed within a few hours in any given location. However, activities may take from 1 to 5 working days to complete.

Anticipated Activities

There were three drainage projects planned for the 05-07 Biennium; however, routine maintenance occurs on an as-needed basis.

<u>Description of Activities Common to Multiple Programs</u>

The following is a description of activities that may occur under multiple programs (Table 1). Unless otherwise specified, the equipment, timing, and duration of these activities has been incorporated into the programs in which they are used.

Vegetation Removal

Description of Activity

Permanent conversion of a vegetated area into a developed area includes clearing vegetation, then grubbing out the roots. Temporary vegetative clearing would include cutting vegetation but

maintaining the root mass to allow for regrowth. The amount of vegetation removal will vary depending on the project. Construction of new lanes, interchanges, and mitigation sites are likely to result in the greatest vegetation losses. For example, interchange upgrades that included turn lanes and ramp widening could result in between 1.3 to 1.7 acres of vegetative loss, while a road widening resulting in 15 acres of vegetative impacts. Minor intersection upgrades, however, ranged from 800 ft^2 to 5,000 ft^2. The following information (Table 5) has been collected from 27 WSDOT projects in western Washington and provides a range of vegetation impacts that have occurred by program of work.

Table 5. Examples of vegetation removal by program or project type.

Program or Project Type	Number of Projects	Average Vegetation Removed	Range of Vegetation Removed	Total Vegetation Removed
Safety Improvement	6	0.53 acre	0 – 1.7 acres	3.18 acres
Mobility Improvement				
Sign installation	1	<50 ft^2	50 ft^2	50 ft^2
Road widening	1	15 acres	15 acres	15 acres
Pavement Preservation	8	767 ft^2	0 – 4,220 ft^2	6,136 ft^2
Bridge Scour Repair	4	726 ft^2	0 – 2,178 ft^2	2,904 ft^2
Bridge Replacement	2	1.0 acre	0.5 – 1.5 acres	2.0 acres
Environmental Retrofit and Enhancement	3	600 ft^2	500 – 800 ft^2	1,800 ft^2
Slide Repair	2	0.63 acre	1,000 ft^2 – 1.23 acres	1.25 acres

Equipment

Vegetation removal activities typically require use of large machinery and other equipment including, but not limited to excavators, bull dozers, backhoes, and chainsaws.

Timing and Duration

The timing and duration of this activity is addressed as part of the larger project (e.g., construction of a new lane).

Anticipated Activities

Based on the information provided, WSDOT anticipates the following removal of vegetation associated with listed species or their critical habitat over the life of the programmatic (Table 6). Note that the removal of individual suitable and un-suitable nest trees may occur as part of the suitable murrelet and/or northern spotted owl suitable and/or critical habitat acreage, or may occur as an individual activity (e.g., hazard tree removal).

Table 6. Anticipated vegetation and habitat impacts by WSDOT Region for federally listed species and their critical habitat per year, per region, and total.

Potential Vegetation Impacts	Southwest Region (per year)	Olympic Region (per year)	Northwest Region (per year)	Total per Region for Programmatic	Total for Programmatic
Removal of understory vegetation (includes trees less than 14 inches dbh) from murrelet nesting habitat	5 acres	5 acres	5 acres	25 acres (no more than 5 acres per stand)	75 acres (no more than 5 acres per stand)
Removal of understory vegetation and/or trees from 14 inches dbh to less than 19 inches dbh within 150 ft of murrelet suitable nest trees	0.5 acre	0.5 acre	0.5 acre	2.5 acres (no more than 0.5 acre per stand)	7.5 acres (no more than 0.5 acre per stand)
Removal of non-potential nest trees[4] 19 inches dbh and greater from murrelet nesting habitat	50 trees (no more than 25 per project or stand over the life of the programmatic)	50 trees (no more than 25 per project or stand over the life of the programmatic)	50 trees (no more than 25 per project or stand over the life of the programmatic)	250 trees	750 trees
Removal of potential nest trees from murrelet nesting habitat	15 trees (no more than five per project or stand over the life of the programmatic) (within Murrelet Zone 2, Southwest Area (Figure 2) only 1 potential nest tree in stands with 5 or more platforms per acre per year)	15 trees (no more than five per project or stand over the life of the programmatic)	15 trees (no more than five per project or stand over the life of the programmatic)	75 trees	225 trees

[4] Non-potential nest tree - a tree that may contain the suitable structure/size for providing nesting habitat, but due to its location or other factors, it is unlikely to be used for nesting purposes.

Potential Vegetation Impacts	Southwest Region (per year)	Olympic Region (per year)	Northwest Region (per year)	Total per Region for Programmatic	Total for Programmatic
Removal of understory vegetation or trees (includes trees less than 14 inches dbh) from murrelet critical habitat	5 acres	5 acres	5 acres	25 acres (no more than 5 acres per stand)	75 acres (no more than 5 acres per stand)
Removal of understory vegetation and/or trees from 14 inches dbh to less than19 inches dbh within 150 ft of murrelet critical habitat	0.5 acre	0.5 acre	0.5 acre	2.5 acres (no more than 0.5 acre per stand)	7.5 acres (no more than 0.5 acre per stand)
Removal of non-potential nest trees 19 inches dbh and greater from murrelet critical habitat	50 trees (no more than 25 per project or stand over the life of the programmatic)	50 trees (no more than 25 per project or stand over the life of the programmatic)	50 trees (no more than 25 per project or stand over the life of the programmatic)	250 trees	750 trees
Removal of potential nest trees from murrelet critical habitat	15 trees (no more than five per project or stand over the life of the programmatic) (within Murrelet Zone 2, Southwest Area (Figure 2) only 1 potential nest tree in stands with 5 or more platforms per acre per year	15 trees (no more than five per project or stand over the life of the programmatic)	15 trees (no more than five per project or stand over the life of the programmatic)	75 trees	225 trees
Removal of understory vegetation and/or trees less than 14 inches dbh from northern spotted owl nesting, roosting, and foraging habitat and/or dispersal habitat	5 acres	5 acres	5 acres	25[1] acres (no more than 5 acres per stand)	75 acres (no more than 5 acres per stand)

Potential Vegetation Impacts	Southwest Region (per year)	Olympic Region (per year)	Northwest Region (per year)	Total per Region for Programmatic	Total for Programmatic
Removal of understory vegetation and/or trees from 14 inches dbh to less than 19 inches dbh from northern spotted owl nesting, roosting, and foraging habitat and/or dispersal habitat	0.5 acre	0.5 acre	0.5 acre	2.5 acres (no more than 0.5 acre per stand)	7.5 acres (no more than 0.5 acre per stand)
Removal of non-potential nest trees 19 inches dbh and greater from northern spotted owl nesting and roosting habitat and/or dispersal habitat	50 trees (no more than 25 per project or stand over the life of the programmatic)	50 trees (no more than 25 per project or stand over the life of the programmatic)	50 trees (no more than 25 per project or stand over the life of the programmatic)	250 trees	750 trees
Removal of potential nest trees from northern spotted owl nesting habitat	15 trees (no more than five per project or stand over the life of the programmatic)	15 trees (no more than five per project or stand over the life of the programmatic)	15 trees (no more than five per project or stand over the life of the programmatic)	75 trees	225 trees
Removal of understory vegetation and/or trees less than 144 inches dbh from northern spotted owl critical habitat	5 acres	5 acres	5 acres	25[1] acres (no more than 5 acres per stand)	75 acres
Removal of understory vegetation and/or trees from 14 inches dbh to less than 19 inches dbh from northern spotted owl nesting, critical habitat	0.5 acre	0.5 acre	0.5 acre	2.5 acres (no more than 0.5 acre per stand)	7.5 acres
Removal of non-potential nest trees 19 inches dbh and greater from northern spotted owl critical habitat	50 trees (no more than 25 per project or stand over the life of the programmatic)	50 trees (no more than 25 per project or stand over the life of the programmatic)	50 trees (no more than 25 per project or stand over the life of the programmatic)	250 trees	750 trees

Potential Vegetation Impacts	Southwest Region (per year)	Olympic Region (per year)	Northwest Region (per year)	Total per Region for Programmatic	Total for Programmatic
Removal of potential nest trees from northern spotted owl critical habitat	15 trees (no more than five per project or stand over the life of the programmatic)	15 trees (no more than five per project or stand over the life of the programmatic)	15 trees (no more than five per project or stand over the life of the programmatic)	75 trees	225 trees
5[2] bridge scour repairs per region within or adjacent to bull trout habitat[3]	3,810 ft^2	3,810 ft^2	3,810 ft^2	19,050 ft^2 (0.44 acre)	57,150 ft^2 (1.31 acres)
2[4]slide abatement and repair projects per region within bull trout habitat	1.26 acre	1.26 acre	1.26 acre	6.3 acres	18.9 acres
2[5] emergency bank stabilization projects per region within bull trout habitat	200 ft^2	200 ft^2	200 ft^2	1,000 ft^2	3,000 ft^2
5[6] projects such as culvert replacement and road repair per region per year within bull trout habitat	2,500 ft^2	2,500 ft^2	2,500 ft^2	12,500 ft^2	37,500 ft^2 (0.86 acre)
10[7] fish habitat and passage enhancement projects per year within bull trout habitat	10,000 ft^2	10,000 ft^2	10,000 ft^2	50,000 ft^2	150,000 ft^2 (3.4 acres)
5 bridge scour repairs per region within bull trout critical habitat	3,810 ft^2	3,810 ft^2	3,810 ft^2	19,050 ft^2 (0.44 acre)	57,150 ft^2 (1.31 acres)
2 slide abatement and repair projects per region within bull trout critical habitat	1.26 acre	1.26 acre	1.26 acre	6.3 acres	18.9 acres
2 emergency bank stabilization projects per region within bull trout critical habitat	200 ft^2	200 ft^2	200 ft^2	1,000 ft^2	3,000 ft^2

Potential Vegetation Impacts	Southwest Region (per year)	Olympic Region (per year)	Northwest Region (per year)	Total per Region for Programmatic	Total for Programmatic
5 projects such as culvert replacement and road repair per region within bull trout critical habitat	2,500 ft^2	2,500 ft^2	2,500 ft^2	12,500 ft^2	37,500 ft^2 (0.86 acre)
10 fish habitat and passage enhancement projects per region within bull trout critical habitat	5,000 ft^2	5,000 ft^2	5,000 ft^2	25,000 ft^2	75,000 ft^2

[1] This 25 acre maximum loss will likely also be counted against the 25 acres maximum loss of murrelet nesting habitat
[2] Bridge scour repair projects are assumed to average 726 ft^2 per project
[3] Bull trout habitat includes all habitat types (spawning, rearing, foraging, overwintering, and migration).
[4] Slide abatement and repair projects are assumed to average 0.63 acre per project.
[5] Emergency bank stabilization projects are assumed to average 100 ft^2 per project and less than 300 cy of material in streams 160 ft^2 and 500 cy in marine environments.
[6] Culvert replacement and road repair projects are assumed to average 500 ft^2 per project.
[7] Fish habitat and passage enhancement projects are assumed to average 1,000 ft^2 per project.

Herbicide Use

Description of Activity

Certain activities included in the PBA may include the application of herbicide for weed control at environmental mitigation sites and application during the pre-planting stage of roadside restoration activities in accordance with noxious weed control policies of the Washington State Department of Agriculture, the local Weed District, or the county Noxious Weed Control Board.

Herbicides used for weed control at environmental mitigation sites are used in conjunction with mechanical weed removal and biological weed control. These weed control methods are also used near plantings to reduce competition from surrounding vegetation.

WSDOT typically uses glyphosate (trade name Aquaneat®, Aquamaster®, or Rodeo®) and the surfactant Agri-Dex or tryclopyr amine (trade name Garlon 3A) for mitigation site weed control. Only these products will be permitted for use under the programmatic. Glyphosate products identified as toxic to fish, such as Round-up®, and the surfactant LI-700 are not covered.

The glyphosate product is typically applied directly to plant foliage by wicking, spraying from a backpack sprayer, injecting, or by applying to cut stumps to inhibit the production of a growth enzyme. It is not applied directly to soil or water. All applications are in accordance with the National Pollution Discharge Elimination System (NPDES) aquatic noxious and nuisance weed permits issued by the Washington State Department of Ecology (WDOE), and all applications are in accordance with the product label requirements.

Noxious weed control will be required for all areas within the project limits designated by the WSDOT Project Engineer including, but not limited to, planting areas, erosion control seeding areas, bark mulch areas, bark mulch rings, preservation areas, and mitigation areas. Herbicides are applied to green or growing tissue and prior to seed production.

Timing and Duration

Herbicide use takes place during spring, summer, and early fall months during dry conditions and may continue for several years until desired vegetation is established.

Equipment

Application equipment is both motorized and non-motorized. In addition to a hand-pump backpack sprayer, a low pressure motorized hand-held sprayer may also be used to apply herbicides. The low-pressure motorized hand-held sprayer is connected to a larger tank that does not need to be refilled as often as a backpack sprayer, and therefore has a greater coverage capacity. The spray application does not differ between the hand-pump backpack sprayer and the motorized low-pressure hand-held sprayer.

Anticipated Activities

Herbicide application could occur in association with any WSDOT project that involves ground disturbance. It would not occur with typical pavement preservation projects.

Revegetation

Description of Activity

Following construction, all exposed areas are typically mulched and seeded with an approved herbaceous seed mix and/or planted with woody shrub vegetation and trees (if appropriate) during the first available planting season.

Equipment

Revegetation activities are typically performed using large and small machinery such as a backhoe, excavator, bulldozer with tilling attachment, or landscaping crews with hand tools to prepare the ground for reseeding and planting.

Timing and Duration

The timing and duration of this activity is addressed as part of the larger project (e.g., culvert replacement). Additional measures may be necessary following the initial revegetation to ensure the successful establishment of the vegetation. This may include additional replanting, weed control, and in some cases recontouring of the landscape to provide for appropriate hydrology. This additional work typically occurs during the spring or fall and is completed within one month.

Anticipated Activities

Revegetation could occur as part of any project that includes ground disturbance and temporary impacts to vegetation.

Culvert replacement and/or installation

Description of Activity

Culvert replacement and/or installations can be stand alone projects (such as replacing a culvert that is a fish passage barrier), or they can be part of a larger project funded under one of the other WSDOT programs (constructed as part of a bank stabilization repair). WSDOT uses the following types of culverts: concrete box, concrete, corrugated metal, timber, and PVC piping. WSDOT determines proper culvert sizing using the WSDOT Highway Runoff Manual (HRM), the WSDOT Hydraulics Manual, and fish passage design guidance from (Bates et al. 2003). All culverts within fish bearing streams will be constructed or repaired to provide unrestricted fish passage. The average crossdrain culvert diameters range between 18 and 36 inches. Replacement culverts are typically larger than existing culverts on fish-bearing streams.

Average fish passage diameter culverts range from 7 ft to 32 ft for bottomless arch culverts and 8 ft to 20 ft for box culverts. Average culvert lengths range between 60 ft and 200 ft. Culvert replacement may include construction of temporary cofferdams around the work area prior to removing the old culvert. Temporary cofferdams are constructed from sandbag berms, temporary culverts, flumes, or sheet piles. Fish are excluded from stream segments with in-water work by following standard protocols (Appendix D or most current protocol). Culvert replacement may require the removal of riparian vegetation at the culvert ends. Riprap may be installed to protect the culvert; however, it may not exceed the width of the culvert by more than 5 percent). Based on the average width of culverts, this would result in between 7.4 and 33.6 lineal ft of riprap per culvert. The following is a description of a typical culvert replacement:

- dewater the work area and establish a flow bypass prior to initiating work
- remove vegetation at the inlet and outlet
- remove existing pavement and roadbed to extract the existing culvert
- place the new culvert
- backfill and patch/replace the pavement
- install armoring
- re-vegetate

Equipment

Culvert replacement and installation activities are typically performed using large machinery, including but not limited to dump trucks, flatbed trucks, backhoes, excavators, mechanical soil compactors, and cranes.

Timing and Duration

Culvert replacements typically require less than one month to complete but may require a complete construction season of several months.

Anticipated Activities

One culvert was proposed for replacement under the Bridge Repair, Retrofit, Replacement, and Maintenance program during the 05-07 Biennium. There were 17 environmental retrofit projects planned for the 05-07 Biennium, of which approximately 40 percent were fishways. There are 38 fish passage projects (including fishways) identified for the next six years in the Regions. There are 47 fishways that are in need of replacement and an additional five that require maintenance within the action area. New culvert installations will not be covered by the PBA unless the project in its entirety is part of this programmatic.

Approximately 1,507 culverts associated with state routes are fish barriers in western Washington (Elizabeth Lanzer, *in litt*. 2008). Of these, 43 occur in local populations within the Puget Sound and Olympic Management Areas. An increase in the number of fish passage barrier

repair projects is anticipated in the future to comply with the *United States of America et al. vs. State of Washington et al State of Washington* (Case No. CV 9213RSM) lawsuit (also known as the "culvert lawsuit" or "Boldt II")[5]. We anticipate that this programmatic will be used to the extent possible for culverts will be replaced as a result of agreements reached under this lawsuit. However, other programmatics, such as the Army Corps of Engineers Restoration Programmatic (FWS Ref. 13410-2008-FWS # F-0209), are also available to provide section 7 coverage for these projects.

WSDOT proposes up to 10 culverts for fish passage enhancement under the Environmental Retrofit and Enhancement program and up to 5 culverts under other programs (i.e., Bank Stabilization and Flood Damage Repair; Bridge Repair, Retrofit, Replacement, and Maintenance) per region per year over the life of the programmatic that may result in adverse effects to bull trout and/or bull trout critical habitat. Although not all enhancement projects are culverts, this would be the maximum number replaced. Projects that would result in adverse effects are not covered by this programmatic for the Lower Columbia Basin Interim Recovery Unit. Therefore, the total number of culverts replaced and/or installed over the life of the programmatic that may result in adverse effects would not exceed 150. The replacement of an additional 75 culverts is proposed that does not result in measurable effects to bull trout or bull trout critical habitat.

Additionally, WSDOT proposes to spatially restrict the number of projects to no more than five culvert projects within a 5th-field watershed per year to limit the volume of sediment released into affected watersheds. No more than one culvert will be replaced within an individual local population per year in the Northwest WSDOT region[6].

Culvert Extensions

Description of Activity

Culvert extensions add length to culverts on one or both ends, typically due to road widening and/or slope modifications. Activities may include removing existing headwalls and inlet/outlet protection such as riprap. Excavation is often required and minor (10 linear ft or less) stream realignment may also be necessary. If the work is conducted while there is flow through the culvert, a bypass will be installed to allow work to occur in a dewatered environment. Once the site is ready, the new culvert length would be attached to the existing culvert. Backfill would then be added and compacted. Appropriate inlet/outlet protection would be added, and disturbed areas would be stabilized with the appropriate best management practices (BMPs).

Equipment

Culvert extensions are typically performed using large machinery that will vary, depending on the size of the culvert and the length of the extension. Equipment likely to be used includes dump trucks, flatbed trucks, backhoes, excavators, soil compactors, cranes, and hand tools.

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[5] The lawsuit does not apply to crossings within the Lower Columbia Basin bull trout management unit.
[6] No bull trout Local Populations occur within the action area in the Olympic WSDOT Region, therefore, none will be impacted.

Timing and Duration

The timing and duration of this activity is addressed as part of the larger project. Work will occur during periods of low flow to reduce aquatic impacts. Culvert extensions typically require less than 1 week to complete.

Anticipated Activities

Culvert extensions typically occur as part of projects that involve widening road surfaces, such as in the Safety Improvement and Mobility Improvement programs. Depending on the length of the roadwork, one to multiple culverts could require extensions for any given project.

Culvert Repair

Description of Activity

Culverts require repair for a variety of reasons including, but not limited to, corrosion or deterioration, collapse, separation between pieces of modular culverts, loss of support due to erosion, cracking, or tearing or squashing at the inlet or outlet ends. Repair methods could include replacing damaged sections of the culvert, which would require excavating, cutting the damage section and removing it, attaching the new section, and restoring the fill. Sometimes culvert liners can be inserted into the existing culvert. In some situations squashed or collapsed culverts can be jacked open. Dewatering of the stream channel and fish handling and exclusion may occur as part of a culvert repair project if flow and fish are present. Repair of culverts that are partial or complete fish passage barriers are excluded from use of this programmatic unless measures to create fish passage of all life stages is incorporated as part of the project. The retrofit of an existing culvert to provide fish passage will require approval of the project design from the WDFW's Area Habitat Biologist and WDFW's Area Engineer, Environmental Technical Assistance Section.

Equipment

Culvert repairs can either be performed with hand tools or heavy equipment, depending on the nature of the repair and the size of the culvert. Typical equipment includes dump trucks, backhoes, excavators, hand tools, metal saw, and welding tools.

Timing and Duration

The timing and duration of this activity is addressed as part of the larger project. Work will occur during periods of low flow to reduce aquatic impacts.

Anticipated Activities

Culvert repairs are most commonly associated with Drainage System Maintenance and Repair, Slide Abatement and Repair, and Bank Stabilization and Flood Damage Repair.

Culvert Cleaning

Description of Activity

Culverts often plug with sediment, rocks, wood, trash, or construction debris. Culverts may be cleaned by flushing with water, pushing or pulling the material with machinery, or by hand. Material that is dislodged from the culvert and water used for cleaning will be vacuumed up, picked up by other machinery or by hand and disposed of at a permitted disposal site that is in compliance with the ESA. If flow is present, the flow is diverted from the culvert during cleaning. During emergency situations, if flows are too high that diversion may not be possible, the minimum cleaning necessary to stop flooding or erosion will occur.

Equipment

Typical equipment used to clean culverts includes hand tools, vactor trucks, and horizontal drill devices to push or pull debris from the pipe. Debris is loaded into trucks for disposal.

Timing and Duration

Culvert cleaning is of short duration (typically completed within 1 day). Work will occur in the dry or when listed fish are unlikely to be present.

Anticipated Activities

Culvert cleaning is most commonly associated with Drainage System Maintenance and Repair, Slide Abatement and Repair, and Bank Stabilization and Flood Damage Repair and can occur in conjunction with culvert repair.

Creation of new impervious surface

Description of Activity

There are two types of impervious surface – non-polluting and polluting. Examples of non-polluting impervious surfaces includes paved sidewalks and bicycle pathways that are separated from roads used by motor vehicles, and metal roofs covered by an inert, nonleachable material. Pollution generating impervious surfaces include surfaces, paved or not, that are regularly used by motor vehicles. Additionally, the HRM includes unvegetated road shoulders, bicycle lanes within the travel lane of a roadway and sidewalks that are regularly treated with salt or other deicing chemicals as pollution generating impervious surfaces. The HRM states that "Upgrading by resurfacing state facilities from gravel to bituminous surface treatment, asphalt concrete pavement, or Portland cement concrete is considered to be adding new impervious surfaces, and is subject to the minimum requirements that are trigged when the thresholds are met" WSDOT (2008). The majority of new impervious surfaces constructed by WSDOT are pollution generating. Additionally, the creation of new impervious surface is limited in most programs. The greatest acreage of new impervious surfaces is anticipated to occur as part of the safety and mobility programs, although some is also associated with the Pavement Preservation, Slide

Abatement and Repair, Bank Stabilization and Flood Damage Repair, Bridge Repair and Retrofit, and Facilities programs. New impervious surfaces may be added due to the following:

Mobility Program

- new or reconstructed interchanges
- new passing lanes
- new turn lanes
- new truck climbing lanes
- widening an existing bridge
- new signing

Safety Program

- Alignment modifications may include:
    - new auxiliary lanes (e.g., truck climbing and acceleration lanes)
    - new channelization (turn lanes),
    - on and off ramp extensions
    - realigning/upgrading an intersection to improve the sight distance
- new sidewalks

During a 4 year period between 2001 and 2005, approximately 240 new lane miles were constructed in western Washington (Marion Carey, *in litt*. 2005b). These lanes included the following:

- 165 state route lane miles (including 37 HOV lane miles)
- 52 lane miles from new or upgraded interchanges
- 25 miles of new turn and acceleration lanes, on and off ramps, or similar work.

Not all of the above new lane miles stated above would be covered under the programmatic (state route lanes that contributed to or resulted in increased growth [including new lanes that are built from intersection to intersection]). However, these values provide some indication of the potential for new lanes and associated impervious surfaces that may occur under the programmatic.

Truck, turn, and acceleration lanes typically average between 10 ft and 12 ft wide. Sidewalk widths vary from 5 to10 ft, depending on jurisdiction and intended use. Non-separated HOV lanes have a 12-foot minimum road width and 10-foot shoulder. A one-lane separated facility has a 15-foot average road width with a 12-foot minimum width for the two shoulders. Often it is possible to narrow the existing road shoulder or widen into the existing median to obtain some of the required width for an HOV lane, thereby reducing the creation of new impervious

surfaces. HOV lane additions typically occur in urbanized areas in the heaviest traveled corridors (e.g., I-5 and I-405), and lanes average between 1.0 and 5.0 miles in length.

Equipment

The equipment used has been addressed as part of the larger project or program.

Timing and Duration

The timing and duration of these activities is included as part of the larger project or program.

Anticipated Activities

The following amounts of impervious surface are anticipated to occur within each of the following programs (Table 7).

Table 7. New impervious surface by program.

Program	**Average Number of Activities per Year**	**Average New Impervious Surface per Program or Activity if known (ft^2)**	**New Impervious Surface per Year (ft^2)**	**New Impervious Surface over Life of Programmatic (acres)**
Paving	68	465	31,620 (0.72 acre)	3.6
Mobility and Safety	23	32,580 - road widening 162,145 – travel lanes 5,208 – intersection improvements 781- other	1,381,016 (31.7 acres)	159
Facility Preservation	7	12,000	84,000	9.6
Total				**172**

Blasting

Description of Activity

WSDOT may need to use explosives for projects funded under several of the programs described above. The scale of blasting operations can vary dramatically. The largest operations can blast thousands of cubic yards of material. To seat explosives, holes are drilled into the rock. Soil and unconsolidated rock on top of the blasting surface is removed prior to blasting. WSDOT uses earthen berms or other fixed barriers to contain rolling debris. Blasting mats may be required to contain flying rock, especially when blasting occurs adjacent to sensitive areas, such as aquatic systems, or if other fixed

barriers are not present to contain or minimize movement of debris. WSDOT may construct small temporary access roads to position the drill rig at the blasting location. Temporary roads and impacted areas would be restored to natural conditions following completion of the project.

Blasting proposed under the programmatic is not covered within suitable nesting habitat if the blast will result in the destruction of nesting habitat or physical injury to nesting, foraging, or roosting listed birds. No blasting is proposed in water. No production blasting is proposed under the programmatic.

Equipment

The types of equipment anticipated for blasting includes rock drills and heavy equipment to construct temporary access roads.

Timing and Duration

All blasting within 1 mile of suitable murrelet and northern spotted owl habitat will occur out side these species nesting seasons (April 1 to September 15 and March 1 to September 30, respectively), except if necessary for the removal of rocks associated with emergency slide removal within the Southwest, Olympic, and Northwest WSDOT Regions.

The duration of rock drilling and blasting typically ranges from 1 to 30 days.

Anticipated Activities

WSDOT data from 1991 to 2005 regarding the use of blasting indicted that it was used for projects a total of 31[7] times over a period of approximately 15 years (Table 8) or an average of two projects per year. The majority of blasting occurred within the WSDOT Southwest Region. The timing of the blasts (within or outside the nesting season for listed species) for these previous projects is not known. However, the majority of the projects did not impact murrelets or northern spotted owls due to distance from suitable nesting habitat, size of blast, or timing of blast. Approximately 25 percent of these projects occurred outside the nesting season for these two species. Up to one blast each per murrelet conservation zone (Conservation Zones 1 and 2) and northern spotted owl provinces (Eastern Cascades and Olympic Peninsula Provinces only) may occur over the life of the programmatic during the nesting season if needed as part of an emergency slide removal activity.

[7] Blasting may have impacted both northern spotted owl and murrelets for the same project.

Table 8. Number of blasting projects by WSDOT region within suitable habitat for northern spotted owl and murrelet from 1999 – 2005 (Marion Carey, *in litt*. 2005a).

Number of Projects with Blasting by WSDOT Region from 1999-2005	**Estimate of the Number of Projects with Blasting Within Potential Habitat for Northern Spotted Owl and Murrelet from 1999 – 2005**	
	Northern Spotted Owl	Murrelet
Northwest Region	3	2
Southwest Region	20	1
Olympic Region	4	4
Total blasts over 15 years per species	27[1]	7[1]
Average Blasts over 15 years per species	1.8	0.5

[1] Blasting may have impacted both northern spotted owl and murrelets for the same project. Actual number of blasts totals 31.

Pile Driving and Removal

Description of Activity

Wooden, concrete, and or steel piles may be used. The specific size and type of pile used and installation time varies. For purposes of this consultation, we anticipate piles will not exceed 24 inches diameter for a steel pile. We expect that without attenuation measures, steel piles of this size may result in underwater sound pressure of up to 207 decibel $(dB)_{peak}$ and 194 dB_{rms} and 178 dB sound exposure level at 10 meters (Keith Pommerenck *in litt*. 2007, p. I-1.1). Unattenuated airborne sound pressure is expected to be up to 115 dBA_{peak} at 50 ft (WSF 2000 in WSDOT 2005, p. 2-30). Installed steel guardrail posts drivers have had above water sound pressure levels up to 98 dBA Lmax using a vibratory hammer and 92 dBA Lmax using an impact drop hammer measured at 15 meters (Poecker and Sposito 1999). For impact pile driving of steel piles, WSDOT's is goal is to achieve a minimum of a 10 dB reduction of underwater sound pressure by using attenuation devices.

There are two general types of pile drivers, impact and vibratory. An impact pile driving hammer is a large piston-like device that is usually attached to a crane. The power source for impact hammers may be mechanical, air steam, diesel, or hydraulic. In most impact drivers, a vertical support holds the pile in place and a heavy weight, or ram, moves up and down striking an anvil which transits the blow of the ram to the pile. Impact hammers can drive at a rate of approximately 40 strikes per minute (WSF 2000 in WSDOT 2005, p. 2-25).

Vibratory hammers can also be used to install and remove piles. A vibratory hammer is a large, mechanical device, mostly constructed of steel (weighing 5 to 16 tons) that is suspended from a crane by a cable. A vibratory pile driving hammer has a set of jaws that clamp onto the top of the pile. The pile is held steady while the hammer vibrates the pile to the desired depth. Vibratory pile driving may generate sound pressures in air up to 101 dbA_{peak} measured at 50 ft (Sharon Rainsberry, *in litt*. 2008). However, all load bearing piles that are installed with a vibratory hammer must be "proofed." Proofing is the striking the pile with an impact hammer to

determine the load bearing capacity of the pile. To remove piles, the hammer is engaged and slowly lifted with the aid of a crane, extracting the piling from the sediment.

In-water pile removal methods include direct pull, vibratory, clamshell dredge, or cutting below ground level. The direct pull method involves wrapping the pile with a cable and applying a lifting force with either a crane or a pneumatic device. Vibratory hammers are suspended by crane and positioned onto the top of a pile. The pile is then unseated from the sediments by engaging the hammer and slowly lifting up on the hammer with the aid of the crane. Once unseated, the crane will continue to raise the hammer and pull the pile from the sediment. Both of these methods may not be effective in stiff, cohesive substrates such as clay or glacial till, or with aged wood piling and stubs that may break or crumble from the applied force. In hard substrates, pilings can be cut (either by hand or mechanically), usually a few feet below ground level. The hole is then backfilled with sand or gravel. In cases where the piling is breaking, clamshell buckets may be used. A clamshell bucket is a hinged steel apparatus that operates like a set of steel jaws. The bucket is lowered from a crane and the jaws grasp the pile stub as the crane pulls up.

No piles will be impact driven or vibrated into marine or estuarine water bodies. No in-water pile driving will occur within spawning areas during spawning, spawning migration, and early development. Tidally influenced waters above the mouth of a river are excluded from this prohibition if there is a topographic feature that precludes sound pressure from reaching these marine and estuarine areas.

Equipment

The types of equipment anticipated for pile driving and removal include vibratory pile driver, impact hammer, clamshell dredge, and crane.

Timing and Duration

Installation of piles will require approximately 30 minutes per pile to drive them into the substrate. It may take up a total of 2 hrs per pile for set-up and driving the pile. Pile removal requires approximately 2 hrs to 4 hrs per pile depending on the pile size and method of removal.

Additional information on the timing and duration of these activities is included as part of the larger project or program.

Anticipated Activities

Pile installation is typically associated with temporary work platform construction, bridge construction, or retaining wall construction. Pile removal is typically completed as part of environmental retrofit projects or bridge replacement projects. Pile installation and removal may be part of both temporary and permanent structures under this programmatic. The number of piles per project and number of projects is unknown. However, no more than 100 piles will be installed per 5th-field watershed. Additionally, WSDOT anticipates that no more than two projects per 5th-field watershed are likely to include pile driving of steel piles where the sound

pressures generated may exceed underwater sound pressure threshold values. This could result in approximately 6 days[8] of elevated underwater sound pressure levels.

Fish capture/handling and exclusion/isolation

Description of Activity

Fish capture/handling and exclusion protocols will follow measures stated in Appendix D or most recent protocol. Fish handling includes herding, netting, and/or electroshocking fish to remove them from areas that are to be dewatered as part of a construction activity.

WSDOT uses cofferdams and stream diversions to isolate work areas during in-water work. Temporary cofferdams are constructed from steel casings/steel sleeves or sheet piles. Temporary stream diversions consist of sandbag berms, temporary culverts, or flumes.

Equipment

Although some of the fish exclusion/isolation devices can be installed by hand or using hand tools (sandbag dam, block nets), approximately 90 percent of cofferdam installations are completed with vibratory hammers. The exception to the use of a vibratory hammer occurs when the substrate consists of very hard material, such as bedrock. In these cases, impact pile driving may be necessary. Other large machinery is also needed to bring the exclusionary material to the site and to install and remove it when completed.

Fish handling typically requires the use of seines, minnow traps, dip nets, and electroshocking equipment.

Timing and Duration

Work is typically conducted during low flows. Installation and removal of the exclusion/isolation devices typically takes one to three work days each for most culvert projects. Larger bridge projects may take up to a week for installation and less than that duration for removal.

Anticipated Activities

In-water construction activities within fish bearing streams typically will require fish isolation/exclusion and handling. An exception may be pile driving and removal. WSDOT anticipates up to 200 projects may require fish capture and handling over the life of the programmatic.

[8] 100 piles x 30 minutes per pile = 3,000 minutes for 100 piles. 3,000 minutes is approximately six 8-hr days of work.

Installation and maintenance of stormwater treatment facilities

Description of Activity

Most projects that result in a net increase in impervious surface require stormwater treatment per the WSDOT HRM (Section 3-2.1). However, non-exempt projects that result in less than 2,000 ft^2 of new replaced or new plus replaced impervious surface and requires temporary erosion and sediment control (TESC) and spill prevention, control and countermeasures (SPCC) planning only. There is a variety of stormwater treatment facilities, including but not limited to constructed stormwater treatment wetlands, sand filters, vegetated biofiltration swales, infiltration trenches, engineered dispersion, and media filter drains. Once these systems are in place, they require periodic maintenance, which often includes removing sediment buildup and vegetation, cleaning filters, and mowing.

Equipment

Typical equipment includes dump truck, backhoe, excavator, vactor truck, grader, hydroseeder, mower, soil compactor, and hand tools.

Timing and Duration

Construction of stormwater treatment facilities is typically part of a larger project, although it may occur as an independent project in some circumstances. Construction may require up to several weeks. Maintenance and repair of these facilities are completed within a few hours in any given location. Work may occur year round, though is typically performed during the dry season.

Anticipated Activities

Any project that results in a net increase in impervious surface may require installation and maintenance of stormwater treatment facilities, especially projects in the Mobility and Safety Improvement programs.

Slope and Ditch Repair

Description of Activity

Slope and ditch repair is the re-grading of existing ditches and slopes to current safety standards. It may also include filling in or repairing sides of the ditches where necessary. Flattening of slopes and the maintenance of clear zones reduces hazards for automobiles that inadvertently leave the roadway. Work does not occur in water bodies that contain bull trout. Work may occur in ditches that contain bull trout forage species.

Equipment

Typical equipment includes backhoe, excavator, dump truck, grader, and soil compactor.

Timing and Duration

Most slope and ditch repair activities are completed within a day or week depending on the length of roadway that is being maintained. Work may occur year-round, depending on weather. Work may occur at any time of day or night depending on the project location.

Anticipated Activities

Slope and ditch repair activities are typically associated with the Safety Improvement or Drainage System Maintenance and Repair programs.

Subsurface Investigation and Hazardous Waste Sampling

Description of Activity

Subsurface sampling and testing of soil, groundwater, and aquatic sediments is performed to provide information necessary for engineering design and the presence of contaminants. WSDOT may conduct subsurface sampling and testing as part of any project funded under the programs described above. Sampling may occur in marine, estuarine, or freshwater systems, as well as within uplands.

For subsurface sampling, WSDOT drills test holes up to 300 ft deep or excavates soil pits up to 8 ft deep. Test pits may also be excavated using a back-hoe to conduct sampling. A casing or other water isolation devices/BMPs are required by the GHPA 113116-1 to contain the boring in freshwater. Several test holes may be necessary for a particular project. For example, a slide repair project may require two to three test holes. WSDOT mounts drill rigs on a variety of vehicles including trucks, tractors, skids, and barges. The drills are 5 to 10 inches in diameter. Drills are lubricated using a mixture of bentonite and water. The fluid is filtered and recycled back through the drilling operation.

Subsurface hazardous materials sampling is similar to subsurface geotechnical sampling. The majority of hazardous waste sampling occurs in urbanized areas. Sampling activities are completed in approximately 1 to 2 days. Subsurface hazardous materials sampling may include the following techniques: soil borings using a drill rig mounted on either a truck or barge to a depth of approximately 30 ft beneath ground surface; test pits excavated to a maximum depth of 10 ft using a backhoe; aquatic sediment testing using a drill rig with an auger or Vibracore (a device that vibrates through the sediments); Ponar and Van Veen samplers that collect grab samples to a depth of approximately 5 cm in aquatic environments; and hand augers. Soil samples are placed in temporary stockpiles that are lined, covered with visqueen, and weighted on the edges. Soil samples may also be placed in drums. Soil that is determined to be contaminated is removed off-site to an appropriate disposal facility[9]. The area affected by

[9] The PBO does not cover projects that require the removal or remediation of contaminated soils; only sampling and

hazardous material sampling may be between a few square feet to several hundred square feet. If access is needed, test pit excavation may affect several thousand square feet of surface area.

Equipment

Typical equipment includes skid-mounted rotary drill, barge, skiff boat, track-mounted drill, truck-mounted drill, cone penetrometer test truck, hollow-stem augers, diamond bit rock corer, and water trucks.

Timing and Duration

These activities could occur year round and in-water test drilling occurs within the fish window identified in the Hydraulic Permit Approval (HPA). The duration depends on the number of test holes being drilled, typically from 1 day to 1 week.

Anticipated Activities

These activities could occur in association with any of the programs identified.

Minimization Measures

The following minimization measures (MM) are considered part of the proposed action. The minimization measures will be applied as applicable to each activity or program as specified below. Due to site specific conditions, some minimization measures may not be necessary and will be addressed as specified in the **Procedures for Using the PBA/PBO**.

MM-1: All projects (except exempt activities as listed in section 3-2.2 of the HRM) (Appendix E) are subject to minimum stormwater management requirements as outlined in section 3-3 of the HRM. As part of the minimum stormwater management requirements, all non-exempt projects must address erosion control; however, a stand-alone TESC Plan is required if more than 7,000 ft^2 of soil will be disturbed. A project specific SPCC Plan is also required for all non-exempt projects as required in Standard Specification 1-07.15(1) (Appendix F).

MM-2: Projects within 200 ft of surface water will install and maintain BMPs as stated in the HRMl to ensure that no foreign material, such as pavement slurry from asphalt grinding equipment, is sidecast, and to control and prevent sediments from entering aquatic systems.

MM-3: No contractor staging areas will be allowed within 200 ft of potentially suitable wetland, stream, river or drainage as identified by the project biologist, unless site specific review completed by the project biologist indicates that no impacts to the sensitive resource areas will occur due to topography or other factors (**applies only to Marsh sandwort and Water howellia**). The PBA Determination Form will provide justification for not implementing the 200 foot buffer.

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testing for contaminated soils is included.

MM-4: Projects within 200 ft of potentially suitable grasslands and prairies as identified by the project biologist will install and maintain appropriate BMPs to ensure that no foreign material, such as pavement slurry, is sidecast (**applies only to Bradshaw's lomatium, Golden paintbrush, and Nelson's checker-mallow**).

MM-5: No contractor staging areas will be allowed within 200 ft of potentially suitable grasslands and prairies as identified by the project biologist, unless site specific review completed by the project biologist indicates that no impacts to the sensitive resource areas will occur due to topography or other factors (**applies only to Bradshaw's lomatium, Golden paintbrush, and Nelson's checker-mallow**). The PBA Determination Form will provide justification for not implementing a 200 foot buffer.

MM-6: Seasonal restrictions applied to work conducted within or below the Ordinary High Water Mark (OHWM), will be as required by the HPA issued by the WDFW and Water Quality Standards for Surface Waters of the State of Washington (Chapter 173-201A WAC) except for the Puyallup (upstream of the Puget Sound Energy Electron Powerhouse outfall), Carbon, and White rivers where the bull trout in-water work window of July 16 through August 15 will apply. In-water work duration will be minimized as practicable.

MM-7: Projects located within 5 miles of suitable murrelet nesting habitat or designated critical habitat will develop and implement a trash handling plan to insure that food wastes and other items attractive to crows, jays, and other Corvidae will be disposed of in a manner that makes it unavailable to these species at any time.

MM-8: Trees that are removed in suitable murrelet habitat will be dropped into the road right of way or areas that will be cleared of vegetation to avoid impacts to adjacent suitable habitat. Downed trees will be retained onsite unless prohibited by the land owner. In those circumstances, LWD will be removed and used for future environmental restoration efforts where possible. The PBA Determination Form will provide justification (e.g., a letter from the land owner or written explanation) for not retaining downed trees on-site or if they are not used for restoration efforts.

MM-9: Known occupied murrelet or northern spotted owl nest trees will not be removed.

MM-10: The number of large conifers (19 inches dbh or larger) removed will be minimized. The PBA Determination Form will provide documentation to support the need to remove trees this size or larger.

MM-11: If an active murrelet or northern spotted owl nest is discovered, the WSDOT activity will cease immediately. A WSDOT and Service biologist will be notified immediately and all activities within the disturbance threshold distances (activities that equal or exceed 92 dBA or are less than 92 dBA and located within 11 yards of suitable murrelet nesting habitat or 20 yards of suitable northern spotted owl habitat) will be postponed until after the nesting season.

MM-12: When working within the northern spotted owl or murrelet nesting season is unavoidable (i.e., due to adverse weather conditions and snow at high elevations (including blasting), low temperature or coastal fog (for paving only), or emergency actions addressed in this PBO), work will be phased so activities within disturbance threshold distances are conducted as late as possible in the nesting period. The PBA Determination Form will provide documentation to support the need to perform work during the nesting season.

MM-13: Projects will not remove northern spotted owl nesting, roosting, or foraging habitat and/or murrelet nesting habitat within forest stands equal to or less than 7 acres. Projects will also not remove suitable murrelet nesting habitat (see Appendix A for definition) such that the stand is reduced to below 7 acres.

MM-14: All projects that may result in disturbance and are more than 4 dBA above ambient within suitable murrelet nesting habitat will restrict activities to between two hours after sunrise and two hours before sunset during the murrelet nesting season (April 1 to September 15).

MM-15: All activities that may result in sound levels of 92 dBA or more within suitable murrelet nesting habitat or are less than 92 dBA and located within 11 yards of suitable murrelet nesting habitat will occur outside the early breeding period (April 1 through August 5).

MM-15a: Compliance with MM-15 can be precluded due to one of the following reasons: adverse weather conditions and snow at high elevations (including blasting), low temperature or coastal fog (for paving), or emergency actions addressed in this PBO. The PBA Determination Form will provide documentation to support the need to perform work during the nesting season.

MM-16: If blasting is to occur in or adjacent to murrelet or northern spotted owl suitable habitat during the nesting season, no blasting will occur that may physically impact suitable nest trees, the trees buffering the nest tree, the individual murrelets, northern spotted owls, and/or their eggs. Information regarding how or why the nest tree, buffer trees, murrelets, northern spotted owl, or their eggs will not be physically impacted by the blast will be provided in the PBA Determination Form.

MM-17: Within Murrelet Zone 2, Southwest Area (Figure 2) only 1 suitable nest tree in stands with 5 or more platforms per acre per year and 0.5 acre of suitable habitat can be removed over the life of the programmatic (5 years).

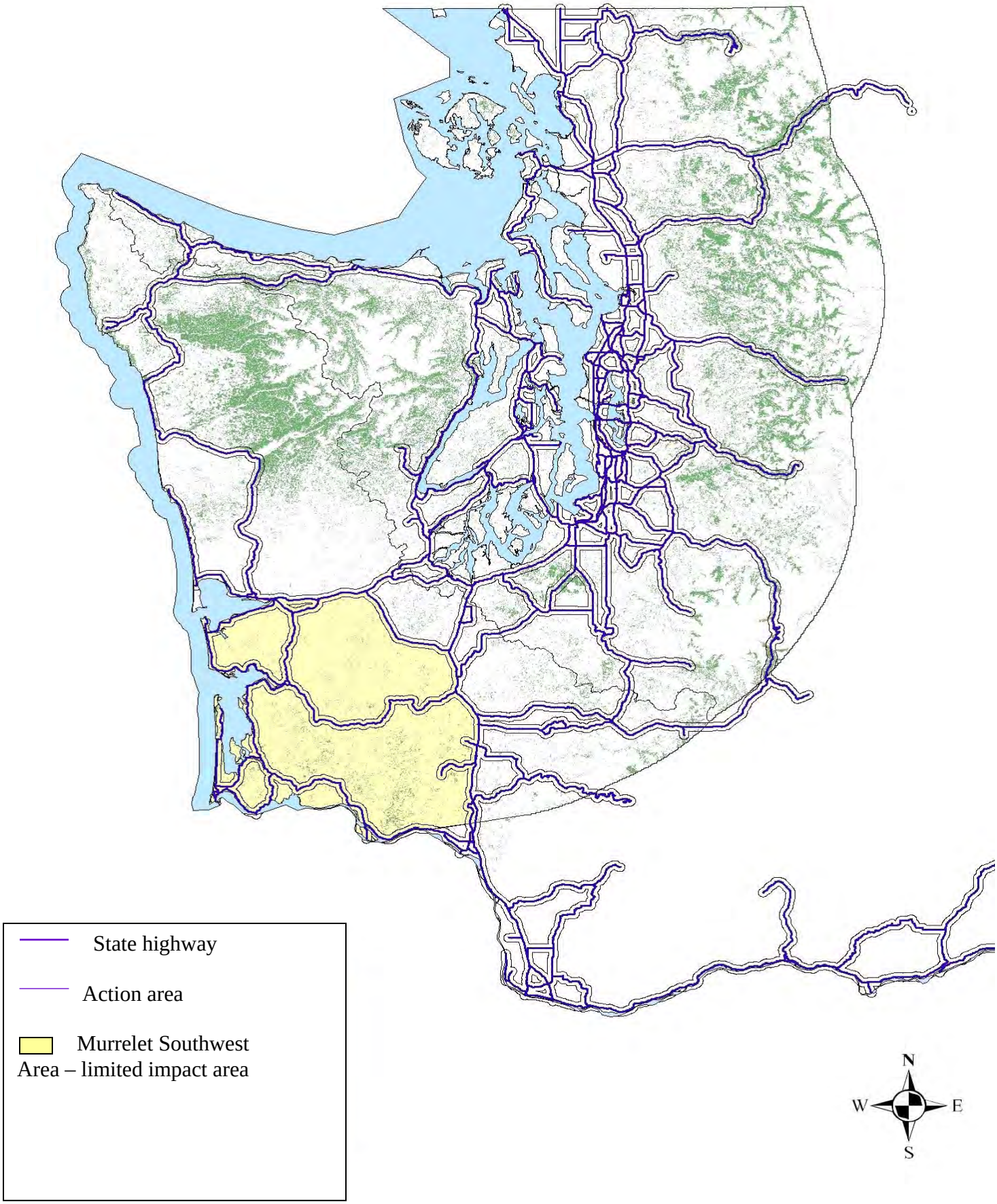

Figure 2. Range of murrelet and limited impact area.

MM-18: Blasting and pile driving activities that may exceed sound disturbance levels (92 dBA) within suitable murrelet and/or northern spotted owl habitat will be monitored if performed during the nesting season. The monitoring will provide the peak levels, as well as the duration of those sound levels, reported in dBA. Monitoring must not occur within 11 yards of a murrelet nesting habitat or 20 yards of northern spotted owl nesting habitat to avoid increased impacts due to visual disturbance. WSDOT will finalize a terrestrial sound monitoring plan prior to commencing such activities.

MM-19: Vegetation removal within or adjacent to[10] murrelet and northern spotted owl designated critical habitat and/or suitable habitat will be no more than 50 ft in width from the edge of the existing roadway clear zone. In those areas where no clear zone exists, no more than a 50 ft width of critical habitat and/or suitable habitat will be removed from the edge of the roadway or maintained shoulder. The extent of vegetation removal will be clearly marked and verified by a trained biologist.

MM-20: Projects will not downgrade a forested stand of suitable murrelet nesting habitat to unsuitable murrelet nesting habitat.

MM-21: To facilitate compliance with the Northwest Forest Plan Standards and Guidelines, WSDOT will coordinate with the appropriate Forest Service ranger district if vegetation removal, including dying, dead, or downed wood is proposed on lands identified in the plan. Coordination will be documented within the PBA determination form[11].

MM-22: All activities that may result in noise levels of 92 dBA or more within suitable northern spotted owl nesting, roosting, and/or foraging habitat or are less than 92 dBA and located within 20 yards of suitable northern spotted owl nesting, roosting, and/or foraging habitat will occur outside the early breeding period (March 1 through July 15) unless precluded by one of the following reasons: adverse weather conditions and snow at high elevations (including blasting), low temperature or coastal fog (for paving only), or emergency actions addressed in this PBO. The PBA Determination Form will provide documentation to support the need to perform work during the nesting season.

MM-23: Projects will not downgrade suitable northern spotted owl nesting habitat to roosting and foraging habitat; roosting and foraging habitat to dispersal habitat, and/or dispersal habitat to non-dispersal habitat.

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[10] Adjacent is defined as within one site potential tree or 150 ft, which ever is greater.

[11] Compliance may be demonstrated either by providing a description of the proposed action and its consistency with the Plan or a letter from the appropriate Forest Service ranger district confirming the proposed projects compliance with the Plan.

MM-24: Trees that are removed in northern spotted owl nesting, roosting, or foraging habitat are to be dropped into the road right-of-way or areas that will be cleared of vegetation to avoid impacts to adjacent suitable habitat. LWD will be retained in the adjacent forest unless prohibited by the land owner. In those circumstances, LWD will be removed and used for future environmental restoration efforts where possible. The PBA Determination Form will provide justification (e.g., a letter from the land owner or written explanation) for not retaining downed trees on-site or if they are not used for restoration efforts.

MM-25: Projects within 200 ft of potentially suitable sand dune, salt-spray meadow, or open field habitat will install and maintain appropriate BMPs to ensure that no foreign material, such as pavement slurry from asphalt grinding equipment, is sidecast (**applies only to Oregon silverspot**).

MM-26: No contractor staging areas will be allowed within 100 ft of potential Oregon silverspot butterfly habitat, as identified by the project biologist unless site specific review completed by the project biologist indicates that topography or other factors preclude impacts to this habitat (**applies only to Oregon silverspot**). The PBA Determination Form will provide the justification for not maintaining a 100 foot buffer.

MM-27: No staging areas will be allowed within 200 ft of a stream, river, or drainage that may be used by bull trout or their forage fish unless site specific review completed by the project biologist indicates that topography or other factors preclude runoff from entering these waterbodies. The PBA Determination Form will provide the justification for not maintaining a 200 foot buffer.

MM-28: Minimize removal of riparian vegetation and replant riparian vegetation. Re-planting may not be possible in some locations such as areas of permanent impact, the roadway clear zone, or adjacent to or under bridges. However, potential replanting of riparian vegetation near the site should be evaluated. The PBA Determination Form will provide the justification for the removal of riparian vegetation and will include the proposed replanting plans, if applicable.

MM-29: All unstable slopes resulting from construction activities with a high likelihood of delivery of material to listed fish-bearing waters will be stabilized as soon as possible.

MM-30: Temporary material storage piles consisting of erosive materials will be placed outside the 100-year floodplain during the rainy season (October 1 through June) except for emergency projects or unless site specific review completed by the project biologist indicates that topography or other factors preclude runoff from entering waterbodies containing bull trout or their prey. Such temporary storage piles will be stabilized with plastic sheeting, straw bales, or other BMPs to prevent sediment delivery to entering waterbodies containing bull trout or their prey. Material to be used within 12 hours of deposition will not be considered a temporary material storage pile.

MM-31: Construction impacts will be confined to the minimum area necessary to complete the project.

MM-32: Boundaries of clearing limits will be clearly flagged to prevent disturbance outside of the limits.

MM-33: Vegetation will only be grubbed from areas undergoing permanent alteration. No grubbing will occur in areas slated for temporary impacts.

MM-34: Disturbance to riparian vegetation from the operation of heavy equipment will be minimized, as practicable, by straddling it with heavy equipment or by pruning it without damaging the roots. Existing riparian vegetation outside of the work area will not be removed or disturbed.

MM-35: Temporarily disturbed areas will be restored to pre-work conditions at a minimum. Achieving pre-work conditions may be delayed until native plantings can mature. Native trees and shrubs will be used that are endemic to the project vicinity or region of the Washington State where the activity is occurring.

MM-36: The establishment and use of temporary access roads will meet the following conditions:

- Existing roadways or travel paths will be used whenever they provide the needed access.
- Where stream crossings are essential, the crossing design will accommodate reasonably foreseeable risks (such as flooding and associated bedload and debris) to prevent diversion of stream flow out of the channel and down the road in the event of a crossing failure.
- Vehicles and machinery must cross riparian areas and streams perpendicular to the main channel unless site specific conditions require an alternate approach.
- Vehicles and machinery will not cross within a wetted stream, unless necessary as part of an emergency action. The PBA Determination Form must state why avoidance of crossing a wetted stream is not possible if proposed as part of an emergency action.
- Temporary roads within 300 ft of streams will avoid, minimize, and mitigate soil disturbance and compaction by clearing vegetation to ground level, and placing clean gravel over geotextile fabric.
- Vehicles and machinery operating below the OHWM (except if operating in the dry or during emergency actions) will use biodegradable hydraulic fluids and lubricants to reduce the potential impacts associated a potential oil spill or leak.
- The number of stream crossings will be minimized.

MM-37: BMPs, as stated in the Highway Runoff Manual, will be used to ensure that no foreign material such as oil or fuel from construction equipment will enter any wetlands, flowing or standing water.

MM-38: All equipment will be fueled and maintained more than 200 ft from the nearest wetland, ditches, flowing or standing water, unless site specific review completed by the project biologist indicates that no impacts to the resource areas will result due to topography or other factors. Exceptions to this requirement are allowed for large cranes, pile drivers, and drill rigs if they cannot be easily moved. The PBA Determination Form will provide the site specific information if an exception to the 200 foot buffer is to be implemented.

MM-39: For projects involving concrete, concrete truck chute cleanout areas will be established to properly contain wet concrete and wash water from entering wetlands and other waterbodies.

MM-40: The contractor will protect all inlets and catchments from stormwater runoff from fresh concrete, tackifier, paving, or paint striping if inclement weather unexpectedly occurs**.**

MM-41: All concrete will be poured in the dry, or within confined waters not being dewatered to surface waters, and will be allowed to cure a minimum of 7 days before contact with surface water.

MM-42: No paving, chip sealing, or stripe painting will be initiated in rainy weather.

MM-43: During bridge removal projects, as much of the existing structure as possible will be removed before finally dismantling the structure to limit the amount of material and debris from entering the receiving waters. This will include all roadbed material, decking, concrete curbs, etc.

MM-44: Bridge construction will take place from the banks, barges, or temporary work bridges.

MM-45: Concentrated accumulations of bird feces, road grit, sand, and loose paint chips will be removed from bridges before dismantling unless such activities would result in a higher risk of materials entering the water. This material will be scraped, swept or vacuumed from the bridge structure and collected and disposed of at permitted and approved upland location that is in compliance with the ESA.

MM-46: Residual grease will be removed by hand from bridges and roadways with a degreaser on absorbent-material to prevent cleaning agents and grease from entering waters of the State.

MM-47: Bridges will first be cleaned using dry methods and equipment. Debris accumulations on the bridge, road surface, and within the bridge drains will be collected or swept up and properly disposed of prior to fresh water flushing. Flushing will involve the use of clean water only, to prevent detergents or other cleaning agents from entering waters of the State.

MM-48: Pressure washing of structures will be done using appropriate filter fabric to control and contain paint particles generated by the activity.

MM-49: Pressure washing of concrete structures will be held to the minimum necessary to maintain structure integrity. (Pressure washing of concrete structures can result in an increased pH discharge with a potential to violate Washington State water quality criteria.)

MM-50: During abrasive blasting of a steel bridge prior to painting, a containment system appropriate for the type and location of the bridge will be in place and maintained to prevent spent blast media from reaching State waters. Spent blast media will be collected, sampled, designated for its hazardous material content, and disposed of as appropriate for its waste designation at an approved and permitted site that is in compliance with the ESA.

MM-51: For brush and/or roller paint applications, painters will work from pails containing a maximum of 2 gallons of paint to minimize the impact of accidental spillage, except for sealed containers that are part of a spray system.

MM-52: Cleaning of paint materials and maintenance equipment will not be done in or over waters of the State nor will resultant cleaning runoff be allowed to enter State waters.

MM-53: Drip pans or other protective devices will be required for all paint mixing and solvent transfer operations.

MM-54: Drip tarps will be suspended below paint platforms to prevent spilled paint, buckets, brushes, etc. from entering State waters).

MM-55: No temporary floating work platform will place its anchors or allow grounding in fish spawning areas in freshwater or in eelgrass, kelp, macro algae, or intertidal wetlands. Anchoring above beds or eelgrass, kelp, or macro algae will be kept to a minimum).

MM-56: During subsurface sampling, when working off the roadway, bridge deck, barge, or road surface, within 200 ft of waters containing listed fish species or their prey, appropriate BMPs must be used or installed to prevent sediments and other contaminants from entering the waterbody.

MM-57: During subsurface sampling within 200 ft of waters containing listed fish species or their prey, all materials removed from the test hole will be removed from the site until sub-sampling is completed. Uncontaminated material may be returned to the test hole. All subsurface sampling sites within waterbodies will be refilled with clean, silt-free material if the holes create a potential stranding hazard.

MM-58: Oil absorbent pads will be placed under the drill rig to catch and control spills during subsurface sampling when within 200 ft of waters containing listed fish species or their prey.

MM-59: For subsurface sampling within 200 ft of waters containing listed fish species or their prey, the team lead will have a minimum of 4 hours erosion control, spill control and containment training.

MM-60: For subsurface sampling all existing LWD will be left on or adjacent to the site if feasible. The PBA Determination Form must provide justification if LWD is removed.

MM-61: For subsurface sampling, no geared mechanisms (e.g., tires, tracks) will enter the wetted perimeter of a waterbody. Truck mounted and tracked drilling equipment will work from a location outside of the wetted perimeter unless working off of a temporary floating work platform. The temporary floating work platforms will not ground on the bed of State waters.

MM-62: Construction equipment will not enter any water body without authorization from WDFW. Use of construction equipment in water will be specifically stated on the PBA determination form. Equipment will be operated as far from the water's edge as possible.

MM-63: Report emergency actions to Washington Fish and Wildlife Office of the Service within one workday where bull trout or other federally listed species under the Service's jurisdiction are potentially present. Limit scope of activities in response to emergency to only those that are necessary to address immediate emergency. Emergency actions that are not evaluated in this PBO may require individual consultation.

MM-64: Projects will implement TESC/SPCC protocols as stated in the HRM.

MM-65: Projects will at a minimum comply with WDOE's State Water Quality Standards or permit modifications, and with all requirements of the most current version of the WSDOT HRM. Permit modifications are limited to temporary extension of the turbidity plume.

MM-66: If site-specific conditions allow, improve fish habitat by incorporating LWD into bank protection projects**.** The PBA Determination Form will provide justification for not including fish habitat improvement measures as part of a bank protection project.

MM-67: Bull trout, all other salmonids, and their forage fish will be removed from the work area prior to any in-water work activities, unless removal would results in more impacts to the individuals. Fish exclusion activities will follow WSDOT's Fish Exclusion Protocols and Standards (Appendix D) or most current protocol. The PBA Determination Form will provide justification if fish removal is not proposed during in-water work.

MM-68: Equipment will be checked daily for leaks and will be well maintained to prevent lubricants and any other deleterious materials from entering waters of the State. Prior to entering the water or below the OHWM, all equipment will be free of any external petroleum products, hydraulic fluid, coolants, and other deleterious materials. Wash water will not be discharged to any water body without pre-treatment.

MM-69: All equipment entering waters that may be used by bull trout or are within bull trout critical habitat will use vegetable oil or other biodegradable acceptable hydraulic fluid substitute.

MM-70: Installation of riprap and other materials will occur from the banks or outside the wetted perimeter as much as possible.

MM-71: For those projects adding stream bank protection, the "Integrated Stream bank Protection Guidelines" (ISPG) will be followed. Exceptions to implementation of this Minimization Measure include the following: 1) emergency projects when the time to complete the needed site/reach assessments is not available and/or 2) if the techniques recommended in ISPG (i.e., engineered log jams, LWD, and bioengineering) are not applicable due to factors such as buoyancy, scour, shear, rotational forces, channel response, and recruitment. Projects that do not follow ISPG techniques must specifically state this in the PBA Determination Form and the specific rationale for not using these methods must be provided.

MM-72: All materials, such as riprap or gravel, placed within the water will be free of rock fines, silt, soil, or other extraneous material. An exception to the presence of fines is permitted if they are required as part of channel bed reconstruction. Inclusion of fines as part of a proposed project must be justified in the PBA Determination form.

MM-73: Water pumped out of the isolated project area will be discharged to a temporary storage and treatment site or into upland areas and filtered through vegetation prior to reentering the stream channel.

MM-74: All intake pumps within fish bearing streams will have a fish screen installed, operated and maintained. Screening techniques must utilize the specifications in the HPA and be in compliance with RCW 77.55.010, RCW 77.57.040 and RCW 77.57.070 or the specifications in the NMFS Anadromous Salmonid Passage Facility Design manual (2008) and NMFS Fish Screening Criteria for Anadromous Salmonids (1997), whichever is more restrictive Should the WSDOT biologist determine that all fish have been removed from the dewatered segment of the stream and that the screens are no longer needed, they may contact the Service project biologist to request permission for the removal of the screens. All requests and responses must be in writing (including email). The screens will not be removed until a written response from the Service has been received.

MM-75: Temporary diversion structures will be non-erosive (e.g., sand bags filled with clean gravel and covered with plastic sheeting, portable bladder dam).

MM-76: Temporary bypass systems will utilize non-erosive techniques, such as pipe or a plastic-lined channel that will accommodate the predicted peak flow rate during construction.

MM-77: Temporary bypass structures will have energy dissipaters at the outflow to prevent erosion.

MM-78: Dewatering must follow the WSDOT Fish Exclusion Protocols and Standards (Appendix D) or most current protocol. Dewatering will occur slowly enough to allow the efficient removal of all listed fish species and avoid strandings. The sites will be re-watered slowly enough to prevent the loss of surface water downstream as the streambed absorbs water and to minimize or avoid a sudden increase in stream turbidity. During re-watering, the sites should be monitored to prevent stranding of aquatic organisms below the construction site as well as excessive turbidity.

MM-79: All stream diversion devices, equipment, pipe, and conduits will be removed and disturbed soil will be restored after diversions are removed.

MM-80: Culvert cleaning, repair, and maintenance will occur during the dry or when listed or proposed fish are least likely to be present.

MM-81: For waters that may be used by bull trout or are within bull trout critical habitat, culvert cleaning will occur either by hand or from the top of the bank when flow is in the channel or when the stream is either dry or a flow bypass is installed.

MM-82: All culverts conveying fish bearing streams will be designed and constructed accordance with WDFW's Design of Road Culverts for Fish Passage (Bates et al. 2003) or most current document and related Washington Administrative Code criteria. Culverts must be designed to either meet the "no slope" or the "stream simulation" model design, which ever is most appropriate.

MM-83: Projects will not inhibit passage of any salmonid species life stage or their prey following completion. When feasible, a bypass system will be installed during construction to permit both upstream and downstream passage of salmonids and their prey. If a bypass system is not installed, this will be explained in the PBA Determination Form.

MM-84: All excavated materials will be removed to an upland location where they cannot enter the water body.

MM-85: New stream crossing structures will not reduce the existing stream width.

MM-86: Fill material will only be placed in specified and permitted locations that are in compliance with the ESA. Fill placement may be permanent or temporary and will be located in a way that minimizes impacts to sensitive areas.

MM-87: Temporary fills must be entirely removed and the site restored to pre-existing conditions.

MM-88: Installation of steel piles with an impact hammer in-water requires the use of a bubble curtain or other approved sound attenuation method(s) to minimize impacts within waterbodies that may be used to bull trout. The PBA Determination Form will state if a bubble curtain is not used when impact pile driving steel piles and explain why.

MM-89: No creosote-treated wood will be used.

MM-90: Any removed piling or other materials, including their waste water, will be fully contained and disposed of at a location with regulatory approval.

MM-91: No anthropogenic debris will be allowed to fall in the water. If any debris does fall in, it will be removed immediately.

MM-92: For pile removal, direct pulling, vibratory removal, or cutting the piles below ground level will be prioritized to minimize localized turbidity. If use of a clamshell bucket is necessary due to pile breakage, silt curtains will be employed if site specific conditions support their use. Limiting factors for silt curtain use include tidal influence and currents. The PBA determination form will state why a silt curtain cannot be used.

MM-93: In tidally influenced areas, piles will be driven during slack tides whenever practicable.

MM-94: All treated wood will be contained during and after removal to preclude sediments and any contaminated materials from re-entering the aquatic environment. All contaminated materials will be disposed of at an approved and permitted disposal facility that is in compliance with the ESA. No reuse of treated wood will occur.

MM-95: Projects that drain to waters that may be used by bull trout and create more than 500 ft^2 of new pollution generating impervious surface in any Threshold Discharge Area (TDA) will use the most current WSDOT stormwater effects analysis guidance to evaluate the potential effects of each proposed project. The PBA Determination Form and/or supplemented documents must include the following information at a minimum:

1. Sufficient information to assess pre-project and post-project stormwater pollutant loadings and end of pipe concentrations.
2. Identify the receiving waterbodies for the stormwater runoff associated with the new pollution generating impervious surface.
3. Identify any proposed new (or modified) stormwater outfalls/structures.
4. A qualitative or quantitative description of pre- and post project mixing zones or dilution analysis, consistent with WSDOT stormwater effects analysis guidance. If exposure of bull trout in the dilution zone cannot be discounted, a quantitative description is recommended.

5. Describe potential effects to hydrology (i.e., peak flows, base flows, flow durations, etc.) and instream conditions (i.e., bed and bank scour or erosion, channel stability, etc.) due to the proposed project.

MM-96: Stormwater will be infiltrated and/or dispersed, when possible. The PBA Determination Form will specify if infiltration and/or dispersion is not used and why.

MM-97: If the WSDOT stormwater treatment studies that are currently being implemented demonstrate that enhanced treatment results in increased removal of contaminants that negatively impact fish (e.g., zinc, copper, TSS) enhanced treatment will be required for stormwater discharged to streams currently designated by WDOE as 303(d) and 305. The PBA Determination Form will specify if enhanced treatment is not be used and why.

MM-98: All exposed areas will be mulched and seeded with an approved native or non-invasive herbaceous seed mix following construction and/or planted with native woody vegetation and trees (if appropriate) during the first available planting season.

MM-99: Excavated or other material removed as part of the programmatic activity will not be reused if it will result in direct or indirect effects to listed species or designated critical habitat.

MM-100 Sound pressure will be monitored per the approved WSDOT in-water pile driving monitoring plan to determine ambient conditions and the sound pressure generated during in-water impact pile driving of steel piles, including H-piles, and sheet piles Sound pressure monitoring will occur for in-water work where bull trout may be present. Monitoring results will be provided to the Service within 90 days following completion of pile driving.

MM-101: Projects located within 200 ft of potentially suitable native upland prairies and open oak woodlands as identified by the project biologist, will install and maintain all appropriate BMPs to ensure that no foreign material, such as pavement slurry, is sidecast, and that sediments are minimized unless site specific review completed by the project biologist indicates that topography or other factors preclude impacts to this habitat (**applies only to Kincaid's lupine**). The PBA Determination Form will provide justification if a 200 foot buffer is not maintained.

MM-102: No contractor staging areas will be allowed within 200 ft of potentially suitable native upland prairies and open oak woodlands as identified by the project biologist, unless site specific review completed by the project biologist indicates that no impacts to the sensitive resource areas will occur due to topography or other factors (**applies only to Kincaid's lupine**). The PBA Determination Form will provide justification if a 200 foot buffer is not maintained.

MM-103: Herbicides will not be used within 200 ft of bull trout spawning and rearing streams unless site specific review completed by the project biologist indicates that topography or other factors preclude herbicides from reaching spawning and rearing stream occupied by bull trout. The PBA Determination Form will provide justification if a 200 foot buffer is not maintained.

MM-104: The project will not cause or contribute to bed or bank scour or erosion (channel instability), and will not measurably affect base, peak, or flow durations in any TDA or receiving waterbody.

MM-105: Repair or extension of culverts that are partial or complete fish passage barriers includes measures to create fish passage for all life stages is incorporated into the project (Bates et al. 2003). The retrofit of an existing culvert to provide fish passage will require approval of the project design from the WDFW's Area Habitat Biologist and WDFW's Area Engineer.

MM-106: Within bull trout local populations, no removal of vegetation is permitted on streambank slopes. The removal of living woody vegetation from riparian areas on the top of the slope is anticipated to be less than 4 inches in diameter. Any riparian vegetation removal from the top of the bank slope will not result in shade or nutrient input reduction or increased temperature and documentation supporting this conclusion will be included in the PBA Determination Form.

Expiration of PBO Consultation

The PBO will expire after 5 years of the signing of this PBO unless a written request is submitted by the FHWA and it is extended in writing by the Service. The extension of the PBO may occur if the effects anticipated in the PBO have not been exceeded.

Procedures for Using the PBA/PBO

All projects that are determined by FHWA/WSDOT to comply with the PBO and result in adverse effects to listed species and/or their critical habitat must follow all early coordination processes agreed to by the Service and FHWA/WSDOT, and must be presented to the Service at Pre-Biological Assessment meetings prior to submittal of formal request for consultation on these proposed projects. Additionally, all projects that remove suitable murrelet nesting habitat in Southwest Washington (see Figure 2) must also be presented at Pre-Biological Assessment meetings. The Service, through this early involvement, may recommend additional minimization measures or present additional Terms and Conditions that may be required as a result of the proposed project.

The Service is currently reviewing the timing windows used to avoid impacts to nesting murrelets. The timing windows do not fully account for potential impacts to incubating murrelets. Therefore, until we have completed our review, projects that may result in disturbance of nesting murrelets during the nesting season (April 1 through September 15) must be discussed with Service prior to formal submittal for concurrence. These discussions are to

assist WSDOT in determining if the effects due to the proposed disturbance may result in insignificant or measurable effects to nesting murrelets based on the project specific information.

All projects that are determined by FHWA/WSDOT to comply with the PBO require the submittal of the "WSDOT Western Washington Determination Form for PBA FWS #13410-2007-F-0004" (PBA Determination Form) to the Service prior to implementation of the proposed project[12]. Projects seeking coverage under the programmatic that create new impervious surface and that discharge to or to tributaries directly upstream of waterbodies used by bull trout must also provide stormwater documentation consistent with current WSDOT guidance. This documentation will, at a minimum, provide sufficient information to assess pre-project and post-project stormwater pollutant loadings and end of pipe concentrations, will identify the project's receiving waterbodies and any proposed new (or modified) stormwater outfalls/ structures, and will describe potential effects to hydrology (i.e., peak flows, base flows, flow durations, etc.) and instream conditions (i.e., bed and bank scour or erosion, channel stability, etc.).

It is the Service's intent to determine within 15 days (but no more than 30 days) of receipt of the submittal of the PBA Determination Form if they agree with the proposed findings or if additional information is needed. For "may affect, likely to adversely affect" determinations, it is the Service's intention to complete the review within 60 days (and no more than 90 days) from receipt of the complete submittal package. The Service will determine the completeness of the package and will provide this verification in writing, including email, to FHWA/WSDOT that the package is complete. If additional clarification or information is requested by the Service, the above timeframes will be extended for the equivalent number of days needed by WSDOT to provide this information to the Service. Should the Service disagree with the findings of FWHA/WSDOT regarding the proposed project, the Service will contact the project manager via email or telephone within the above time periods to explain why they are unable to agree. FHWA/WSDOT will provide the Service the additional information needed to demonstrate that the project is in compliance with the PBO or must submit the project for individual consultation. The Service will respond in writing (including email) with their final decision regarding the projects compliance with the PBO to FHWA/WSDOT. The project cannot proceed until written verification (including email) has been received from the Service that the proposed project meets the conditions of the PBO. For any project where there is uncertainty regarding PBO coverage, early coordination with the Service is recommended.

We anticipate that some projects that we have identified in the PBO as resulting in "may affect, likely to adversely affect" determinations may, due to site specific conditions, more appropriately be determined to result in a "may affect, not likely to adversely affect" call. The PBO may be used for these projects, and they would be considered to be consistent with the programmatic. These projects must be discussed with the Service via email, telephone, or at a Pre-Biological Assessment Meetings prior to submittal to the Service; only those projects that the Service has agreed may meet the criteria of an insignificant or discountable effect, based on this preliminary information, may then be submitted for review as "may affect, not likely to adversely affect." The PBA Determination Form must clearly identify why these projects would

[12] The PBA determination form will document the WSDOT's finding of a particular project's effect on listed species or critical habitats. For NE projects, the WSDOT will document the NE determination in their project files. Notification or concurrence from the Service is not required and will not be provided for NE determinations.

not adversely affect the listed species, but would instead result in insignificant or discountable affects. Once submitted, the Service may determine, based on review of all the information, that the effects of the proposed projects are measurable, and require review as a formal consultation under the PBO. We strongly recommend that Pre-Biological Assessment Meetings be used for those projects where there is uncertainty regarding the effect call to minimize the risk of time delays associated with submittal of projects to the Service should we not concur on the proposed effect call.

If the proposed project meets the conditions of the PBO for some but not all species, individual consultations will be conducted to address those species that can not be covered by the programmatic consultation. In that case, both the PBA determination form and an individual BA will be submitted to the Service.

If at any time there are uncertainties with interpreting the conditions of the PBO or with a project's compliance with the PBO, the project biologist will coordinate with the Service to address these concerns and determine a course of action.

Projects that do not meet the specific description and criteria of the action, including all applicable minimization measures as written in this PBO, may be submitted to the Service as a reference biological assessment. This procedure applies only to those projects that would result in "may affect, not likely to adversely affect" determinations for those species addressed as part of this PBO, where the proposed project is only a minor deviation from the action currently included in the PBO consultation. The PBA determination form must specifically and clearly identify why the proposed project does not meet the programmatic as described in the PBO. FHWA/WSDOT may propose additional Minimization Measures, or modify or exclude existing Minimization Measures specific to the activity under review. Any modification, exclusion, or addition of Minimization Measures will be stated and explained on the PBA determination form.

A meeting will be held between FHWA, WSDOT, the Service, and other interested Federal action agencies to discuss the use of the PBA and PBO, the PBA notification and agreement process, and suggested changes. The first meeting will occur within 6 months after the PBO is finalized. The next meeting will occur 6 months later, and each subsequent meeting will occur yearly, before the date of signing of the PBO. WSDOT/FHWA will be responsible for scheduling the meetings. The above procedures, conservation and performance measures, and terms and conditions may be modified prior to the annual meeting based on review of the PBAs submitted, including their completeness and consistency with the action covered in the PBO. Modification to conservation and performance measures and terms and conditions may require reinitiation of the consultation.

WSDOT will provide a yearly monitoring report to the Service regarding the use of the programmatic at least 30 days prior to the annual meeting. The report will identify the following:

1. Projects that were submitted under the programmatic. Include the Service reference number for the specific project, name, type of activity, and the WSDOT program and

region that submitted the consultation. Projects will be identified as those that met the programmatic and those that used the programmatic as a reference biological assessment.

2. The listed species and/or critical habitat and its effect call by project.
3. Take authorized per species per project and actual take used per species per project.

These procedures are in addition to those that may be required by other Federal agencies, such as the National Park and National Forest Services, regarding the use of this programmatic on lands within their jurisdiction. For example, Mount Rainier and North Cascades National Parks have requested specific coordination and consultation procedures for projects within their administrative boundaries. For those projects that occur within or on these Federal lands, the proposed projects cannot go forward under the PBO until the Federal land agency has also concurred on the project as requested and/or a determination is made that the project is in compliance with the conditions of the applicable forest and/or park. This concurrence and/or compliance determination will be included in the PBA determination form submitted to the Service.

Extent of Impacts Proposed under the Programmatic

The PBA and subsequent correspondence identifies the following extent of habitat and disturbance impacts that may result in adverse impacts to bull trout, murrelets, northern spotted owls, and their associated critical habitats under this programmatic.

Bull Trout

Habitat impacts

Annually per WSDOT Northwest and Olympic Regions, adverse effects associated with up to **5** bridge scour repairs and seismic retrofit projects, **2** slide abatement and repair projects, **2** emergency bank stabilization projects, **5** projects such as culvert and bridge replacements, and **10** fish habitat and passage enhancement projects are allowed outside of the Lower Columbia Basin IRU.

The number of projects that may result in adverse effects to bull trout is limited to no more than five projects within a 5th-field watershed per year for each of the WSDOT Olympic and Northwest Regions. Additionally, only one of these adverse projects per year may occur within a bull trout local population for the WSDOT Northwest Region[13]. No take of bull trout is permitted for the WSDOT Southwest Region.

[13] All actions proposed within the WSDOT Olympic Region would occur outside of a bull trout local population.

Capture and Handling

Adverse effects associated with capture and disturbance to bull trout during fish handling applies to a maximum of **20** projects per WSDOT Northwest and Olympic Regions, annually. Therefore, up to 200 projects may result in adverse effects associated with fish handling for projects outside of the Lower Columbia Basin IRU for the life of this PBO.

Bull Trout Critical Habitat

Annually per WSDOT Northwest and Olympic Regions, adverse effects for up to **5** bridge scour repairs, **2** slide abatement and repair projects, **2** emergency bank stabilization projects, **5** projects such as culvert and bridge replacement, and **10** fish habitat and passage enhancement projects are allowed outside of the Lower Columbia Basin IRU.

Murrelets

Visual and Sound Disturbance Impacts

Adverse effects associated with disturbance to murrelets are expected for 1 project per year per WSDOT Region for a total of 15 projects over the life of the programmatic.

Habitat Impacts

- The removal of up to **5 acres** understory vegetation, including trees less than 14 inches dbh, within murrelet nesting habitat per WSDOT Region, per year is allowed. Therefore, a maximum of **25 acres** of such habitat per region (not to exceed 5 acres per project or stand) can be removed for the life of this PBA for a total of **75 acres** for the life of this PBO[14].
- The removal of up to **0.5 acre** understory vegetation, including trees from 14 inches dbh to less than 19 inches dbh within 150 ft of murrelet suitable nest trees per region, per year is allowed. Therefore, a maximum of **2.5 acres** of such habitat per WSDOT Region (not to exceed 0.5 acre per project or stand) can be removed for the life of this PBA for a total of **7.5 acres** for the life of this PBO.
- The removal of up to **50** non-potential nest trees19 inches dbh and greater from murrelet nesting habitat per region per year is allowed (no more than 25 trees per project or stand over the life of the programmatic). Therefore, a maximum of **250 trees** of such habitat per WSDOT Region can be removed for the life of this PBO, for a total of **750 trees** for the life of this PBO.

[14] Habitat impacts murrelets, northern spotted owls and their critical habitat may occur at the same location and the total maximum impact to each cannot be exceeded. For example, the removal of 2 acres of understory vegetation including trees less than 14 inches dbh within suitable murrelet nesting habitat may also be count against the maximum loss of this type of habitat if it is considred to be within or meet the defintion of murrelet critical habitat, northern spotted owl suitable habitat, northern spotted owl dispersal habitat, and/or northern spotted owl critical habitat. .

- Removal of **15** potential nest trees from murrelet nesting habitat per region per year is allowed outside of the nesting period (no more than 5 per project or stand per over the life of the programmatic). Therefore, a maximum of **75 trees** of such habitat per WSDOT Region can be removed for the life of this PBO, for a total of **225 trees** for the life of this PBO.
- Within Murrelet Conservation Zone 2, Southwest Area (Figure 2) only one potential nest tree in stands with five or more platforms per acre per year and 0.5 acre of suitable habitat may be removed over the life of the programmatic (5 years). Also, up to 25 non-potential nest trees 19 inches dbh and greater may be removed from murrelet nesting habitat within this area over the life of the programmatic. These habitat impacts are part of the total removal permitted per year and over the life of the programmatic within Conservation Zone 2.

Murrelet Critical Habitat

- The removal of up to **5 acres** understory vegetation, including trees less than 14 inches dbh, within murrelet nesting habitat per region, per year is allowed. Therefore, a maximum of **25 acres** of such habitat per WSDOT Region (not to exceed 5 acres per project or stand) can be removed for the life of this PBA for a total of **75 acres** for the life of this PBO.
- The removal of up to **0.5 acre** understory vegetation, including trees from 14 inches dbh to less than 19 inches dbh within 150 ft of murrelet suitable nest trees per WSDOT Region, per year is allowed. Therefore, a maximum of **2.5 acres** of such habitat per region (not to exceed 0.5 acre per project or stand) can be removed for the life of this PBA for a total of **7.5 acres** for the life of this PBO.
- The removal of up to **50** non-potential nest trees 19 inches dbh and greater (no more than 25 trees per project or stand over the life of the programmatic) from murrelet nesting habitat per WSDOT Region per year is allowed. Therefore, a maximum of **250 trees** of such habitat per region can be removed for the life of this PBO, for a total of **750 trees** for the life of this PBO.
- Removal of **15** potential nest trees (no more than 5 per project or stand per over the life of the programmatic) from murrelet nesting habitat per region per year is allowed outside the nesting period. Therefore, a maximum of **75 trees** of such habitat per WSDOT Region can be removed for the life of this PBO, for a total of **225 trees** for the life of this PBO.

Northern Spotted Owls

Visual and Sound Disturbance Impacts

Adverse effects associated with disturbance to northern spotted owl and their potential progeny is limited to 1 project per year per WSDOT Region for a total of 15 projects over the life of the programmatic.

Habitat Impacts

- The removal of up to **5** acres of understory vegetation or trees less than 14 inches dbh from nesting, roosting, and foraging habitat and dispersal habitat per region, per year is allowed. Therefore, each WSDOT Region can remove a maximum of **25** acres of such habitat (not to exceed 5 acres per project or stand) for a total of **75 acres** for the life of this PBO.
- The removal of up to **0.5 acre** understory vegetation, including trees between from 14 inches dbh to less than 19 inches dbh from northern spotted owl suitable habitat per region, per year is allowed. Therefore, a maximum of **2.5 acres** of such habitat per WSDOT Region (not to exceed 0.5 acre per project or stand) can be removed for the life of this PBA for a total of **7.5 acres** for the life of this PBO. This maximum loss will likely also be counted against the maximum loss of murrelet nesting habitat.
- The removal of up to **50** non-potential nest trees 19 inches dbh and greater (no more than 25 per project or stand over the life of the programmatic) from northern spotted owl nesting and roosting habitat per region, per year is allowed. Therefore, each WSDOT Region can remove a maximum of **250 trees** of such habitat for a total of **750 trees** for the life of this PBO
- The removal of up to1**5** potential nest trees (no more than 5 per project or stand over the life of the programmatic) from northern spotted owl nesting habitat outside the nesting period per region, per year is allowed. Therefore, each WSDOT Region can remove a maximum of 7**5** trees of such habitat for a total of **225 trees** for the life of this PBO.

Northern Spotted Owls Critical Habitat

- The removal of up to **5** acres of understory vegetation, including trees less than 14 inches dbh, from northern spotted owl critical habitat per WSDOT Region, per year is allowed. Therefore, each region can remove a maximum of **25** acres of such habitat (not to exceed 5 acres per project or stand) for a total of **75 acres** for the life of this PBO.
- The removal of up to **0.5 acre** understory vegetation, including trees from 14 inches dbh to less than 19 inches dbh from northern spotted owl critical habitat per region, per year is allowed. Therefore, a maximum of **2.5 acres** of such habitat per WSDOT Region (not to exceed 0.5 acre per project or stand) can be removed for the life of this PBA for a total of **7.5 acres** for the life of this PBO.
- The removal of up to **50** non-potential nest trees 19 inches dbh and greater (no more than 25 per project or stand over the life of the programmatic) from northern spotted owl critical habitat per region, per year is allowed. Therefore, each WSDOT Region can remove a maximum of **250 trees** of such habitat for a total of **750 trees** for the life of this PBO.
- The removal of up to1**5** potential nest trees (no more than **5** per project or stand over the life of the programmatic) from northern spotted owl critical habitat outside of the nesting season per WSDOT Region, per year is allowed. Therefore, each region can remove a maximum of 7**5** trees of such habitat for a total of **225 trees** for the life of this PBO.

Activities Not Covered Under this Programmatic Consultation

The following projects have not been included in the programmatic consultation. These activities require individual consultation.

1. Projects that include vibratory or impact pile driving in marine or estuarine waters. Tidally influenced waters above the mouth of a river can be included in the programmatic if there is a topographic feature that precludes sound pressure from reaching these marine and estuarine areas.
2. Projects that result in adverse effects to bull trout or their critical habitat in the Lower Columbia River Basin Interim Recovery Unit.
3. Projects that create brown and/or brook trout access into previously isolated bull trout populations.
4. Projects that remove suitable or potentially suitable murrelet or northern spotted owl nesting habitat during the nesting season.
5. Projects that permanently eliminate or impede passage for any life stage of bull trout and/or forage for a listed or proposed fish species.
6. Projects, including new general purpose lanes, new interchanges, or new lanes from interchange to interchange, which result in or contribute to increased traffic capacity or other land use changes that result in effects, including indirect effects, not consider in this PBO[15].
7. Projects requiring the removal and disposal of contaminated soils. This exclusion does not apply to the *Subsurface Investigation and Hazardous Waste Sampling.*
8. Programmatic activities affecting Federal lands, such as a National Forest or National Park, where the administering Federal agency has not provided written acceptance of these activities and their effects as described in the programmatic for use on their lands.
9. Non-emergency bank stabilization and non-emergency flood damage repair projects using hardened structures or materials (such as riprap) in streams that may be used by bull trout or their forage species. This exclusion does not apply to the use of riprap or other material used for bridge pier scour prevention and repair projects or those projects that replace previously existing riprap provided the placed bed and bank armor is in-kind and does not exceed the pre-existing ("as built") condition by more than 5 percent.
10. Projects adding riprap bank stabilization marine or estuarine waters outside of the approximate highway segments specified on SRs 101, 105, 106, 112, and 401.

[15] WSDOT shall use the most current version of the ESA, Transportation and Development: Assessing Indirect Effects guidance, which can be found on the following web site: http://www.wsdot.wa.gov/Environment/Biology/BA/default.htm

11. Projects that do not provide stormwater runoff treatment (or a combination of treatment and dispersion or infiltration) for an area equivalent to the net-new PGIS, plus any replaced PGIS[16].

12. Projects that do not provide flow control (or a combination of flow control and infiltration) for an area equivalent to the net-new PGIS, plus any replaced PGIS[12], except for those projects that discharge into the following flow exempt waterbodies: Columbia River, Puget Sound, Pacific Ocean, Lake Washington, Lakes Sammamish, Union, Washington, and Whatcom.

13. Projects that do not comply with all requirements from current versions of the WSDOT *Highway Runoff Manual*.

14. Projects that cause or contribute to bed or bank scour or erosion (channel instability), and measurably and adversely affect base flows or flow durations in any TDA.

15. Pesticide (including herbicide) applications used for non-restoration/mitigation purposes or as part of the pre-planting stage of roadside restoration activities. All pesticides (including herbicides) are precluded from use except glyphosate with the surfactants Agri-Dex or tryclopyr amine (trade name Garlon 3A).

16. Activities that exceed the sound disturbance threshold (92 dBA) or are less than 92 dBA and located within 11 yards of murrelet suitable nesting habitat and/or within 20 yards of northern spotted owl suitable nesting, roosting, and foraging habitat during the murrelet nesting season (April 1 through August 5) and northern spotted owl early nesting season (March 1 through July 15 outside of Mt Rainier National Park; March 15 through July 30 within Mount Rainier National Park[17]), except in high elevation or coastal areas where adverse weather conditions (e.g., snow at high elevations, low temperatures for paving, fog in coastal areas) preclude these activities from occurring outside the nesting season or for emergency actions addressed in the PBO.

17. Production blasting that may affect listed species.

18. In-water blasting.

19. Blasting that is less than 200 ft from suitable northern spotted owl and/or murrelet habitat during the northern spotted owl and/or murrelet nesting season, except for limited emergency slide removal activities as described in the PBO. The blast must not result in the destruction of nesting habitat or physical injury to nesting, foraging, or roosting listed birds

20. New road alignments within a riparian corridor or the creation of a new riparian crossing (not a replacement crossing) that will result in significant alteration (0.5 acre or more) of riparian habitats.

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[16] Exceptions to this exclusion are only applicable to projects that do not trigger the following HRM and WDOE requirements. The HRM does not require runoff treatment or flow control for projects that create less than 2000 ft^2, and WDOE does not require water quality treatment for projects creating less than 5,000 ft^2.

[17] Based on site specific survey data, the nesting season for northern spotted owls on Mount Rainier is different from other locations in Washington.

21. Non-emergency actions that require extensive in-water work outside the timing window stated in the HPA and *Water Quality Standards for Surface Waters of the State of Washington* (Chapter 173-201A WAC) or outside of July 16 through August 15 if in the Puyallup (upstream of the Puget Sound Energy Electron Powerhouse outfall), Carbon, and White rivers. Extensive is defined as over one month in duration,
22. Activities within known or potential bull trout spawning habitat that occur in-water during bull trout spawning, early development, and spawning migration. If spawning adults are observed after initiation of a project, all in-water work must stop. The Service will be contacted immediately to determine whether or not work can proceed and if additional measures to protect bull trout are necessary.
23. Projects that replace or modify existing culverts or bridge(s), but do not correct existing fish passage barriers associated with the culvert(s) or bridge(s).
24. Bridge removal projects that involve dropping bridge sections within the OHWM of a stream.
25. Realignment of a state route by more than 0.5 mile.
26. New alignments that are more than 0.25 mile long.
27. Projects that conduct blasting or pile driving within one mile of a brown pelican roost site and/or impact or modify brown pelican roost sites.
28. Projects with listed plant species located within the project area that do not have draft or final Recovery Plans.
29. Projects within the boundaries of Mount Rainier National Park that result in adverse effects to marbled murrelets or suitable murrelet nesting habitat, or northern spotted owls or their suitable habitat.
30. Projects within the boundaries of Mount Rainier National Park that result in adverse effects to bull trout and/or bull trout critical habitat.
31. Trees proposed to be removed that are located on Federal, State, or private lands and/or are covered by a habitat conservation plan (HCP), which would violate conditions set forth by the landowner(s) and/or the requirements of the HCPs.
32. Projects that create new pollution generating impervious surfaces that discharges to streams that may be used by bull trout within bull trout local populations.
33. New or modified stormwater outfalls that discharge to streams that may be used by bull trout within bull trout local populations.
34. Bridge painting projects that do not meet conditions of GHPA and general NPDES permit.
35. Beaver dam removals that do not meet Beaver Dam Removal GHPA requirements.

Interrelated and Interdependent Actions

Interdependent and/or interrelated actions anticipated for the activities proposed under the PBO include the following.

Utility Relocations

WSDOT road widening or realigning projects, as well as bridge projects (implemented under the Safety and Mobility programs) may require above-ground or buried utility relocations. The utilities are located on WSDOT right-of-way by Franchise Agreement. Relocations are the responsibility of the utility, including obtaining the necessary permits and approvals. Utility relocation may include moving utility poles or uncovering buried utilities and trenching them in at new locations. Utility pole installation is typically accomplished with a large drill. Relocations may involve tree and other vegetation removal. Revegetation is possible, but would typically not include tree planting due to safety and maintenance concerns. Additionally, if streams are present, installing buried utilities would involve boring beneath the stream channel. However, directional drilling under fish bearing streams is not covered by this programmatic.

Activities associated with slide abatement and repair

Some slide abatement activities may be conducted as a temporary measure to alleviate an immediate problem. A long-term repair would be necessary in the future. However, the long-term repair is unlikely to meet the conditions set forth in the PBO due to more extensive construction activities and effects to the environment, and therefore is not addressed further. The PBA Determination form must clearly indicate if a Slide Abatement and Repair activity is conducted only as a temporary measure.

Activities associated with bank stabilization activity

Some bank stabilization activities (such as placement of riprap) may be conducted to temporarily alleviate the problem until a more permanent repair can be implemented. A long-term repair would be necessary in the future. However, the long-term repair is unlikely to meet the conditions set forth in the PBO due to more extensive construction activities and effects to the environment, and therefore is not addressed further. The PBA Determination form must clearly indicate if a bank stabilization activity is conducted only as a temporary measure.

Federally Listed Species and/or Critical Habitat – Insignificant and or Discountable Effects

Based on the program descriptions provided by FHWA and WSDOT, the minimization measures incorporated into the projects, and the distribution, habitat needs, and biology of theses species, the Service concurs with the “may affect, not likely to adversely affect” determinations for the following species and/or critical habitat, provided the projects/activities are implemented as specified in the PBO. Consequently, these species will not be addressed further in this PBO beyond the following discussion of our rationale for concurrence for each species. Any activity or project that does not meet the parameters described in the PBO, including the pertinent conservation measures, and that would adversely affect any of these species, would not be covered by this programmatic consultation and would require an individual consultation.

Gray Wolf

The following measures are proposed by WSDOT to minimize impacts to gray wolves and their prey as part of the proposed action.

GW-5: Activities generating noise above ambient levels within 0.5 mile of a known gray wolf den or rendezvous site will occur outside of the denning and rendezvous period (between the dates of July 1 and March 14).

GW-6: Activities within a known, occupied gray wolf territory, which generate noise above ambient levels or otherwise create disturbance within occupied ungulate wintering areas will occur outside of the wintering period (between April 16 and November 30), or outside of the calving period (between June 16 and November 30), in occupied ungulate calving, fawning or kidding grounds.

Noise and visual disturbance from proposed project activities could affect gray wolf. This species is very rare in western Washington. The few documented occurrences have primarily been in the North Cascades at higher elevations, where few of the highway projects addressed under the programmatic consultation are likely to occur.

In addition, the potential for individual animals to be disturbed by these activities is minimal because they typically avoid regularly used roads, such as state highways. Therefore, the likelihood of exposure of gray wolves to project activities is expected to be discountable.

Proposed projects may alter suitable habitat for this species. However, projects would occur near or adjacent to existing roads. This species typically avoid regularly used roads, such as state highways. Therefore habitat affected would be limited and of lower quality. Because this species is wide-ranging, the effect of the loss of small amounts of habitat would be minimal. The proposed action would not impact ungulate wintering areas. The majority of the proposed projects would not occur during the ungulate wintering period (generally December 1 to March 31), except for emergency repair actions. Therefore, although impacts to gray wolves via their prey species may occur, we anticipate it that these impacts would occur very rarely and be temporary in nature. Therefore, we anticipate that the effects to gray wolves would not be measurable.

Based on the proposed project, conservation measures, and measures GW-5 and GW-6, we expect that the effects of the proposed action will be insignificant to gray wolves.

Grizzly Bear

Projects meeting any of the following conditions proposed by WSDOT will minimize or avoid impacts to grizzly bears and their prey.

GB-4: Those projects that occur east of Interstate 405, SR 167, SR 507, or Interstate 5 (north of Interstate 405 or south of SR 507), but do not occur within suitable grizzly habitat as identified by a qualified biologist.

GB-5: All projects located within the developed limits of a town east of Interstate 405, SR 167, SR 507, or Interstate 5 (north of Interstate 405 or south of SR 507).

GB-6: Those projects that occur east of Interstate 405, SR 167, SR 507, or Interstate 5 (north of Interstate 405 or south of SR 507) and are within 0.25 mile of an active developed transportation corridor.

Noise and visual disturbance from proposed project activities could affect grizzly bears. This species is very rare in western Washington. The few documented occurrences have primarily been in the North Cascades at higher elevations, where few of the highway projects addressed under the programmatic consultation are likely to occur.

In addition, the potential for individual animals to be disturbed by these activities is minimal because they typically avoid regularly used roads, such as state highways. Therefore, the likelihood of exposure of individuals of these species to project activities is expected to be insignificant.

Proposed projects may alter suitable habitat for these species. However, this is expected to be very unlikely. Projects would occur near or adjacent to existing roads. These species typically avoid regularly used roads, such as state highways. Therefore, should habitat be affected, it would be limited and of lower quality. Because these species are wide-ranging, the effect of the loss of small amounts of habitat would not be measurable.

Based on the proposed project and measures GB-4 to GB-6, we expect that the effects of the proposed action will be insignificant to grizzly bear.

Canada Lynx

The following measures are proposed by WSDOT to minimize impacts to Canada lynx and their prey as part of the proposed action.

CL-6: No removal of suitable lynx foraging and/or denning habitat outside of the currently maintained right-of-way except for the removal of individual hazard trees. WSDOT will coordinate with the appropriate National Park Service or Forest Service biologist to identify suitable lynx foraging and/or denning habitat.

CL-7: Up to two hazard trees per acre may be cut within suitable lynx foraging and/or denning habitat during the life of the programmatic (5 years). Downed trees must be retained onsite. A description of the size, location, and type of tree to be removed, and why its removal will not affect suitability of the habitat for Canada lynx or its primary prey species [snowshoe hare (*Lepus americanus*)] must be included in the PBA determination form.

Canada lynx has been documented adjacent to the North Cascades Scenic Highway (SR 20) (Aubry et al. 2002) within the area included in the PBA. SR 20 is the only State highway where proposed projects may affect Canada lynx. Sub-alpine fir zone is considered potential den habitat for the Canada lynx, and occurs between SR 20 mile post (MP) 132.63 and 148.10.

Primary vegetation that contributes to lynx habitat is lodgepole pine (*Pinus contorta*), subalpine fir (*P. lasiocarpa*), and Engelmann spruce (*Picea engelmannii*) (Aubry et al. 2000 in Ruggiero et al. 1999). Cool, moist Douglas-fir (*Psuedotsuga menzisii*), grand fir (*Abies grandis*), western larch (*Larix occidentalis*), and aspen forests may provide secondary vegetation for Canada lynx when it is interspersed within subalpine forests. Dry forest types (e.g., ponderosa pine, climax lodgepole pine) do not provide lynx habitat. Construction activity on the roadway may produce sound above ambient levels. No increase in vehicle speeds or number of vehicles is anticipated from projects proposed under this PBA.

The proposed action will not affect Canada lynx den sites, remove suitable denning and/or foraging habitat (other than individual hazard trees), result in increased vehicle speeds, and/or number of vehicles on the highway. The proposed action may result in temporary disturbance of lynx during dispersal and foraging due to increased noise. Although the effects of human disturbance on Canada lynx are not well studied, anecdotal observations indicate that Canada lynx are tolerant of human disturbance (Ruggiero et al. 1999; Mowat et al. 2000).

Based on the proposed project, conservation measures, and measures CL-6 and CL-7, we expect that the effects of the proposed action will be insignificant to Canada lynx.

<u>Columbia White-Tailed Deer</u>

The following measure is proposed by WSDOT to minimize impacts to Columbia white-tailed deer as part of the proposed action.

CWD-3: Projects located within Wahkiakum and Cowlitz Counties, on SR 4 west of Longview and east of Skamokawa, or on SR 409, will not alter suitable woodland habitat within the Columbia River corridor or tidal spruce forest communities, and will not enable higher traffic speeds.

Rockfall and slope failure projects may result in the removal of foraging habitat adjacent to SR 4. Up to 0.5 acre of foraging habitat may be impacted or removed over the life of the programmatic. Currently, Columbia white-tailed deer have a very small range in Washington State. They are found in portions of Wahkiakum County (Puget Island, in the Columbia River, and the Julia Butler Hansen National Wildlife Refuge), and in Cowlitz County (Fisher Island, Hump Island, Willow Grove Peninsula, in the Columbia River, and portions of the mainland near the Columbia River). Within Wahkiakum and Cowlitz Counties, only WSDOT projects on SR 4 west of Longview and east of Skamokawa, or on SR 409 would be within the range of Columbia white-tailed deer. When proposed projects are located within the range of Columbia white-tailed deer, they will not 1) result in increased volumes or speed of traffic, which decreases the potential for increased road kill, 2) will not alter suitable habitat, and 3) will result in only the minor removal of foraging habitat. Therefore, effects of proposed project activities to Columbian white-tailed deer are not measurable.

Based on the proposed project, conservation measures, and measure CWD-3, we expect that the effects of the proposed action will be insignificant to Columbia white-tailed deer.

California Brown Pelican

The following measures are proposed by WSDOT to minimize impacts to California brown pelican as part of the proposed action.

BP-3: Activities conducted June 1 through October 31, which generate noise levels above ambient levels within 0.25 mile (less than1 mile for blasting or pile driving) of a night roost site will occur between two hours after sunrise and two hours before sunset.

BP-5: Activities within 0.25 mile from suitable roosting (less than 1 mile for blasting or pile driving) will be visually screened from the roost site.

California brown pelicans are only found in Washington during the summer and fall months (approximately June 1 to October 31), and no nesting occurs in the State. California brown pelicans are limited to a narrow band of shoreline along the Pacific coast, with concentrations in the estuaries and bays. They are uncommon in the Straits of Juan de Fuca and Puget Sound. However, as their numbers increase, more individuals may be seen in inland marine waters.

Sound from activities occurring within 0.25 mile of marine waters (less than 1 mile if blasting or pile driving would occur) may temporarily displace foraging and day roosting brown pelicans. However, the effects of temporary displacement of California brown pelicans to adjacent areas is not expected to be measurable, because potential disturbance would be limited in duration and alternative foraging and day roosting habitat is typically available. No day roosting habitat will be altered. Therefore, these effects due to temporary displacement are anticipated to be insignificant to brown pelicans.

Activities near night roost sites would be conducted during the daytime (between 2 hours after sunrise and 2 hours before sunset) during the time period that California brown pelicans may be within the action area (June 1 through October 31), which would limit brown pelican exposure to project activities. Screening of roost sites would also be required if activities are within 0.25 mile (less than 1 mile for blasting and pile driving) of the roost, further minimizing potential impacts to California brown pelicans. The PBA does not cover projects that conduct blasting or impact pile driving within 1 mile of a California brown pelican night roost. It also does not cover projects that impact or modify brown pelican roost sites. Therefore, effects of proposed project activities to night roosting brown pelicans are expected to be discountable.

To minimize impacts to fish, including forage fish utilized by California brown pelicans, BMPs will be incorporated into all projects which have activities in marine waters. Therefore, effects of proposed project activities to brown pelican forage species are insignificant.

Based on the proposed project, conservation measures, and measures BP-3 and 5, we expect that the effects of the proposed action will result in both insignificant and discountable effects to California brown pelican.

Western Snowy Plover

The following measure is proposed by WSDOT to minimize impacts to western snowy plover as part of the proposed action.

SP-4: Projects will not alter unvegetated beach areas that are considered potentially suitable western snowy plover nesting habitat.

Western snowy plovers are present year round on marine beaches in Washington State. Nesting occurs on three beaches in Grays Harbor and Pacific Counties. No direct alteration of potentially suitable nesting habitat, either occupied or unoccupied, is proposed. Proposed projects may alter beach foraging habitat. Western snowy plovers primarily forage along the wrack line within the surf zone. The proposed projects are limited in scope, so impacts to overall foraging areas are not anticipated to be significant relative to overall foraging area. Some temporary disturbance to foraging western snowy plovers may occur during construction, but disturbance will be limited in duration, and therefore is not anticipated to be significant. Best management practices to minimize the water quality effects will be used at all projects in or near marine waters. Therefore, effects to western snowy plover habitat are considered discountable.

Oregon Silverspot Butterfly

The following measures are proposed by WSDOT to minimize impacts to Oregon silverspot butterfly as part of the proposed action.

MM-25, MM-26

OSB-4: Activities in the Willapa Bay area and the Pacific coastal area of Grays Harbor County and Pacific County may occur in or within 200 ft of potential Oregon silverspot butterfly habitat, and may work outside of the developed portion of the road prism if the larval host species, the western blue violet, is not located during a survey conducted at the appropriate time of year by a qualified biologist.

Oregon silverspot butterflies use sand dunes, salt-spray meadows, and open field habitat in coastal Pacific and Grays Harbor Counties. The western blue violet is a necessary food source for the larvae. Available habitat is extremely limited. There are only a few coastal highways or state roads that are adjacent to this habitat. Projects covered by this programmatic consultation would rarely be conducted within this habitat. However, when projects are proposed in potential Oregon silverspot butterfly habitat, the above measures will apply to avoid adverse effects to the species and its habitat.

Additionally, when a proposed project is in or within 200 ft of Oregon silverspot butterfly habitat and involves work outside the road prism, WSDOT will conduct appropriate surveys to assure that western blue violets are not present. Therefore, given the conservation measures listed and surveys to ensure the absence of western blue violets, impacts to Oregon silverspot butterflies from project activities are discountable.

Bradshaw's lomatium

The following measures are proposed by WSDOT to minimize impacts to Bradshaw's lomatium as part of the proposed action.

MM-4, MM-5

Bradshaw's lomatium occurs in wet seasonally flooded, low elevation grasslands and prairies. Only two occurrences of Bradshaw's lomatium are known and both occur in Clark County. If projects are proposed within Clark County and work would affect potential Bradshaw's lomatium habitat, the above measures will be implemented to avoid adverse effects to the species and its habitat.

WSDOT will determine, through reviews and surveys that Bradshaw's lomatium is not present before proceeding with ground-disturbing activities outside of the road prism. Projects that involve ground-disturbing activities, where Bradshaw's lomatium is located, will require an individual consultation. Given the conservation measures listed and surveys to ensure the absence of the species before ground-disturbance, impacts to Bradshaw's lomatium from project activities are discountable.

Golden Paintbrush

The following measures are proposed by WSDOT to minimize impacts to golden paintbrush as part of the proposed action.

MM-4, MM-5

The golden paintbrush occurs in a very narrow geographic range in suitable grassland or prairie habitat. There are only 10 known populations of golden paintbrush, one of which is believed to be extirpated. Populations occur in Island, San Juan, and Thurston Counties. Other potentially suitable prairie habitat exists in Thurston and Pierce Counties.

When projects are proposed within Island, Pierce, San Juan, and Thurston Counties in potential golden paintbrush habitat, the following conservation measures will apply to avoid adverse effects to the species and its habitat.

Before proceeding with ground-disturbing activities outside of the road prism, WSDOT will determine, through reviews and surveys that golden paintbrush is not present.

Given the conservation measures listed and surveys to ensure the absence of the species before ground-disturbance, impacts to golden paintbrush from project activities are discountable.

Kincaid's Lupine

The following measures are proposed by WSDOT to minimize impacts to Kincaid's lupine as part of the proposed action.

MM-101, MM-102

Kincaid's lupine is currently known to grow only in three populations in Lewis County, where suitable habitat (i.e., native upland prairies, which may include scattered oaks) is available. If projects are proposed within Lewis County, and the work would affect native upland prairies or open oak woodlands, a WSDOT project biologist will conduct a survey to assure that Kincaid's lupine is not present. The two minimization measures would further avoid adverse effects to Kincaid's lupine.

Therefore, given the above measures and surveys to ensure the absence of the species, we concur that the proposed action is unlikely to adversely affect the Kincaid's lupine and the effects are anticipated to be discountable.

Marsh Sandwort

The following measure is proposed by WSDOT to minimize impacts to marsh sandwort as part of the proposed action.

MM-3

Marsh sandwort occurs in wetland areas. Although, marsh sandwort was historically located in Pierce County, there are no known occurrences of marsh sandwort in the State. Other potential habitat exists along the coast.

When projects are proposed within Pierce, King, Gray's Harbor, and San Juan Counties, in potential marsh sandwort habitat, the following conservation measures will apply to avoid adverse effects to the species and its habitat.

WSDOT will determine, through reviews and surveys that marsh sandwort is not present before proceeding with ground-disturbing activities outside of the road prism. Given the conservation measures listed and surveys to ensure the absence of the species before ground-disturbance, impacts to marsh sandwort project activities are discountable.

Nelson's Checker-mallow

The following measures are proposed by WSDOT to minimize impacts to Nelson's checker-mallow as part of the proposed action.

MM-4, MM-5

Suitable habitat for the Nelson's checker-mallow is wet, remnant grasslands and prairies. The species is only known from a few populations, one in Cowlitz County and several in Lewis County. Project sites within Cowlitz and Lewis Counties will be surveyed by the project biologist for Nelson's checker-mallow. The two minimization measures will further reduce the potential for projects to adversely affect the Nelson's checker-mallow.

Therefore, given the conservation measures listed and surveys to ensure the absence of the species, impacts to Nelson's checker-mallow are discountable.

Water Howellia

The following measure is proposed by WSDOT to minimize impacts to water howellia as part of the proposed action.

MM-3

Water howellia occurs in shallow water or along the edges of deep ephemeral ponds and vernal pool wetlands ringed by primarily deciduous vegetation. In western Washington, there are several populations of water howellia in Clark County, Pierce County, and Thurston County. Historical locations of water howellia occurred in Mason County.

When projects are proposed within Clark, Pierce, or Thurston counties in potential water howellia habitat, the above measure will apply to avoid adverse effects to the species and its habitat. WSDOT will determine, through reviews and surveys, that water howellia is not present before proceeding with ground-disturbing activities outside of the road prism.

Therefore, given the conservation measures listed and surveys to ensure the absence of the species, impacts to water howellia are discountable.

ANALYTICAL FRAMEWORK FOR THE JEOPARDY AND ADVERSE MODIFICATION DETERMINATIONS

Jeopardy Determination

In accordance with policy and regulation, the jeopardy analysis in this PBO relies on four components: (1) the *Status of the Species*, which evaluates the bull trout, murrelet, and northern spotted owl range-wide condition, the factors responsible for that condition, and its survival and recovery needs; (2) the *Environmental Baseline*, which evaluates the condition of the bull trout, murrelet, and northern spotted owl in the action area, the factors responsible for that condition, and the relationship of the action area to the survival and recovery of the bull trout, murrelet, and northern spotted owl; (3) the *Effects of the Action*, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the bull trout, murrelet, and northern spotted owl; and (4) *Cumulative Effects*, which evaluates the effects of future, non-Federal activities in the action area on the bull trout, murrelet, and northern spotted owl.

In accordance with policy and regulation, the jeopardy determination is made by evaluating the effects of the proposed Federal action in the context of the bull trout, murrelet, and northern spotted owl current status, taking into account any cumulative effects, to determine if implementation of the proposed action is likely to cause an appreciable reduction in the likelihood of both the survival and recovery of the bull trout, murrelet, and northern spotted owl in the wild.

The jeopardy analysis in this PBO places an emphasis on consideration of the range-wide survival and recovery needs of the bull trout, murrelet, and northern spotted owl and the role of the action area in the survival and recovery of the bull trout, murrelet, and northern spotted owl as the context for evaluating the significance of the effects of the proposed Federal action, taken together with cumulative effects, for purposes of making the jeopardy determination.

Adverse Modification Determination

This PBO does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02. Instead, we have relied upon the statutory provisions of the ESA to complete the following analysis with respect to critical habitat.

In accordance with policy and regulation, the adverse modification analysis in this PBO relies on four components: 1) the *Status of Critical Habitat*, which evaluates the range-wide condition of designated critical habitat for the bull trout, murrelet, and northern spotted owl in terms of primary constituent elements (PCEs), the factors responsible for that condition, and the intended recovery function of the critical habitat overall; 2) the *Environmental Baseline*, which evaluates the condition of the critical habitat in the action area, the factors responsible for that condition, and the recovery role of the critical habitat in the action area; 3) the *Effects of the Action*, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the PCEs and how that will influence the recovery role of affected critical habitat units; and 4) *Cumulative Effects*, which evaluates the effects of future, non-Federal activities in the action area on the PCEs and how that will influence the recovery role of affected critical habitat units.

For purposes of the adverse modification determination, the effects of the proposed Federal action on [species name] critical habitat are evaluated in the context of the range-wide condition of the critical habitat, taking into account any cumulative effects, to determine if the critical habitat range-wide would remain functional (or would retain the current ability for the PCEs to be functionally established in areas of currently unsuitable but capable habitat) to serve its intended recovery role for the bull trout, murrelet, and northern spotted owl.

The analysis in this PBO places an emphasis on using the intended range-wide recovery function of bull trout, murrelet, and northern spotted owl critical habitat and the role of the action area relative to that intended function as the context for evaluating the significance of the effects of the proposed Federal action, taken together with cumulative effects, for purposes of making the adverse modification determination.

ENVIRONMENTAL BASELINE AND STATUS OF THE SPECIES
for Bull Trout, Marbled Murrelet, Northern Spotted Owl, and their Critical Habitat

Regulations implementing the ESA (50 CFR 402.02) define the environmental baseline as the past and present impacts of all Federal, State, or private actions and other human activities in the action area. Also included in the environmental baseline are the anticipated impacts of all proposed Federal projects in the action area that have undergone section 7 consultation, and the impacts of State and private actions which are contemporaneous with the consultation in progress. The action area was described earlier, and generally includes a 1 mile distance measured from approximately the centerline of both sides of the state route for airborne impacts and 1 mile upstream and downstream of in-water sound impacts.

The following sections will address the status of the species and critical habitat (rangewide) and within the action area for each species and their critical habitat. Within each of the sections, the effects of the action will also be identified.

STATUS OF THE SPECIES: Bull Trout - Rangewide

See Appendix L for Status of the Species: Bull Trout - Rangewide.

STATUS OF THE CORE AREAS: Bull trout - within the Action Area

The action area considered in this PBO affects most Core Areas in the range of the Puget Sound and Olympic management units, and portions of the Lower Columbian Basin management unit. The core areas within the action area are the Nooksack, Lower Skagit, Upper Skagit, Stillaguamish, Lower Puyallup, Snohomish/Skokomish, Quinault, Hoh, Elwha, Queets, Dungeness, Skokomish, Lewis, and Klickitat core areas. Only two core areas in the Puget Sound management unit (Chilliwack and Chester Morse) are not affected by the proposed action; however, individuals from the Chilliwack core area may use the Nooksack and Skagit Rivers. However, the likelihood is considered very low. Although the Lower Columbia Basin management unit is within the action area, no projects that result in adverse effects to bull trout are permitted under this PBO; therefore, a description of the core areas within this portion of the action area is not provided.

The environmental baseline in the action area is described below using data compiled and summarized during the comprehensive Bull Trout Five Year Review process , the draft Recovery Plan , the recently completed Washington Department of Natural Resources (WDNR) Forest Practices HCP Plan Biological Opinion (USFWS 2006b), data are the most recent and comprehensive in analyzing current status of native salmonids and habitat conditions of freshwater systems in the State of Washington.

The following recovery objectives are similar for all core areas: maintaining current bull trout distributions and restoring distribution in previously occupied areas, maintaining stable or increasing trends in abundance, restoring and maintaining suitable habitat for all life-history

stages, conserving genetic diversity, and providing opportunity for genetic exchange. This can be achieved by correcting prevailing threats in each core area. In addition, the establishment of fisheries management goals and objectives, research and monitoring programs, adaptive-management approaches, and use of available conservation programs and regulations will aid in reaching recovery goals. Many core areas currently support fewer than 1,000 adult spawners and are at increased risk of genetic drift and loss of populations from stochastic events.

The following are brief summaries of the environmental baseline conditions occurring in the action area.

Coastal-Puget Sound Interim Recovery Unit

In the Puget Sound management unit, populations are low and generally declining in the Snohomish-Skykomish, Puyallup, and Stillaguamish core areas (3 to 5 local populations each, most with fewer than 100 individuals). This is largely attributed to habitat modifications related to their proximity to the urban areas of Puget Sound. The populations of bull trout are much stronger in the Skagit (lower and upper) and Nooksack core areas, with most local populations having more than 1,000 adult spawners each. In the Olympic Peninsula management unit, most of the bull trout spawning and rearing habitat is within wilderness areas or Federal reserves and the migratory corridors are generally in a forested condition. In areas where the primary threats are relatively low, like the Olympic Peninsula and the upper Skagit Core Area, bull trout populations are generally stable or increasing.

Puget Sound Management Unit

Lower Skagit Core Area

The Lower Skagit Core Area is comprised of 21 local populations: Bacon Creek, Baker Lake, Buck Creek, Cascade River, Downey Creek, Forks of Sauk River, Goodell Creek, Illabot Creek, Lime Creek, Lower White Chuck River, Milk Creek, Newhalem Creek, South Fork Cascade River, Straight Creek, Sulphur Creek, Tenas Creek, Upper South Fork Sauk River, Upper Suiattle River, Upper White Chuck River, Stetattle Creek and Sulphur Creek (Lake Shannon). Fluvial, adfluvial, resident, and anadromous life-history forms occur in the core area. The core area, with a spawning population of migratory bull trout that numbers in the thousands, probably contains the highest abundance of bull trout of any Washington core area, with most local populations showing stable or increasing population trends. As an example, annual redd counts in the South Fork Sauk bull trout spawning index reach have ranged from four redds in 1990 to 370 redds in 2004. The majority of local populations in the core area have more than 100 adult spawners. Anadromous bull trout use the lower estuary and nearshore marine areas for foraging and subadult rearing. Key spawning and early rearing habitat in the tributaries is generally on federally protected lands, including the North Cascades National Park, Ross Lake National Recreation Area, Glacier Peak Wilderness, and Henry M. Jackson Wilderness Area.

Bull trout critical habitat has been designated in the following streams in the Lower Skagit Core Area: Alma Creek, Bacon Creek, Baker River, Bald Eagle Creek, Cascade River, Corkingdale Creek, Crystal Creek, Dan Creek, Diobsud Creek, East Fork Bacon Creek, Finney Creek, Illabot

Creek, Jones Creek, Marble Creek, Newhalem Creek, Pass Creek, Rocky Creek, Sauk River, Skagit River, Suiattle River, Sulphide Creek, and Tenas Creek.

Upper Skagit Core Area

The Upper Skagit Core Area is comprised of eight local populations: Ruby Creek, Panther Creek, Lightning Creek, Big Beaver Creek, Little Beaver Creek, Silver Creek, Pierce Creek, and Thunder Creek. A significant portion of the upper Skagit River drainage lies within Canada. Much of the bull trout habitat in the upper watershed is within undisturbed wilderness in the North Cascades National Park, Pasayten Wilderness Area, and Skagit Valley Provincial Park. Adfluvial, fluvial and, possibly, resident life-history forms of bull trout occur in this area and the population of the Upper Skagit Core Area is thought to exceed 1,000 adult spawners. This core area supports both bull trout and Dolly Varden. Connectivity is good, with the exception of Ross Dam which isolates the Thunder Creek local population from the rest of the core area. Other habitat conditions are generally good in the action area. Brook trout have been introduced within tributaries to Ross Lake, and some impacts to bull trout have been recorded from these non-native fish.

Bull trout critical habitat in the Upper Skagit Core Area has been designated on lands administered by the National Park Service (National Parks and Recreation Areas) and non-Federal lands in the following water bodies: Big Beaver Creek, Devils Creek, Lightning Creek, Little Beaver Creek, Panther Creek, Pierce Creek, Deer Creek, Goodall Creek, Roland Creek, Ruby Creek, Silver Creek, Three Fools Creek, and Thunder Creek.

Nooksack Core Area

The Nooksack Core Area is comprised of 10 local populations: Glacier Creek, Lower Canyon Creek, Lower Middle Fork Nooksack River, Lower South Fork Nooksack River, Lower North Fork Nooksack River, Middle North Fork Nooksack River, Upper North Fork Nooksack River, Upper Middle Fork Nooksack River, Upper South Fork Nooksack River, and Wanlick Creek. Fluvial, anadromous and, possibly, resident life-history forms of bull trout occur in the Nooksack Core Area, and Dolly Varden trout also occur in this Core Area. Eight of the local populations likely have fewer than 100 adults each, based on the relatively low number of migratory adults observed returning to the core area. Only the Glacier Creek and Upper North Fork Nooksack River local populations have at least 100 spawning adults. Although a number of spawning areas have been documented within this core area, the abundances observed within these spawning areas are low. Much of the habitat within the basin is still recovering from past forest practice impacts and associated road building. A single large barrier blocks bull trout access from the Upper Middle Fork Nooksack local population. Estuarine and marine nearshore habitats required for the anadromous life history form have been reduced and degraded as a result of urbanization and shoreline development. Brook trout pose an additional threat to bull trout from hybridization and competition, due to broad distribution of brook trout within the core area. Bull trout critical habitat has been designated within Bear Lake, Howard Creek, the Middle Fork, South Fork, and mainstem of the Nooksack River.

Puyallup Core Area

The Puyallup Core Area is comprised of five local populations: Carbon River, Greenwater River, Upper Puyallup and Mowitch River, Upper White River, and West Fork White River. Resident, fluvial, and anadromous forms occur in the Core Area. Probably fewer than 100 total bull trout occur within the combined White River local populations. No population status information is available for the other local populations. Very few spawning areas have been discovered within these two local populations. Many of the headwater reaches are in either Mount Rainier National Park or designated wilderness areas (Clearwater Wilderness, Norse Peak Wilderness) which provide pristine habitat conditions. However, just downstream of the protected areas, multiple dams block fish passage, and channel modifications are degrading bull trout migratory, overwintering, and rearing habitat. Brook trout have been introduced and are widespread within the basin.

Bull trout critical habitat has been designated in Mount Rainier National Park and non-Federal lands within the following drainages: Carbon River, Chenuis Creek, Clearwater River, Crystal Creek, Fryingpan Creek, Greenwater River, Huckleberry Creek, Ipsut Creek, Klickitat Creek, Lodi Creek, Mowich River, Puyallup River, Ranger Creek, June Creek, Falls Creek, South Mowich River, South Puyallup River, St. Andrews Creek, four unnamed tributaries, West Fork White River, and the White River.

Snohomish-Skykomish Core Area

The Snohomish-Skykomish Core Area is comprised of four local populations: North Fork Skykomish River; Troublesome Creek; Salmon Creek; and South Fork Skykomish River. The Core area probably supports between 500 and 1,000 adult bull trout, with the majority of adult fish spawning in the North Fork and South Fork local populations. The annual North Fork Skykomish River spawning redd index count has ranged from 21 in 1988 to 538 in 2002. Fluvial, resident, and anadromous life-history forms of bull trout occur in the core area. A large portion of the migratory segment of this population is anadromous. Habitat conditions in the upper watershed are generally good, however past logging legacy effects, such as roads, has impacted bull trout habitat. Habitat conditions downstream have been altered, resulting in modified stream morphology and water quality in these migratory and rearing reaches. Bull trout critical habitat has been designated on the Foss River, Skykomish River, Snohomish River, Snoqualmie River, South Fork Skykomish River, and West Fork Foss River.

Stillaguamish Core Area

The Stillaguamish Core Area is comprised of four local populations: Upper Deer Creek, North Fork Stillaguamish River, South Fork Stillaguamish, and Canyon Creek. The scarcity and spatial isolation of available spawning habitat limits the number of local populations in the Stillaguamish Core Area; spawning apparently is limited to the upper reaches of occupied streams. Bull trout exhibit anadromous and fluvial life history forms, with limited areas with resident forms. Fewer than 100 adults probably exist in each of the local populations, though bull trout snorkel counts in the North Fork Stillaguamish River local population have been as high as 300 adult fish. Migratory corridors are currently functioning appropriately in this core

area. Other habitat conditions are degraded, with over-widened stream channels, loss of pools and pool quality, and increased water temperatures. Spawning habitat in the Upper Deer Creek and Canyon Creek local populations is in poor condition. Bull trout critical habitat has been designated in the Boulder River, Canyon Creek, Deer Creek, Glacier Creek, Jim Creek, North Fork Stillaguamish River, Pilchuck River, South Fork Stillaguamish River, and Squire Creek.

Olympic Peninsula Management Unit

Dungeness Core Area

The Dungeness Core Area is comprised of two local populations: Middle Dungeness River and Gray Wolf River. Bull trout occur throughout the Dungeness and Gray Wolf rivers downstream of impassable barriers, which are present on both rivers. Both fluvial and anadromous life history forms of bull trout occur in the Dungeness Core Area. Mainstem rivers within the Core Area provide spawning, rearing, foraging, migration, and overwintering habitats. Dolly Varden trout are found upstream of impassable barriers. In 2002, three bull trout redds were observed in the Gray Wolf River. In 2004, 32 redds were counted during a comprehensive survey in the Gray Wolf River and 8 redds were observed in the upper Dungeness River. Approximately 90 percent of available spawning habitat was surveyed in 2004, indicating low overall bull trout population abundance in the core area. Since bull trout are restricted to below-barrier areas, habitat threats are mainly associated with channel modifications for agriculture, as well as residential and commercial infilling of the floodplain and tidal areas. In addition, numerous culverts block migration in tributary streams. Bull trout critical habitat has been designated in Bell Creek, the Dungeness River, and Gray Wolf River.

Elwha Core Area

The Elwha Core Area is comprised of a single local population. Anadromous, fluvial, adfluvial, and resident life history forms probably occurred in the Elwha River prior to the construction of the dams. Elevated stream temperatures likely limits reproducing populations of bull trout in both the lower and middle reaches of the Elwha River (downstream of Lake Mills). Although no spawning areas have been identified, the presence of multiple age classes of bull trout and accessible tributaries upstream from Glines Canyon Dam indicates spawning and juvenile rearing is occurring in the Elwha River. Bull trout critical habitat has been designated in Boulder Creek, Cat Creek, Griff Creek, Hughes Creek, Little River, and the Elwha River.

Hoh Core Area

The Hoh Core Area is comprised of the Hoh River (above the confluence with the South Fork Hoh River) and the South Fork Hoh River local populations. Resident and migratory life history forms of bull trout, including anadromous forms, likely occur in this core area. No bull trout were detected in 17 of 18 tributaries surveyed in the upper Hoh River and no population estimates are available for the two local populations. Limited visibility and access makes surveys in glacial rivers difficult. Culvert barriers occur in several tributaries, but there are no barriers to migration in the mainstem. Extensive rip rapping of the lower Hoh River has occurred, impacting lateral floodplain habitats. Bull trout critical habitat has been designated in

Olympic National Park and non-Federal lands in the Hoh River, Mount Tom Creek, Owl Creek, South Fork Hoh River, and Winfield Creek.

Queets Core Area

The Queets Core Area has one local population and bull trout in this watershed consist of fluvial, resident, and anadromous life history forms. Bull trout occur in the mainstem river up to river mile 48, and tributaries including the Salmon, Sams, and Clearwater rivers and Matheny Creek. Except for the lower eight miles, the entire river is contained within a narrow corridor of Olympic National Park. The occupied tributaries flow through the Quinault Indian Reservation, Olympic National Forest, and State and private landholdings. No population estimates are available for this Core Area. A single bull trout spawning area has been documented in the mainstem of the Queets River between river miles 45 and 48. Although there are barriers to movement (e.g., impassable culverts) in some tributaries, there are no barriers to movement in the mainstem Queets River. Bull trout critical habitat has been designated in Olympic National Park lands and non-Federal lands in the Clearwater River, Matheny Creek, Queets River, Sams River, and Tshletshy Creek.

Quinault Core Area

The Quinault Core Area is comprised of two local populations: the North Fork Quinault River and upper mainstem Quinault River. These two local populations occur entirely within the Olympic National Park, and are well connected. Fluvial, adfluvial, anadromous and, possibly, resident life history forms of bull trout are present. Dolly Varden trout coexist with bull trout in the upper Quinault River basin. Bull trout occur from the headwaters to the estuary and in numerous tributaries above Lake Quinault. Although bull trout spawning sites have not been located in the Quinault Core Area, the presence of multiple age classes of bull trout in both local populations indicates spawning and rearing does occur. No population estimates or redd counts are available for these two local populations. Snorkel surveys conducted in three miles of the Quinault River above Lake Quinault resulted in 77 bull trout observed in 2003 and 105 bull trout observed in 2004. Tributary habitats outside of Olympic National Park have been altered by logging and associated road construction. The Quinault River and tributaries below Lake Quinault are significantly impacted by logging and associated road construction. Critical habitat has been designated in Big Creek, Rustler Creek, Irely Creek, Quinault Lake, Quinault River, and North Fork Quinault River.

Skokomish Core Area

The North and South Fork Skokomish Rivers support the two local populations of bull trout in the Skokomish Core Area. Fluvial, adfluvial and, possibly, anadromous and resident life history forms of bull trout are present in this Core Area. The Skokomish Core Area likely supports fewer than 200 adult bull trout. Approximately 60 adult bull trout occupy the South Fork Skokomish, based on surveys conducted by the U.S. Forest Service. In the North Fork Skokomish River bull trout numbers remained relatively stable from 1990 to 1996. Counts during this period ranged from a low of 250 to a high of 413 (average 302 adults). More recent

counts from 1998 to 2004 indicated a decline to an average of 100 adults, ranging from 89 to 133. The two local populations do not have connectivity to each other or to marine waters in Hood Canal.

Grays Harbor and Lower Chehalis River Basin Foraging Migration and Overwintering (FMO)

Adult bull trout have recently been found in the Chehalis River Basin, apparently engaged in foraging, migration, and overwintering activities. No bull trout spawning has been documented in this basin.

ENVIRONMENTAL BASELINE: Bull Trout (within the Action Area)

Water quality and quantity in much of Washington has been adversely impacted by development, livestock grazing and agricultural practices, forest management, roads, dams and water control structures, and pollution. Reduced flows may cause mortality of juvenile and adult salmonids by delaying or blocking their migration, stranding of fish resulting from rapid flow fluctuations, entrainment of juveniles into poorly screened or unscreened diversions, increased water temperatures, deposition of fine sediments in spawning gravels, and loss of habitat and spawning gravels (Spence et al. 1996).

Some information available regarding bull trout habitat within the action area can be generally summarized. The action area contains approximately 4,035 miles of state roadways within bull trout key habitat (excluding the Lower Columbia IRU) (Appendix G). Of this, approximately 127 miles of state roadway are within 300 ft of bull trout key habitat. Generally, waterbodies in proximity to roadways are likely to be degraded due to contaminants that enter via stormwater runoff. Additionally, the associated bridges and culverts have resulted in the loss of riparian habitat as part of the construction and maintenance of these facilities. A number of culverts within the action area also result in fish barriers. This likely affects bull trout both directly and indirectly, as either they and/or their forage are precluded from reaching additional spawning, rearing, and foraging areas. WSDOT has identified approximately 1,149 bridges under their jurisdiction within the action area. However, there are only about 172 bridges that occur within bull trout key habitat. WSDOT has implemented actions to provide passage at some of these facilities.

Additionally, most, though not all of the action area is in urbanized or urbanizing areas, especially that portion of the action area within the bull trout Puget Sound management area. Urbanization has resulted in increased impervious surfaces, with resulting increases in stormwater flows, decreased infiltration and groundwater flows, increased contaminants from other private and public roadways, and increased use of herbicides and pesticides on private and public lands. Development also results in the loss of forested areas and reduced buffers, reducing the amount of LWD, shade, and nutrients available to streams used by bull trout and their forage species.

In many river basins, land management activities have:

1) Reduced connectivity (i.e., the flow of energy, organisms, and materials) between streams, riparian areas, floodplains, and uplands. Channeling, straightening, or diking rivers for flood control, urban and agricultural land development, and other activities eliminates channel sinuosity, affects hyporheic flow, and reduces the amount of off-channel rearing habitat for juvenile salmonids (Poole and Berman 2001);
2) Elevated fine sediment yields, filling pools and reducing spawning and rearing habitat;
3) Reduced instream and riparian large wood that traps sediment, stabilizes stream banks, and helps form pools;
4) Reduced or eliminated vegetative canopy that minimizes temperature fluctuations and reduces bank stability, which causes bank erosion and increased sediment loading into the stream. Examples of human activities that have affected riparian vegetation include past forest harvesting, agricultural land clearing, livestock grazing, and on-going urban development (Murphy et al. 1981; Spence et al. 1996; May et al. 1997; Karr and Chu 1999; NRC 2002);
5) Caused streams to become straighter, wider, and shallower, resulting in increased temperature fluctuations (Spence et al. 1996; May et al. 1997; Miller et al. 2003);
6) Altered peak flow volume and timing, leading to channel changes and potentially altering fish migration behavior. Streams with water withdrawals or water control structures generally have higher maximum water temperatures and lower flows during the summer than would occur under natural conditions (Spence et al. 1996; Karr and Chu 1999);
7) Altered floodplain function, water tables and base flows, resulting in riparian wetland and stream dewatering; and
8) Degraded water quality by adding heat, nutrients and toxicants (Spence et al. 1996).

Freshwater Habitat

While there has been substantial habitat degradation across all land ownerships, habitat in many headwater stream segments is generally in better condition than in the largely non-Federal lower portions of tributaries (USFS 1997). Most of bull trout spawning and rearing occurs in tributaries where riparian areas are still relatively intact and dominated by mature forests.

Beginning in the early 1800s, many of the riparian areas in the lower rivers were extensively changed by human activities such as logging, mining, livestock grazing, agriculture, beaver removal, dams and water diversions, and development. Very little of the once-extensive riparian vegetation remains to maintain water quality and provide habitats for threatened salmonids. Dams, diversions, and other water control structures have affected flow, sedimentation, and gravel patterns, which in turn have diminished regeneration and natural succession of riparian vegetation along downstream rivers. Introduced plant species pose a risk to some riparian habitat by dominating local habitats and reducing the diversity of native species. Improper grazing in riparian areas is another significant threat. The width and age of stream-adjacent vegetation decreases in the middle and lower portions of the watersheds and less than 20 percent of the riparian vegetation now consists of mature trees.

Forty species of freshwater fish have been introduced in Washington and are now self-sustaining, making up nearly half of the State's freshwater fish fauna (Wydoski and Whitney 2003). Most of the introduced species are warm-water game fish that are thriving in reservoirs and other areas where stream temperatures are higher than natural conditions because of human-caused changes to the landscape. Introduced species are frequently predators on native species, compete for food resources, alter freshwater habitats, and are displacing native salmonids from areas that historically had colder water temperatures.

The Nature Conservancy, in coordination with the Washington Department of Fish and Wildlife, recently completed an assessment of all freshwater systems in the State. The Nature Conservancy evaluated the existing threats for native fish in each 6th field watershed and then conducted a suitability analysis based on the biodiversity found in each watershed and existing threats. The product of this analysis is depicted in several Geographic Information System (GIS) maps that describe the existing condition (threats and/or baseline) and identify areas with the highest potential for recovery (best opportunity watersheds).

Figure 3 illustrates the combined rating for threats to aquatic resources. This map visually displays the current condition (environmental baseline) and limitations for recovery by 6th field watershed. The watersheds were rated based on the following threats 1) human population and development, 2) land conversion (permanent site conversions like development rather than forest management), 3) fish passage barriers (dams), 4) non-native/exotic species, 5) game fish management (usually lakes that are stocked and/or areas where Rotenone is used to kill non-native fish), and 6) effects of global climate change.

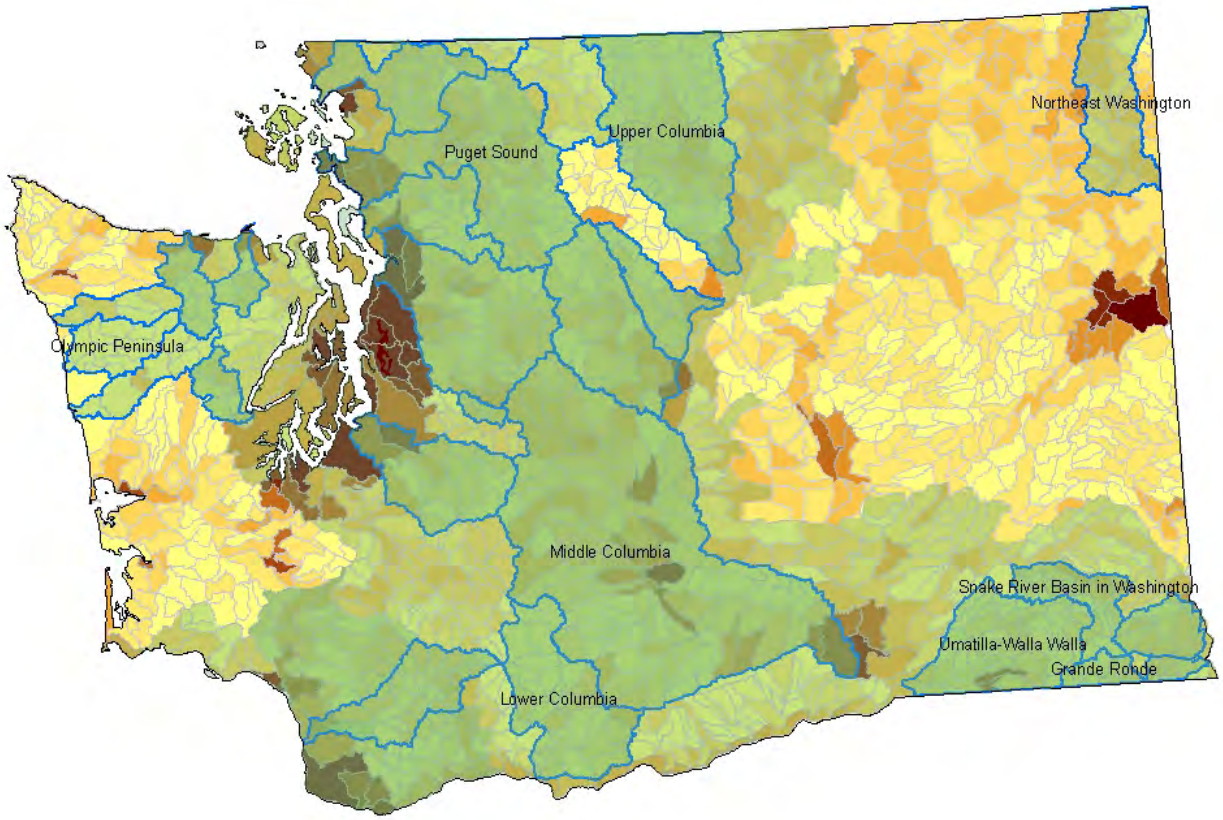

Figure 3. Combined threats rating based on human populations, land conversion, fish passage barriers, exotics/non-natives, game fish management and effects of global climate change

Areas in Figure 3 with lighter shades of yellows and oranges depict areas with lowest threats. Darker brown areas reflect centers of urban growth and development, which have the highest levels of threats to aquatic habitat due to increased water consumption, permanent land conversion, and infrastructures that impede or block fish migration.

Water Quality

Water pollution of almost every type is increasing. Sedimentation and increased water temperature related to logging, mining, urban development, and agriculture is a primary cause of salmon habitat degradation. Although the State regulates most activities that affect water quality, the baseline condition includes a legacy of these past activities.

Section 305(b) of the CWA requires that each state periodically prepare a water quality assessment report. The WDOE compiles and assesses available water quality data on a statewide basis in order to get a better picture of the overall status of water quality in Washington's waters. According to the 2002 report, approximately 30 percent of the streams statewide are impaired due to high temperatures; 15 percent have dissolved oxygen levels that are below the state standards; nearly 60 percent of all streams statewide are impaired by metals; and between 35 and 50 percent of the streams in all ecoregions have use impairments caused by fecal coliform.

When a lake, river, stream, or other waterbody fails to meet the standards, the CWA requires the state to place the waterbody on a list of "impaired" water bodies called the 303(d) list. A

cleanup plan and implementation schedule is then developed for each of the water bodies on the 303(d) list that sets the timeline to bring the water quality into compliance with the standards. The latest comprehensive assessment included 32,165 stream segments. Of the total number of stream segments that were assessed, about two thirds are currently in compliance with the standards. The rest are either showing evidence of problems or will require attention to prevent further degradation. Approximately 13 percent of the latter are waters of concern (showing signs of impairments), 9 percent are impaired by physical factors (fish passage barriers or low instream flows), and 8 percent do not meet the state standards for one or more water quality parameters. The key elements that have affected water quality in Washington are fecal coliform, temperature, dissolved oxygen, pH, and total phosphorus. Of the total list of polluted waters, about 70 percent are for these parameters. The most significant increase in 303(d) listings is related to high stream temperatures.

Physical Barriers

As stated above, about 9 percent of the rivers and streams in the State of Washington are not properly functioning to support the aquatic life uses that occur in the water body because of human-caused barriers and low instream flows. Anadromous salmonids have been dramatically affected by the development and operation of the Federal Columbia River Power System as well as dams that are owned and operated by public utility districts. Storage dams have eliminated spawning and rearing habitat and have altered the natural hydrograph, decreasing spring and summer flows and increasing fall and winter flows. This has virtually reversed the natural hydrograph on the Columbia River. Water storage for flood control and withdrawal for irrigation causes river elevations and flows to fluctuate, affecting fish movement through reservoirs and riparian ecology, and stranding fish in shallow areas. The dams in the migration corridor of the Columbia River alter smolt and adult migrations. Dams also have converted the once-swift river into a series of slow-moving reservoirs. Water velocities throughout the migration corridor now depend far more on volume runoff than before development of the mainstem reservoirs.

While large dams block or impede migration on the mainstem rivers, improperly designed culverts present a major problem for up- and down-stream fish passage in many areas that are used by listed salmonids for spawning and juvenile rearing. The U.S. Forest Service and National Park Service have relatively up-to-date culvert inventories and are required to replace or remove culverts that affect fish passage on Federal lands. The process of identifying and replacing culverts that prevent or impair fish passage is ongoing on State and privately owned timber lands, but the process becomes slower and more expensive lower down in the watershed. Revisions to State and Federal roads and highways are extremely costly, especially in urban areas. Tide gates and water control structures that were installed to drain wetlands and floodplains for farming and development have resulted in the loss of nearly 90 percent of the historic estuaries and off-channel rearing habitats. Removal or replacement of many of these blockages will require complex negotiations and may not be socially or economically feasible.

The data in Table 9 represent those data contained in the WDFW Fish Passage and Diversion Screening Inventory database. This data base is not a complete inventory of fish passage barriers, but has the most complete data for WSDOT. Culverts owned by Federal and other State

agencies, as well as commercial forest land owners, may not be included in the data base. Only watersheds with listed fish are included in the data listed in Table 10. The data in Table 10 is a subset of Table 9, and represents only those culverts within the action area that on WSDOT roadways within bull trout local populations.

Table 9. List of culverts that are partial or complete barriers for fish (as of February 2008).

Watershed Name	WRIA	Total Blockage	Partial Blockage	Unk.	Listed Fish and/or Critical habitat
Nooksack	1	153	499	2	BT, CH, ST,
Lower Skagit	3	106	152	204	BT, CH, ST
Upper Skagit	4	56	40	99	BT, CH, ST
Stillaguamish	5	90	186	-	BT, CH, ST
Snohomish-Skykomish	7	120	252	200	BT, CH, ST
Cedar-Sammamish	8	137	350	9	BT, CH, ST
Duwamish/Green	9	29	41	-	BT, CH, ST
Puyallup/White	10	38	77	205	BT, CH, ST
Nisqually	11	24	53	1	CH, ST, BT (marine)
Chambers/Clover	12	-	1	-	CH, ST, BT (marine)
Deschutes	13	52	79	3	ST
Kennedy/Goldsborough	14	108	133	1	ST
Kitsap	15	176	177	84	Chum, CH, ST
Skokomish/Dosewallips	16	49	28	-	BT, Chum, CH, ST
Quilcene/Snow	17	142	119	1	CH, ST, Chum
Elwha/Dungeness	18	31	25	2	BT, CH, ST, Chum
Soleduc/Hoh	20	87	99	3	BT
Queets/Quinault	21	27	50	2	BT
Grays/Elochoman	25	18	37	42	CH, ST, Chum, Coho
Chehalis	22	140	1335	51	BT
Cowlitz	26	203	197	624	CH, ST, Chum
Lewis	27	103	216	55	BT, CH, ST, Chum, SOC (Columbia)
Salmon/Washougal	28	41	58	2	CH, ST, Chum
Wind/White Salmon	29	11	4	-	BT, CH, ST
Klickitat	30	4	10	1	BT, CH, ST

Table 10. Stream passage barriers associated with WSDOT roadways within bull trout local populations within the action area.

Core Area	Local Population	Stream	Tributary To:	Species	LatWGS84	LongWGS84	State Roadway	Mile Post
Puyallup	Upper White River	Unnamed	White R	**BT,** CO, RT	46.9522514	-121.5305786	SR 410	59.57
	Upper White River	Unnamed	White R	CO, RT, SH	47.0070915	-121.5263519	SR 410	55.51
	Upper White River	Dry Cr	White R	**BT,** RT, SH	47.0107206	-121.5270721	SR 410	55.29
	Upper White River	Unnamed	White R	CO, RT, SH	47.0328283	-121.5584515	SR 410	53.01
	Upper White River	Unnamed	White R	**BT**, CO, RT, SH	47.073866	-121.5787101	SR 410	49.93
	Upper White River	Unnamed	Unnamed	**BT,** RT	47.0878656	-121.5832266	SR 410	48.94
	Upper White River	Boundary Cr	White R	**BT**, CO, RT, SH	47.0964166	-121.5877234	SR 410	48.29
Nooksack	Upper North Fork Nooksack River	Unnamed	NF Nooksack R	CO, RT, SH, SRCT	48.8922081	-121.9206085	SR 542	34.49
	Upper North Fork Nooksack River	Deerhorn Cr	NF Nooksack R	**BT**, CO, RT, SH, SRCT	48.9046792	-121.8580513	SR 542	38.15
	Upper North Fork Nooksack River	Unnamed	NF Nooksack R	RT	48.9047717	-121.9107414	SR 542	35.55
	Upper North Fork Nooksack River	Lookout Cr	NF Nooksack R	**BT**, RT, SH, SRCT	48.9051094	-121.8895111	SR 542	36.61

Core Area	Local Population	Stream	Tributary To:	Species	LatWGS84	LongWGS84	State Roadway	Mile Post
Nooksack (Continued)	Upper North Fork Nooksack River	Chain-up Cr	NF Nooksack R	**BT**, CO, PK, RT, SH, SRCT	48.9053804	-121.8414969	SR 542	38.98
	Upper North Fork Nooksack River	Unnamed	NF Nooksack R	RT	48.9057579	-121.8523331	SR 542	38.38
	Upper North Fork Nooksack River	Unnamed	NF Nooksack R	RT, SRCT	48.9058623	-121.8438319	SR 542	38.86
	Middle North Fork Nooksack River	Hedrick Cr	Nooksack R	**BT**, CO, PK, RT, SH, SRCT	48.8959236	-121.971489	SR 542	
	Lower North Fork Nooksack River	Unnamed	NF Nooksack R	RT	48.9162825	-122.0058683	SR 542	48.94
	Lower North Fork Nooksack River	Unnamed	Nooksack R	CH, CK, CO, RT, SH, SK, SRCT	48.9231682	-122.0524368	SR 542	48.78
	Lower North Fork Nooksack River	Unnamed	NF Nooksack R	CO, RT, SH, SRCT	48.9245808	-122.0184839	SR 542	49.87
	Lower North Fork Nooksack River	Unnamed	NF Nooksack R	**BT**, CO, RT, SH, SRCT	48.9256973	-122.020635	SR 542	52.39

Core Area	Local Population	Stream	Tributary To:	Species	LatWGS84	LongWGS84	State Roadway	Mile Post
Nooksack (Continued)	Lower North Fork Nooksack River	Baptist Camp Cr	NF Nooksack R	CO, RT, SH, SRCT	48.92696	-122.0226212	SR 542	47.75
	Lower North Fork Nooksack River	Bruce Cr	Nooksack R	CO, RT	48.9279718	-122.0384322	SR 542	52.47
Snohomish/Skykomish	South Fork Skykomish River	Unnamed	Tye R	**BT**, CO, RT, SH	47.7170405	-121.2791842	US 2	52.7
	South Fork Skykomish River	Unnamed	Tye R	**BT**, RT	47.7171628	-121.2781736	US 2	52.75
	South Fork Skykomish River	Unnamed	SF Skykomish R	**BT**, CO, PK, RT, SH	47.7327434	-121.4181137	US 2	45.47
	South Fork Skykomish River	Unnamed	SF Skykomish R	CO, RT	47.7418571	-121.4392186	US 2	44.26
	South Fork Skykomish River	Unnamed	SF Skykomish R	**BT**, RT, SH	47.7422742	-121.4396277	US 2	44.23
Upper Skagit	Ruby Creek	Cabinet Cr	Granite Cr	RT	48.63950434	-120.8513974	SR 20	147.07
	Ruby Creek	County Line Cr	Granite Cr	RT	48.66067431	-120.8639638	SR 20	145.45
	Ruby Creek	Unnamed	Granite Cr	RT	48.67081146	-120.8768178	SR 20	144.51
	Ruby Creek	Beebe Cr	Granite Cr	**BT**, RT	48.68879238	-120.8891666	SR 20	143.13

Core Area	Local Population	Stream	Tributary To:	Species	LatWGS84	LongWGS84	State Roadway	Mile Post
Upper Skagit (Continued)	Ruby Creek	Unnamed	Ruby Cr	**BT**, RT	48.70426887	-120.9492784	SR 20	139.75
	Ruby Creek	Unnamed	Granite Cr	RT	48.70488794	-120.9139537	SR 20	141.48
	Ruby Creek	Unnamed	Ruby Cr	**BT,** RT	48.70581301	-120.9613668	SR 20	139.17
Stillaguamish	North Fork Stillaguamish River	Fortson Cr	NF Stillaguamish R	**BT**, CO, RT, SH, SRCT	48.2685713	-121.7228311	SR 530	42.99
	North Fork Stillaguamish River	Unnamed	Fortson Ponds	CO, RT, SH, SRCT	48.2686687	-121.7149849	SR 530	43.34
	North Fork Stillaguamish River	Little French Cr	Fortson Cr	CO, RT, SH, SRCT	48.2735511	-121.7391008	SR 530	42.14

BT - bull trout; CH – chum salmon; CK - Chinook salmon; CO - coho salmon; PK - Pink salmon; RT - resident; SH - steelhead; SK - sockeye salmon; SRCT - Sea-run cutthroat trout.

Estuarine, Nearshore Marine, and Marine Habitat Conditions

An 1885 survey estimated that there were 267 square kilometers of tidal marsh and swamps bordering Puget Sound. Tidelands extended 20 km inland from the shoreline in the Skagit and Stillaguamish watersheds. Approximately 100 years later, only 54.6 $km^2$of intertidal marine or vegetated habitat is estimated to occur in the Puget Sound basin. This represents a decline of 80 percent across the region due to agricultural and urban modification of the lowland landscape (Johnson et al. 1997). In heavily industrialized watersheds, such as the Duwamish, intertidal habitat has been eliminated by 98 percent (Shared Strategy 2007a; Shared Strategy 2007b).

STATUS OF BULL TROUT CRITICAL HABITAT -Rangewide

See Appendix L for Status of Bull Trout Critical Habitat - Rangewide.

ENVIRONMENTAL BASELINE - BULL TROUT CRITICAL HABITAT (within the Action Area)

The action area includes all of the Coastal-Puget Sound and a small portion of the Columbia River Interim Recovery Units. The draft recovery plan states that maintaining viable populations of bull trout is essential to the conservation of species within each of the core areas, Interim Recovery Unit, and the coterminous listing (USFWS 2004a). To maintain or restore the likelihood of long-term persistence of self-sustaining, complex, interacting groups of bull trout within the action area, the Service has identified the following needs: 1) maintain the current distribution of bull trout and restore distribution in previously occupied areas, 2) maintain stable or increasing trends in abundance of bull trout, 3) restore and maintain suitable habitat conditions for all bull trout life history stages and strategies, and 4) conserve genetic diversity and provide opportunities for genetic exchange. The core areas are central to the survival and recovery of bull trout. They are the smallest scale necessary for maintaining a functioning metapopulation of bull trout because they contain the habitat qualities necessary for them to spawn, rear, forage, overwinter, and migrate and the contiguous habitat necessary to survive catastrophic events.

The intended recovery function of critical habitat is to support the core areas and ensure that the habitat requirements of bull trout are met, now and in the future. The primary constituent elements provide a measure of the habitat conditions and are essential components of critical habitat.

The Coastal Puget Sound Interim Recovery Unit is made up of two smaller units: Olympic Peninsula (Unit 27 and Puget Sound (Unit 28). The status of bull trout critical habitat for the Puget Sound and the Olympic Peninsula Units are described briefly below. The status of critical habitat in the lower Columbia River Basin is not provided as the effects to critical habitat that may result in adverse effects are excluded from the PBO.

Olympic Peninsula - Critical Habitat Unit 27

Critical habitat has been designated in streams and rivers in all core areas within this unit. On the Olympic Peninsula, a significant portion of the major river basins, particularly the upper river

portions where most bull trout spawning and rearing occurs, lie within the Olympic National Park. Spawning and rearing critical habitat has been designated in these areas within the Park. Habitat conditions in most of the migratory corridors are degraded downstream of the park boundary. In the largely rural setting of the Olympic Peninsula, habitat effects are primarily related to past logging and associated roading and, to a lesser degree, dams and agricultural practices. Habitat conditions have improved to some extent over the past decade with more protective forest practices and declining timber harvest on public lands. Although migratory corridors are still functional, especially on the west side of the Olympic Peninsula, critical habitat conditions related to suitable temperatures, floodplain connectivity, substrate, timing and magnitude of flows, and habitat complexity related to large woody material have been degraded by historical land-management practices.

There are approximately 294 miles of state roadway within 1 mile of this Critical Habitat Unit (CHU). Of this, approximately 217 miles are within 300 ft of the CHU. Impacts associated with these roadways included increased impervious surfaces and undersized stream crossings. This results in increased stormwater runoff, with associated contaminants, and potential impacts to stream flows and groundwater recharge.

PCEs 1, 2, 3, 4, 5, 6, and 7 within the designated critical habitat have likely been degraded, although the severity of degradation varies on a site specific basis.

Puget Sound - Habitat Unit 28

All PCEs of freshwater, estuarine, and nearshore critical habitat have been degraded throughout the Puget Sound region, some more severely than others. At least 33 percent of Puget Sound nearshore and marine shorelines have been modified with bulkheads or other armoring. These modifications resulted in loss of riparian vegetation, obstruction of sediment movement along the shoreline, interference with wave action, and burial of upper beach areas. Although upper beach areas are not utilized directly by salmon, they are egg-laying grounds for species of smaller forage fish that salmon depend on. Roughly 73 percent of the wetlands in major deltas of Puget Sound rivers have been lost in the last 100 years. The number of piers and docks in Puget Sound is 3,500; the number of small boat slips is 29,000; and the number of large ship slips is 700, each a source of structure and shade which can diminish aquatic food supply and are a potential source of water pollution from boating uses (Shared Strategy 2007a, pp. 75-76).

The urban rivers of Puget Sound have effects comparable to those on the Olympic Peninsula from past logging and logging roads in the upper reaches, but critical habitat has been further degraded in the lower floodplains. Intensive channelization to protect urban development and agricultural areas has resulted in permanent loss of floodplain functions in most of the lower rivers.

Additionally, hydroelectric dams block migration and have isolated bull trout populations in several core areas while water-control structures in the floodplains have effectively eliminated most of the estuaries and wetlands that historically provided rearing and foraging areas for bull trout or their forage fish.

The WDOE has placed a large number of waterways throughout Puget Sound on the 303(d) list of impaired waters. There are 972 municipal and industrial wastewater dischargers into the

Puget Sound Basin. Of these, 180 permit holders had specific permission to discharge metals, including mercury and copper, which affect olfaction in a manner that interferes with critical behaviors, such as predator avoidance, homing to natal streams, and spawning, as well as impacting fish health at sublethal degrees. Over 1 million pounds of chemicals were discharged to Puget Sound in 2000 by the 20 industrial facilities that reported their releases to the Environmental Protection Agency. An estimated 500,000 on-site sewage systems are estimated to occur in the Puget Sound basin. Sixteen major (greater than 10,000 gallons) spills of oil and hazardous materials occurred in Puget Sound between 1985 and 2001, plus 191 smaller spills occurred from 1993 to 2001, releasing a total of more than 70,000 gallons. More than 2,800 acres of Puget Sound's bottom sediments are contaminated to the extent that cleanup is warranted (Shared Strategy 2007a, p. 76).

Vegetation removal has also altered the hydrologic system in many watersheds, affecting the watershed's retention of moisture and increasing the magnitude and frequency of peak and low flows. Wetlands also play an important role in hydrologic processes, as they store water which ameliorates high and low flows. There has been a significant loss of wetlands in western Washington.

There are approximately 494 miles of state roadway within 1 mile of this CHU. Of this, approximately 417 miles are within 300 ft of the CHU. Impacts associated with these roadways included increased impervious surfaces. This results in increased stormwater runoff, with associated contaminates, and potential impacts to stream flows and groundwater recharge.

PCEs 1, 2, 3, 4, 5, 6, and 7 within the designated critical habitat have likely been degraded, although the severity of degradation varies on a site specific basis.

STATUS OF THE SPECIES – Marbled Murrelet - Rangewide

See Appendix L for Status of the Species: Marbled Murrelet - Rangewide.

ENVIRONMENTAL BASELINE – Marbled Murrelet (within the Action Area)

Assessment of Marbled Murrelet Habitat in Washington and the Action Area

Murrelets in Washington generally use large patches of old-forest or uneven-aged forest with old-growth characteristics for nesting habitat (Nelson and Hamer 1995b). Hamer and Nelson (1995b) described both landscape and forest stand characteristics of 36 murrelet nest stands in the Pacific Northwest (a stand being defined as a contiguous group of trees with no gaps larger than 330 ft).

Murrelets are known to locate their nests throughout forest stands and fragments, including various types of natural and man-made edges (McShane et al. 2004). Riparian forests can provide potential nest sites for murrelets if the appropriate structures are present (i.e., large trees with suitable nest platforms located within a patch of suitable nesting habitat). McShane et al. (2004) reviewed several studies describing murrelet nest locations and summarized their review: "Most of the nests occurred along edges (76 percent), but in most cases these were natural edges

(59 percent). [In this review, edge was defined as within 180 ft of an edge]. Nests on natural edges occur along streams, wetlands, forest gaps, large natural openings, or avalanche chutes." In summary, murrelets may select riparian areas for nesting if the appropriate habitat features are available. Murrelets appear to require canopy gaps to access nest sites, and many nest sites documented by research studies have been located along natural edges such as stream corridors or wetland areas. However, there are no studies that demonstrate that murrelets specifically select edge habitats over other available habitats (McShane et al. 2004).

The acreage of potential suitable murrelet nesting habitat in Washington was estimated using the assessment method described in the Forest and Fish HCP (USFWS 2006b). Detailed information on this assessment methodology may be found in the administrative record for that consultation. To summarize the method, map data developed by Raphael et al. (2006) using 1992 to 1996 satellite images was used to evaluate murrelet habitat conditions on lands within murrelet conservation zones 1 and 2. The Expert Judgment Model (EMJ) outputs of Class 3 (moderately suitable) and Class 4 (highly suitable) (EJM Class 3-4) were selected to depict murrelet habitat because this model output represents the median of the range of possible values derived from the habitat models developed by Raphael et al. (2006). The EJM Class 3-4 model is consistent with the Service's current view of the distribution of murrelet habitat in Washington. The Class 3 category was included in the model output because this category depicts some acres of "moderate suitability" murrelet habitat in southwest Washington, which is consistent with the distribution of known murrelet observations on that landscape. Based on the information provided by Raphael et al. (2006), the EJM Class 3-4 model provides a reasonable estimate of potential murrelet nesting habitat in Washington; however, we recognize that this model may overestimate potential nesting habitat in some landscapes (e.g., the western Washington lowlands) or underestimate it in others. Work by Healey et al (2003) was also used to evaluate the effects of the stand-replacing fires and timber harvests on murrelet habitat that occurred between 1992 and 2002. These data only include stand-replacing disturbance, and doe not capture the effects of partial harvests such as commercial thinning. Using the EJM Class 3-4 model output, the Raphael et al. (2006) data indicate there were approximately 1.58 million acres of potential murrelet nesting habitat in Washington in 2003 (Table 11).

Table 11. Potential nesting habitat acres within the range of the marbled murrelet in Washington and the action area[1].

Murrelet Recovery Zone	Total Murrelet Nesting Habitat in Washington (acres)	Total Murrelet Nesting Habitat within the Action Area (acres)	Murrelet Nesting Habitat within the Action Area (percent)	Murrelet Nesting Habitat within 50 ft of State Roadways within the Action Area (acres)
Zone 1	1,077,900	146,100	14	-
Zone 2	497,100	36,600	7	-
Total	1,575,000	182,700	12	7,249

[1]All acres are approximate values derived from GIS data. Totals were computed prior to rounding. Murrelet habitat estimates represent approximate conditions in 2003, as depicted by Raphael et al. (2006) map data, Expert Judgment Model Class 3 and Class 4, and account for stand-replacing timber harvest and fire losses that occurred from 1992 to 2002 (Healey et al. 2003). Action area is defined as 1 mile from state highway.

Based on this assessment, the action area (i.e., within one mile of state routes) was determined to contain approximately 182,700 acres or approximately 12 percent of suitable murrelet nesting habitat in Washington (Table 11). Approximately 80 percent of this acreage is within Conservation Zone 1 and 20 percent in Conservation Zone 2. However, much of this habitat exists as small isolated patches which may be too fragmented to support murrelets. Therefore, 182,700 acres may over-estimate the actual suitable murrelet habitat within the action area.

An assessment of suitable nesting habitat using GIS was also conducted by WSDOT for the amount of suitable habitat within 50 ft of state roadways. The total acreage is approximately 7,249 in both zones 1 and 2. A breakdown by conservation zone was not provided. However, we assume that approximately 5,799 acres occurs in Conservation Zone 1 and 1,450 acres in Conservation Zone 2 based on the percent of suitable habitat within each conservation zone in the action area.

Potential Marbled Murrelet Nesting Habitat in Murrelet Detection Areas within Washington and the Action Area

We also analyzed the amount of potential murrelet nesting habitat in the action area that occurs in murrelet detection areas. Murrelet detection areas include the section of land where a status 1 through 4[18] murrelet observation was documented, and the eight surrounding sections. This analysis indicated that about 7 percent (48,220 acres) of the murrelet potential nesting habitat in the action area is located in murrelet detection areas (Table 12). An analysis of nesting habitat in detection areas was not specifically conducted for areas within 50 ft of state routes. However, approximately 3,359 acres was determined to occur within approximately 180 ft of state routes (Table 12). Suitable habitat within detection areas has a higher probability of being occupied than other areas of suitable habitat. However, due to the lack of recent surveys, these data may not fully reflect existing conditions.

[18] Status 1-4 observations: 1) nest site; 2) downy young or eggshell fragments (this may not indicate the accurate location of a nest); 3) sub-canopy behavior and circling above canopy; 4) above canopy behavior (this also includes heard only detections, unless the heard only adequately documents a circling behavior). In general, Status 1-3 are considered occupied and Status 4 is presence. However, see the caveats attached to Status 2 and 3. Additionally, WDFW Status 3 murrelet occurrences are observed behaviors at or below 1.0 canopy, and circling flight between >1.0 to 2.0 canopy (i.e., a height of 1.0 canopy above the dominant trees). Flight is considered circling when the direction of the bird(s) deviates from the initially observed flight path. A circling behavior includes any circular, arcing, curvilinear, or turning flight. In most cases, above canopy partial circles and arcs are actually complete circles, but limited visibility prevents the observer from seeing the complete circle. For Northwest Forest Plan Status 3 occurrences, circling above the stand below 2 canopies is considered an occupied behavior.

Table 12. Marbled Murrelet potential nesting habitat in marbled murrelet detection areas[1, 2].

Murrelet Recovery Zone	Murrelet Nesting Habitat in Detection Areas in Washington (acres)	Murrelet Nesting Habitat in Detection Areas in the action area (acres)	Murrelet Nesting Habitat within the Detection Areas in the Action Area (percent)	Murrelet Nesting Habitat in Detection Areas and within 180 ft of State Routes (acres)	Murrelet Nesting Habitat in Detection Areas within 180 ft of State Routes (percent)
Zone 1	390,500	29,640	8	1,723	0.4
Zone 2	267,400	18,580	7	1,636	0.6
Total	657,900	48,220	7	3,359	0.5

[1] Detection areas include the section in which a status 1 through 4 murrelet site is documented and the eight surrounding sections.
[2]All acres are approximate values derived from GIS data. Murrelet habitat estimates represent approximate conditions in 2003, as depicted by Raphael et al. (2006) map data, Expert Judgment Model Class 3 and Class 4, and account for stand-replacing timber harvest and fire losses that occurred from 1992 to 2002 (Healey et al. 2003).

STATUS OF MARBLED MURRELET CRITICAL HABITAT - Rangewide

See Appendix L for Status of Marbled Murrelet Critical Habitat - Rangewide.

ENVIRONMENTAL BASELINE - Marbled Murrelet Critical Habitat (within Washington and the Action Area)

Federally designated murrelet critical habitat in Washington covers approximately 1,204,500 acres distributed across 10 critical habitat units (CHUs) (Table 13). Each Critical Habitat Unit is comprised of several subunits. There are a total of 33 critical habitat subunits in Washington ranging from 200 acres to over 108,000 acres in size. Lands designated were those areas identified as essential to the conservation of the murrelet, with the major foundation of the designation being Federal lands managed under the Northwest Forest Plan (USFWS 1996). Over 99 percent of the CHUs in Washington are located on Federal lands that are managed as Late-Successional Reserves under the Northwest Forest Plan.

Using the Raphael et al. (2006) EJM Class 3-4 habitat model, we estimated that the CHUs in Washington encompass a total of approximately 401,200 acres of potential murrelet habitat. This represents approximately 33 percent of the designated acres. There is a high percentage of second-growth forest and some naturally non-suitable habitat areas within the CHUs.

Table 13. Marbled murrelet critical habitat and suitable nesting habitat within action area and 50 ft of state roadway within the action area by conservation zone. Suitable nesting

Conservation Zone	Critical Habitat Unit	Murrelet Critical Habitat within Washington (acres)	Total Potential Murrelet Nesting Habitat in Washington (acres)	Total Potential Murrelet Nesting Habitat within Critical Habitat in Washington (percent)	Murrelet critical habitat within the action area (acres)	Murrelet critical habitat within 50 ft of state roadways in the action area (acres)	Murrelet critical habitat within 50 ft of state roadways in Washington (percent)
Zone 1	WA-01	68,654	23,973	35	12,130	148	1
Zone 2	WA-02	64,677	31,122	48	3,990	94	2
Zone 2	WA-03	162,827	53,779	33	4,970	134	3
Zone 2	WA-05	1,434	258	18	1,434[1]	109[2]	8
Zone 1	WA-06	115,731	39,139	34	5,610	109	2
Zone 1	WA-07	192,019	64,220	33	18,950	925	5
Zone 1	WA-08	105,601	35,839	34	260	0	0
Zone 1	WA-09	178,696	72,188	40	1,600	31	2
Zone 1	WA-10	144,245	49,298	34	9,000	267	3
Zone 1	WA-11	172,267	31,389	18	16,260	610	4
Total		1,206,151[3]	401,205	33	87,111	3,410	4

habitat based on 2003 data.

[1]Acreage of critical habitat in this unit within the action area was not provided in the PBA; therefore, used value for entire critical habitat unit. The actual acreage within the action area is likely to be a subset of this value as portions of WA-05 were excluded from critical habitat under the WDNR HCP.

[2] Acreage includes lands that may be excluded under the WDNR HCP; therefore, this acreage may be an overestimate of the area within 50 ft of the state roadway.

[3]Total acreage exceeds previously stated critical habitat acreage in Washington likely due to mapping error.

Approximately 2,500 acres designated murrelet critical habitat occurs on private lands. Under the Washington Forest Practices Rules, federally designated critical habitat on non-Federal lands is managed under the provisions of the State's murrelet rule [WAC 222-16-080(2)]. The designated private lands occur primarily in coastal Conservation Zone 2, in southwest Washington. All of the private lands that are within designated critical habitat occur within 1.5-mile radius circles surrounding status 1 through 3 occupied murrelet sites. Therefore, all occupied murrelet habitat within these non-Federal CHUs is protected under the existing Washington Forest Practice Rules.

Within the action area, there are approximately 87,111 acres of designated critical habitat. Of this, 3,410 acres occur adjacent to a state roadway and may be affected by the proposed actions. The following is a brief description of the status of the critical habitat units within the action area.

STATUS OF THE SPECIES: Northern Spotted Owl - Rangewide

See Appendix L for Status of the Species: Northern Spotted Owl - Rangewide.

ENVIRONMENTAL BASELINE - Northern Spotted Owl (within Washington and the Action Area)

The range of the northern spotted owl in Washington includes four physiographic provinces covering an area of over 21 million acres. The four provinces are the Olympic Peninsula, the western Washington lowlands, the western Washington Cascades, and the eastern Washington Cascades. Northern spotted owls now occur primarily on the eastern and western slopes of the Cascades and on the Olympic Peninsula. Historically, northern spotted owls were likely distributed throughout much of the western Washington lowlands, but now are considered rare in that portion of their range. Northern spotted owls occur at elevations ranging from sea level up to 3,500 ft to 5,000 ft depending on the region, and as in other parts of their range, northern spotted owls in Washington primarily use mature and old forest habitats for nesting, roosting, and foraging.

The Olympic Peninsula is an isolated province bordered on three sides by marine waters. Thomas et al. (1990) identified the Olympic Peninsula as an area of special concern for northern spotted owls due to the physical isolation of the northern spotted owl population on the Peninsula to other populations in adjacent provinces. Major threats to northern spotted owls on the Olympic Peninsula include low populations levels and poor population distribution, habitat loss, isolation, natural disturbances, and the presence of barred owls (USFWS 1992; 2008).

There are no current estimates of the total number of northern spotted owls across its range. However, past assessments have indicated that approximately 15 to 20 percent of the rangewide population occurs in Washington (USFWS 2004b). The most recent demographic-monitoring information indicates that the northern spotted owl population in Washington is declining at an annual average rate of 7.1 percent, compared to an average rate of 1.7 percent per year in the remainder of the range (Lint 2005; Anthony et al. 2006). The realized population change estimates (i.e., the proportion of the population remaining each year, given the rates of decline) indicate that currently only about 40 to 60 percent of the initial 1990 northern spotted owl population in Washington remains (Lint 2005; Anthony et al. 2006). Anthony et al. (2006) suggest that the combined influences of high densities of barred owls; lag effects associated with rapid habitat loss prior to the Federal listing of the northern spotted owl in 1990; continued habitat loss from wildfire, timber harvest and defoliation; and poor weather conditions are the likely causes for these declines.

Recent habitat assessments indicate that about 25 to 30 percent of the rangewide northern spotted owl habitat occurs in Washington (Davis and Lint 2005). The Service estimated that there were approximately 3.68 million acres of suitable northern spotted owl habitat in Washington (all land ownerships) in 2003 using Davis and Lint's (2005) data (USFWS 2006a) (Table 14).

Table 14. Northern spotted owl suitable habitat within the action area[19.]

Province	Total Northern Spotted Owl Suitable Habitat in Washington (acres)	Northern Spotted Owl Suitable Habitat in the action area (acres)	Northern Spotted Owl Suitable Habitat in Province in the action area (percent)
Olympic Peninsula	717,000	46,909	6.5
Western Washington Lowlands	378,600	59,485	15.3
Western Washington Cascades	1,616,300	113,587	7.0
Eastern Washington Cascades	972,500	13,110	1.3
Totals:	**3,684,400**	**233,091**	**6.3**

Due primarily to historical timber harvest, approximately 84 percent of the known northern spotted owl site centers (*n* = 878) (Buchanan and Sweeden 2005) and about 60 to 70 percent of extant northern spotted owl habitat in Washington is located on Federal lands managed under the Northwest Forest Plan (Davis and Lint 2005).

Since the Federal listing in 1990, the Service has consulted on the removal or downgrading of about 240,000 acres of suitable northern spotted owl habitat in Washington under section 7 of the ESA. Most (89 percent) of this consulted-on habitat loss is associated with HCPs (≈ 143,000 acres) or tribal forest management plans (≈ 70,000 acres).

As of October 2004, there were 1,044 territorial sites (status 1, 2, or 3) documented in the WDFW database (Buchanan and Sweeden 2005) (Table 15). Status 1 through 3 sites represent known northern spotted owl pair locations, pairs of unknown breeding status, or resident singles. This figure likely over estimates the actual number of active northern spotted owl territories in Washington because once a site is documented, the status of the site at the time of the last survey remains in the database until new information is available to revise the status (Buchanan and Sweeden 2005).

[19] All values are derived from GIS data and are approximate. Northern spotted owl habitat estimates represent approximate conditions in 2003, as depicted by Davis and Lints' (Thomas et al. 1990) map data, and accounting for stand-replacing timber harvest and fire losses that occurred from 1992 to 2002 (WSDOT 1997).

Table 15. Northern spotted owl site centers and circles in the action area by province in Washington[1].

Province	Total number of northern spotted owl site centers (all ownerships)	Number of northern spotted owl site centers located in the action area
Olympic Peninsula	244	19
Western Washington Lowlands	21	3
Western Washington Cascades	456	31
Eastern Washington Cascades	323	4
Washington Totals	**1,044**	**57**

[1]Includes only status 1, 2, and 3 sites documented in the WDFW northern spotted owl database. Status 1 = known pair location; status 2 = two owls (male and female) located, but pair status unknown; status 3 = resident single

Given the annual declines in the northern spotted owl population in Washington, it is likely that some northern spotted owl sites classified as status 1, 2, or 3 are no longer occupied. However, they are still considered active in the database. Additionally, northern spotted owl surveys are not updated. Thus, this information is of limited use for our analysis.

The action area accounts for approximately 6.3 percent of suitable northern spotted owl habitat (Table 14). However, much of the suitable habitat in the action area exists as small isolated patches which are too small to support northern spotted owls. The 6.3 percent figure likely over estimates the actual suitable northern spotted owl habitat in the action area.

STATUS OF NORTHERN SPOTTED OWL CRITICAL HABITAT

See Appendix L for Status of Bull Trout Critical Habitat - Rangewide.

ENVIRONMENTAL BASELINE - Northern Spotted Owl Critical Habitat (within Washington and the Action Area)

There area six northern spotted owl CHUs in Washington. All critical habitat occurs on Federal lands. The proposed action area encompasses portions of five of these CHUs within three provinces (Table 16). Of this, only a small percentage of the total designated critical habitat (less than 0.5 percent) occurs within 50 ft of a state highway and could be affected by the proposed action.

Table 16. Northern spotted owl critical habitat within action area and 50 ft of state roadway[1].

Province	Northern Spotted Owl Critical Habitat Unit	Critical Habitat per unit (acres)	WSDOT Road Miles Adjacent to Critical Habitat (miles)	Critical Habitat within Action Area (acres)	Critical Habitat within 50 ft of state roadway (acres)	Critical Habitat within 50 ft of state roadway (percent of total in CHU)
Olympic Peninsula	**Olympic Peninsula (CHU 1)**	332,100	5.3	6,734	63	0.019
West Cascades	**Northwest Washington Cascades (CHU 2)**	393,500	19.9	25,528	240	0.061
East Cascades	**Okanogan (CHU 3)**	115,600	3.8	4,872	46	0.040
West Cascades	**Southwest Washington Cascades (CHU 5)**	523,700	28.0	35,777	336	0.064
East Cascades	**Southeast Washington Cascades (CHU 6)**	143,400	<1[2]	0	0[2]	0
	Total	1,508,300	57	72,911	685	0.045

[1] Acres of critical habitat within action area and 50 ft of the state roadway are considered estimates. They are based on GIS analysis using the number of miles of WSDOT roadway adjacent to northern spotted owl critical habitat. The actual amount of critical habitat may be different due to mapping error, but this is considered the best available information at this time.
[2] Approximately 56 ft of roadway occur in CHU 6. Due to this small value and mapping error, we have excluded it from our calculation.

EFFECTS OF THE PROPOSED ACTION

The Service regulations for implementing the ESA define "effect of the action" as the direct and indirect effects of an action on the listed species and their habitat together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 CFR § 402.02).

The following analysis forms the foundation for our jeopardy and adverse modification analysis, which is intended to determine whether we would reasonably expect threatened or endangered species to experience reductions in reproduction, numbers, or distribution that would appreciably reduce the species' likelihood of surviving and recovering in the wild and/or the destruction or adverse modification of designated critical habitat.

This PBO does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02. Instead, we have relied upon the statutory provisions of the ESA and the August 6, 2004, Ninth Circuit Court of Appeals decision in Gifford Pinchot Task Force v. U.S. Fish and Wildlife Service (No. 03-35279) to complete the following analysis with respect to critical habitat.

Effects to Bull Trout

This section addresses the effects related to the construction, operation, and/or maintenance associated with the proposed action identified in the PBO. Bull trout utilize portions of the action area year-round and are likely to be in the action area during construction and operation of the proposed projects. Some effects may be short term; others may be in perpetuity. We assume that affected bull trout are from the following core areas: Chilliwack, Nooksack, Lower Skagit, Upper Skagit, Stillaguamish, Lower Puyallup, Snohomish-Skykomish, Quinault, Hoh, Elwha, Queets, Dungeness, and Skokomish.

Summary of Minimization Measures Specific to Bull Trout

The following minimization measures are proposed in the PBA and will minimize impacts of the proposed project to bull trout. These measures are considered part of the proposed action, and are taken into account in determining the effects of the proposed action on bull trout.

MM-1	MM-2	MM-6	MM-21	MM-27	MM-28	MM-29
MM-30	MM-31	MM-32	MM-33	MM-34	MM-35	MM-36
MM-37	MM-38	MM-39	MM-40	MM-41	MM-42	MM-43
MM-44	MM-45	MM-46	MM-47	MM-48	MM-49	MM-50
MM-51	MM-52	MM-53	MM-54	MM-55	MM-56	MM-57
MM-58	MM-59	MM-60	MM-61	MM-62	MM-63	MM-64
MM-65	MM-66	MM-67	MM-68	MM-69	MM-70	MM-71
MM-72	MM-73	MM-74	MM-75	MM-76	MM-77	MM-78
MM-79	MM-80	MM-81	MM-82	MM-83	MM-84	MM-85
MM-86	MM-87	MM-88	MM-89	MM-90	MM-91	MM-92
MM-93	MM-94	MM-95	MM-96	MM-97	MM-98	MM-99
MM-100	MM-103	MM-104	MM-105	MM-106		

We have analyzed the activities listed in Table 1 that may affect bull trout due to the proposed projects/programs covered by the PBO. Not all of the activities identified will result in measurable impacts to bull trout or occur within all core areas.

In- and near-stream construction activities and the discharge of stormwater may affect bull trout through the following stressors:

- Fish capture, handling, exclusion, and dewatering
- Increased sedimentation and turbidity

- Increased headcutting and slope failure
- Elevated underwater sound pressure levels
- Change in water quantity
- Exposure to contaminants during construction and/or post-construction, including stormwater related pollutants
- Change in prey base
- Change in available instream habitat due to streambank and riparian habitat removal and restoration, and fish passage modifications.

The following sections will describe the potential effects to bull trout, including their habitat.

Insignificant and Discountable Effects to Bull Trout

Some of the proposed projects are likely to result in insignificant or discountable effects to bull trout, both individually and cumulatively. Additionally, some programs as a whole are precluded from resulting in adverse impacts per the sideboards included in the PBA. These include the Facilities Preservation and Construction, and Pavement Preservation programs. If activities associated with these programs may result in adverse effects to bull trout, they will require an individual consultation. We have made the following determinations based on the description of the proposed project, including all proposed minimization measures, and assumptions regarding the location and presence of the species. Please note that some activities (for example, culvert repair) may result in either measurable or unmeasurable effects based on site-specific information. The PBA Determination Form will provide the information to support compliance with the PBO findings.

The following proposed activities may affect but are unlikely to adversely affect bull trout.

Subsurface and Hazardous Waste Sampling

- No in-water work would occur within bull trout local populations. However, work may occur in the uplands.

- No work will occur adjacent to waterbodies when bull trout are actively holding or spawning.

    - Although bull trout may be present during the proposed activity, no in-work will occur. Additionally, no work will occur adjacent to waterbodies when bull trout are actively holding or spawning, reducing the likelihood of disturbance at this critical time period. Although bull trout may be disturbed within these waterbodies at other times of the year, the duration of disturbance is not anticipated to measurably affect an individual's ability to forage or rear.
    - Minimization measures are proposed, including use of appropriate BMPs to control sediments and contaminants. Therefore, the likelihood that sediments or

contaminants would enter waterbodies is considered low. If these materials do enter the waterbody, we anticipate it will be in extremely small amounts, at levels that would not measurably affect bull trout or their prey.

- Therefore, we anticipate that effects to bull trout are likely to be insignificant due to disturbance and exposure to sediment and/or contaminants as part of subsurface sampling.

- The proposed activity may occur within waterbodies while bull trout or their forage species are present, and may result in avoidance and/or displacement of these species.

  - In-water work windows would be implemented to reduce the potential effects to bull trout and their forage species. However, individuals may still be present and exposed to in-water disturbance. The duration of sampling is unlikely to result in prolonged disturbance of these organisms. Therefore, we do not anticipate the disturbance effects to bull trout or their forage species to measurably affect normal behaviors such as breeding, foraging, or migration.

- In-water work may result in a temporary increase in sediment. There is also the potential that contaminants may be released into the aquatic environment if they occur at the sample site.

  - Due to the use of in-water work windows and proposed minimization measures, exposure of bull trout and their forage species will be reduced, but may not be eliminated.
  - The amount of sediment that is likely to be generated during sampling is expected to be small and remain within a few feet of the sampling site, reducing the likelihood of exposure to bull trout and their prey.
  - Although contaminants may be released during sampling, the amount that may be released is anticipated to be minor due to the minimization measures implemented and the limited amount of material that may be released into the aquatic environment. We do not anticipate that bull trout or their prey would be exposed to contaminant levels that would measurably affect normal behaviors such as breeding, feeding, or migrating.
  - Therefore, we anticipate that effects to bull trout are likely to be insignificant due to disturbance and exposure to sediment and/or contaminants as part of subsurface sampling.

Brushing Road Prisms and Slope Repair

- No in-water work is proposed. However, the proposed activities may be on the top of banks adjacent to waterbodies used by bull trout.

- The removal of herbaceous and woody vegetation would occur within existing maintained right-of-ways. Woody vegetation is limited to stems less than 4 inches in

diameter and removal does not occur on the bank slope of waterbodies that may be used by bull trout.

- ➢ Vegetation removal will only occur within existing cleared areas and limited to vegetation that is of small diameter, precluding the loss of LWD. Additionally, it will not occur on the banks of waterbodies used by bull trout, reducing the potential loss of shading and nutrients to these waterbodies. Therefore, we anticipate that the effects to bull trout would be insignificant.

- These activities may result in increased sediment, and/or release of contaminants into waterways containing bull trout.

  - ➢ Although bull trout may be present during the proposed activity, due to the minimization measures proposed, including use of appropriate BMPs to control sediments, and the lack of in-water work, the likelihood that sediments would enter waterbodies is considered low. If these materials do enter the waterbody, we anticipate it will be in very small amounts, at levels that would not measurably affect bull trout or their prey. Therefore, we do anticipate that the effects to bull trout would be insignificant.

Equipment Staging Areas, Vehicle Storage, and Refueling

- No in-water work is proposed.

- The proposed project will require sites to stage, store, and/or refuel machinery. These activities may result in the removal of herbaceous vegetation, increased sediment, and/or release of contaminants into waterways containing bull trout.

- Sites used for these purposes will be located near existing roadways. No staging areas will be allowed within 200 ft of a stream, river, or drainage that may be used by bull trout or their forage fish unless site specific review completed by the project biologist indicates that topography or other factors preclude runoff from entering these waterbodies. Temporary material storage piles consisting of erosive materials will be placed outside the 100-year floodplain during the rainy season (October 1 through June) unless site specific review completed by the project biologist indicates that topography or other factors preclude runoff from entering waterbodies containing bull trout or their prey.

  - ➢ We do not anticipate that any discharges from these sites will enter waters that may contain bull trout due to the proposed minimization measures. If sediments or contaminants do enter the waterbody as a result of the proposed activity, we anticipate they will be in very small amounts, at levels that would not measurably affect bull trout or their prey. Therefore, we anticipate that the proposed activity will not have a measurable effect on bull trout or their prey.
  - ➢ Vegetation removal is limited to herbaceous plants, thus effects to bull trout due to loss of shade and/or nutrients are not expected to be measurable to bull trout.

- Based on the proposed minimization measures and BMPs proposed as part of the proposed project, we anticipate that the effects to bull trout are likely to be insignificant.

Road Repair, Grinding Old Pavement Repaving, Striping, Sweeping, and Removal of Debris from Roadway

- No in-water work is proposed. However, work may occur over or adjacent to a waterbody when bull trout may be present.

- No additional impervious surfaces are created.

- The proposed activity may result in contaminants and/or sediments entering waterbodies that may be used by bull trout and/or their forage species.

    - Although bull trout and/or their forage species may be present during the proposed activity, due to the minimization measures proposed and the lack of in-water work, the likelihood that contaminants and/or sediments would enter waterbodies is considered low. If these materials do enter the waterbody, we anticipate it will be in very small amounts, at levels that would not measurably affect bull trout or their prey. Therefore, we anticipate that the proposed activity will have an insignificant effect on bull trout or their prey.

Asphalt Plants

- No in-water work is proposed.

- The proposed activity may result in contaminants entering waterbodies that may be used by bull trout if located in proximity (approximately 200 ft) of these waterbodies due to the potential of spills.

    - Although bull trout may be present during the proposed activity, due to the minimization measures proposed and the lack of in-water work, the likelihood that contaminants would enter waterbodies is considered extremely unlikely.
    - Therefore, we anticipate that the proposed activity would have a discountable effect on bull trout.

Use of Existing Gravel Pits

- No in-water work is proposed.

- All gravel pits are existing permitted facilities that are in compliance with the ESA. The proposed project does not include any modifications to these facilities, including operation, maintenance, and construction.

- The proposed activity may result in sediments entering waterbodies that may be used by bull trout if located in proximity (approximately 200 ft) of these waterbodies due to rainfall events within exposed, erodible sites.

    - Although bull trout may be present during the proposed activity, due to the minimization measures proposed and the lack of in-water work, the likelihood that sediments would enter waterbodies is considered extremely unlikely.
    - Therefore, we anticipate that the proposed activity would have a discountable effect on bull trout.

Disposal of Debris into Approved, Existing Upland Disposal Sites

- No in-water work is proposed.

- All disposal sites are existing permitted facilities that are in compliance with the ESA.

    - We do not expect that bull trout or their prey will be exposed to the use of existing upland disposal sites. Therefore, we anticipate that the proposed activity would have a discountable affect on bull trout.

Installation and/or Replacement of Signs, Guideposts, Concrete Jersey Barriers, Impact Attenuators Signal Improvements, Illumination, Guardrails, Noise Walls, Temporary Fencing, Paving, Raised Channelization, and Pavement Markers

- No in-water work is proposed.

- The proposed activity may result in small amounts of new impervious surface. The actual acres of new impervious surfaces per project that may result due to the proposed projects are unknown; however, the acreage associated with each of these projects is typically less than 500 ft^2, although some paving projects may result in approximately 0.7 acres of new pollution generating impervious surfaces.

    - The project will not cause or contribute to bed or bank scour or erosion (channel instability), and will not measurably affect base, peak, or flow durations in any TDA or receiving waterbody (MM-104). Therefore, we anticipate that the hydrologic effects of the proposed activities on bull trout will be insignificant.
    - The proposed project will not create any new points of discharge (new stormwater outfall or structure) to waterbodies that may be used by bull trout.

- The stormwater design for proposed activities are expected to achieve measurable reductions (at least 5 percent) in annual stormwater pollutant loadings for all pollutants (i.e., total suspended solids, total and dissolved zinc, total and dissolved copper) in all TDAs that discharge to waterbodies that may be used by bull trout[20]. Projects exempt from these requirements, due to their small footprint, are not anticipated to result in increases of these stormwater pollutants that would measurably affect bull trout or their prey.
- The stormwater design for the proposed project will not result in discharges of treated or untreated stormwater runoff directly to receiving waterbodies that may be used by bull trout or will not discharge treated or untreated stormwater runoff exceeding known sublethal adverse effects thresholds for dissolved zinc or dissolved copper. Therefore, the effects to bull trout from increase contaminants associated with stormwater discharges from the proposed projects are anticipated to be insignificant.

- Vegetation removal may occur due to the installation of new signs, guideposts, lighting, and guardrails, and paving activities.
  - Although the quantity of vegetation and other disturbance is unknown, if these activities are constructed independently, we do not anticipate the removal of significant areas of mature vegetation. The installation would most likely be adjacent to existing roadways in areas that are currently cleared or mowed. Therefore, the effects due to vegetation removal associated with these activities are likely to be insignificant to bull trout and their habitat.

- Increased sediment may occur due to the installation of new signs, guideposts, lighting, noise walls, temporary fencing, and guardrails.
  - We do not anticipate that these activities, when conducted as independent projects will produce significant amounts of sediment as work will not occur in-water and appropriate BMPs will be implemented to minimize these impacts.

- If galvanized metal is used, zinc may be leached and enter waterbodies occupied by bull trout and/or their prey. The amount of zinc that may be leached from galvanized metal is unknown. However, stormwater for the proposed activities will not discharge treated or untreated stormwater runoff exceeding known sublethal adverse effects thresholds for dissolved zinc at the point of discharge. Additionally, some of the leachate will likely enter stormwater facilities where there will be some reduction in the amount of zinc prior to it entering water bodies that may be used by bull trout.

[20] Loading concentrations will be based on pre- and post project loadings as determined using the Highway Runoff Dilution and Loading Model, Analysis of Highway Stormwater Water Quality Effects for Endangered Species Act Consultations.

- Although bull trout may be exposed to some additional zinc, we anticipate that effects to bull trout are unlikely to be measurable due to exposure to increased impervious surfaces, sediment and/or contaminants as a result of installation of signs, guideposts, concrete barriers, impact attenuators signal improvements, illumination, noise wall barriers, temporary fencing, and guardrails. Therefore, we anticipate the installation and/or replacement of these items would be insignificant.

- Use and/or installation of lighting may attract or repel bull trout during nighttime use. Lighting may result in increased risk of predation on juvenile bull trout by fish eating birds and larger predatory fish or may increase the ability of bull trout to forage more effectively on their prey. We anticipate that most work will occur during day light hours. However, in some circumstances, lighting at night will be necessary.

    - Negative effects due to lighting are more likely to occur in areas identified as bull trout Local Populations due to the presence of fry and juveniles. To minimize effects to these individuals, all lighting will be directed away from streams that may be used by bull trout fry and juveniles, reducing the potential for increased predation risk. We therefore anticipate that the effects due to lighting will be discountable.

Rivet Replacement and Crack Stabilization

- No in-water work is proposed. However, work may occur over water when bull trout may be present.

- BMPs implemented will collect debris and wastewater, precluding it from entering waterbodies used by bull trout or their prey species.

    - Although bull trout may be present during the proposed activity, due to the minimization measures and BMPs proposed, and the lack of in-water work, the likelihood that contaminants and/or sediments would enter waterbodies is considered low. If these materials do enter the waterbody, we anticipate it will be in very small amounts and will not have a measurable effect on bull trout or their prey. Therefore, we anticipate that the effects to bull trout would be insignificant.

Slope Flattening/Shaping and Installation of Buttresses, Earth Berms, and Fixed barriers

- No in-water work is proposed. However, work may occur near water when bull trout may be present.

- The proposed activity may result in sediments entering waterbodies that may be used by bull trout or their forage species.

- Although bull trout may be present during the proposed activity, due to the minimization measures proposed, including use of appropriate BMPs to control sediments, and the lack of in-water work, the likelihood that sediments would enter waterbodies is considered low. If these materials do enter the waterbody, we anticipate it will be in very small amounts and will not have a measurable effect on bull trout or their prey. Therefore, we anticipate that the effects to bull trout would be insignificant.

Bridge Painting and Washing

- No in-water work is proposed; however, work may occur above and/or adjacent to waterbodies occupied by bull trout.

- No work will occur within bull trout local populations when bull trout are staging or actively spawning.

- BMPs implemented will collect debris and wastewater, precluding it from entering waterbodies.

    - Although bull trout may be present during the proposed activity, due to the minimization measures proposed and the lack of in-water work, the likelihood that contaminants and/or sediments would enter waterbodies is considered low. If these materials do enter the waterbody, we anticipate it will be in very small amounts and will not have a measurable effect on bull trout or their prey. Therefore, we anticipate that the effects to bull trout would be insignificant.

Pile Removal and Pile Driving (impact or vibrated concrete and untreated wood piles; vibratory driven steel piles including sheet piles and H piles)

- No in-water work will occur in bull trout Local Populations.

- Piles may be removed or installed as part of a complete or independent project. Impacts associated with pile removal include increased turbidity, release of contaminants if the pile is treated wood or in a contaminated area, and disturbance including underwater sound disturbance, due to in-water work.

- For pile removal, direct pulling, vibratory removal, or cutting the piles below ground level will be the primary methods used to minimize localized turbidity. If use of a clamshell bucket is necessary due to pile breakage, silt curtains will be employed if site specific conditions support their use. Limiting factors for the use of silt curtains includes tidal influence and currents.

- Sediment and turbidity generated during pile removal and installation are anticipated to dissipate to background levels within a relatively short distance of the pile. Use of a clamshell bucket may generate the most suspended sediment if the substrate is disturbed during stub removals.

- Although bull trout may be present during the proposed project, due to the minimization measures proposed, increased turbidity and release of contaminants is anticipated due be very localized and to not result in measurable effects to bull trout or their habitat. Therefore, we anticipate that effects to bull trout will be insignificant.

- Concrete or untreated wood piles may be vibrated or impacted driven. Steel piles, including sheet piles, may only be vibrated in. Disturbance to bull trout due to increased sound and in-water work may occur due to the installation of piles that meet these installation conditions.

  - Sound pressures generated due to the above activities are not known to have resulted in physical harm or injury to bull trout or other fish. Projects that are of short duration (less than 1 week during daylight hours only), that occur during the recommended in-water work window, and do not occur within areas identified as local populations, will typically result in disturbance levels that do not measurably impact bull trout.
  - Therefore, we anticipate that effects to bull trout due to pile driving (as described above) would be insignificant.

Removal of Derelict Nets, Repair/Replacement of Floating Bridge Cables, and Barge Use

- The removal of derelict nets may result in a temporary increase in sediment and disturbance within the marine environment.

  - Although bull trout may be present during the proposed activities, the increased turbidity and disturbance are anticipated to be localized and short term. We do not anticipate that it will result in measurable effects to bull trout or their habitat. Therefore, we anticipate that effects to bull trout due to the temporary increase in sediment and disturbance would be insignificant.

- The repair/replacement of floating bridge cables may result in a temporary increase in sediment and disturbance within the marine and/or freshwater environment.

  - Although bull trout may be present during the proposed activities, the increased turbidity and disturbance are anticipated to be localized and short term. We do not anticipate that it will result in measurable effects to bull trout or their habitat. Therefore, we anticipate that effects to bull trout due to the temporary increase in sediment and disturbance would be insignificant.

- The use of barges may result in a temporary increase in sediment and disturbance within the marine and/or freshwater environment.

- ➢ Although bull trout may be present during the proposed activities, the increased turbidity and disturbance are anticipated to be localized and short term. Barges are not permitted to ground or impact eelgrass. We do not anticipate that it will result in measurable effects to bull trout or their habitat. Therefore, we anticipate that effects to bull trout due to the temporary increase in sediment and disturbance would be insignificant.

New Sidewalk

- No in-water work is proposed.

- No new sidewalks will be constructed in areas designated as bull trout Local Populations.

- The proposed activity would likely result in small amounts of new impervious surface. However, the PBA did not estimate the amount of new impervious surfaces due to new sidewalks.

  - ➢ The proposed action will not cause or contribute to bed or bank scour or erosion (channel instability), and will not measurably affect base, peak, or flow durations in any TDA or receiving waterbody (MM-104). Therefore, we anticipate that the effects of the proposed activities on bull trout will be insignificant.

- Sidewalks are considered non-polluting impervious surfaces if they are separated from roads used by motor vehicles. We assume that the proposed sidewalks will be separated from roads, and therefore will have minimal additional pollutants associated with their use by pedestrians and non-motorized equipment.

  - ➢ Therefore, the effects to water quality due to new impervious surfaces associated with sidewalks are expected to be insignificant to bull trout and their habitat.

Facilities Preservation and Construction

- No in-water work is proposed.

- No new facilities or expansion of existing facilities would be constructed within areas identified as bull trout Local Populations.

- The proposed projects would likely result in a total of up to 9.6 acres of new impervious surface, including up to 8.35 acres of new pollution generating impervious surfaces.

- All new buildings will be constructed at existing facilities only. We have assumed that new buildings may result in an increase in non-polluting impervious surfaces by up to 0.25 acre per project. Additionally, we anticipate that there may be up to one project per year over the life of the programmatic, up to 1.25 acres total.

- The action will not cause or contribute to bed or bank scour or erosion (channel instability), and will not measurably affect base, peak, or flow durations in any TDA or receiving waterbody (MM-104). Therefore, we anticipate that the effects of the proposed projects on bull trout will be insignificant.
- The proposed project will not create any new points of discharge (new stormwater outfall or structure) to waterbodies that may be used by bull trout.
- The stormwater design for proposed projects are expected to achieve measurable reductions (at least 5 percent) in annual stormwater pollutant loadings for all pollutants (i.e., total suspended solids, total and dissolved zinc, total and dissolved copper) in all TDAs that discharge to waterbodies that may be used by bull trout[21]. Projects exempt from these requirements, due to their small footprint, are not anticipated to result in increases of these stormwater pollutants that would measurably affect bull trout or their prey.
- The stormwater design for the proposed project will not result in discharges of treated or untreated stormwater runoff directly to receiving waterbodies that may be used by bull trout or will not discharge treated or untreated stormwater runoff exceeding known sublethal adverse effects thresholds for dissolved zinc or dissolved copper. Therefore, the effects to bull trout from increase contaminants associated with stormwater discharges from the proposed project are anticipated to be insignificant.

Creation of Detour Routes

- No in-water work is proposed.
- No vegetation removal is proposed.
- The proposed project would not result in the creation of new impervious surface. Existing roadways would be used for detours.
- The proposed project may result in a temporary increase in vehicle traffic in proximity to bull trout and forage fish waterbodies. This may result in increased contaminants generated from these roadways.
    - The project will not cause or contribute to bed or bank scour or erosion (channel instability), and will not measurably affect base, peak, or flow durations in any TDA or receiving waterbody (MM-104). Therefore, we anticipate that the effects of the proposed action on bull trout will be insignificant.
    - The proposed project will not create any new points of discharge (new stormwater outfall or structure) to waterbodies that may be used by bull trout.

[21] Loading concentrations will be based on pre- and post project loadings as determined using the Highway Runoff Dilution and Loading Model, Analysis of Highway Stormwater Water Quality Effects for Endangered Species Act Consultations.

- The stormwater design for proposed projects are expected to achieve measurable reductions (at least 5 percent) in annual stormwater pollutant loadings for all pollutants (i.e., total suspended solids, total and dissolved zinc, total and dissolved copper) in all TDAs that discharge to waterbodies that may be used by bull trout[22]. Projects exempt from these requirements, due to their small footprint, are not anticipated to result in increases of these stormwater pollutants that would measurably affect bull trout or their prey.
- The stormwater design for the proposed project will not result in discharges of treated or untreated stormwater runoff directly to receiving waterbodies that may be used by bull trout or will not discharge treated or untreated stormwater runoff exceeding known sublethal adverse effects thresholds for dissolved zinc or dissolved copper. Therefore, the effects to bull trout from increase contaminants associated with stormwater discharges from the proposed project are anticipated to be insignificant.
- Although the proposed project may result in a temporary increase in contaminants associated with a short term increase in road traffic, we do not expect that the increase would result in a measurable effect to bull trout or their prey. Therefore, we anticipate that the effects to bull trout would be insignificant.

Wetland Enhancement and Revegetation

- No in-water work will occur in bull trout local populations.

- No work in uplands adjacent to waterbodies will occur when bull trout are actively holding or spawning.
  - Although bull trout may be present during the proposed activity, no in-water work will occur and no work will occur in adjacent uplands when bull trout are actively holding or spawning, significantly reducing the likelihood of disturbance.
  - Additionally, minimization measures are proposed, including use of appropriate BMPs to control sediments and contaminants. Therefore, the likelihood that sediments or contaminants would enter waterbodies within local populations is considered very low.
  - Therefore, the effects to bull trout within a local population due to wetland enhancement and revegetation are anticipated to be insignificant.

- No work will be performed in waterbodies used by bull trout or due to the timing window when work will occur, the likelihood that bull trout would be present is extremely unlikely.

[22] Loading concentrations will be based on pre- and post project loadings as determined using the Highway Runoff Dilution and Loading Model, Analysis of Highway Stormwater Water Quality Effects for Endangered Species Act Consultations.

- The proposed project may result in sediments entering waterbodies that may be used by bull trout or their forage species.

    - Bull trout are unlikely to be present during the proposed project. Additionally, due to the minimization measures and BMPs proposed, the likelihood that sediments would enter waterbodies is considered low. If these materials do enter the waterbody, we anticipate it will be in very small amounts. We anticipate that the proposed project would not measurably affect bull trout or their prey. Therefore, the proposed project will have an insignificant effect on bull trout.

Installation and/or Maintenance of Stormwater Treatment Facilities, Repair and Maintenance of Roadside Ditches and Channels, Maintenance of Cross Culverts and Catch Basins, and Construction and Restoration of Temporary Access Roads

- No in-water work will occur in bull trout local populations.

- No work in uplands adjacent to waterbodies will occur when bull trout are actively holding or spawning.

- No removal of vegetation will occur within 200 ft of a stream within a bull trout local population.

    - Although bull trout may be present during the proposed activity, no in-water work will occur and no work will occur in adjacent uplands when bull trout are actively holding or spawning, significantly reducing the likelihood of disturbance.
    - Vegetation within 200 ft of a stream within a bull trout local population will not be removed to preclude the loss of shade and nutrients to the stream. The potential for an increase in sediment to the stream due to upland work is reduced significantly.
    - Additionally, minimization measures are proposed, including use of appropriate BMPs to control sediments and contaminants. Therefore, the likelihood that sediments or contaminants would enter waterbodies within local populations is considered very low.
    - Therefore, the effects to bull trout within a local population are anticipated to be insignificant.

- The proposed activities may result in an increase in sediment and contaminants generated during construction and/or maintenance.

- In-water work is at least 600 ft upstream of a waterway used by bull trout, or due to the timing window when work will occur; the likelihood that bull trout would be present is extremely unlikely.

- ➢ Although bull trout may use the waterbodies during part of the year, due to the minimization measures proposed and/or the lack of in-water work in waterbodies bull trout may use, the likelihood that contaminants and/or sediments would enter waterbodies and expose bull trout to them is considered low. If these materials do enter the waterbody, we anticipate it will be in very small amounts and will not have a measurable effect on bull trout or their prey. Therefore, the effects to bull trout are anticipated to be insignificant.

- The proposed project may result in the removal of herbaceous and woody vegetation. The removal of living woody vegetation is anticipated to be less than 4 inches in diameter and would occur on the top of slope only in those waterbodies that may be used by bull trout.

  - ➢ The removal of vegetation will not be on the slide slopes of waterbodies occupied by bull trout. Although there may be a loss of some shade and nutrients associated with this vegetation, due to its location and the lack of effect to large woody vegetation, we anticipate that the effects to bull trout will be insignificant.

Installation of Drains in Slopes

- No in-water work is proposed. However, discharges may drain to waterbodies occupied by bull trout and/or their prey.

- Sediment may be generated during and post-construction.

  - ➢ Although bull trout may be present during the proposed project, due to the minimization measures proposed, including BMPs, and the lack of in-water work in waterbodies bull trout may use, the likelihood that sediments would enter waterbodies is considered low. If these materials do enter the waterbody, we anticipate it will be in very small amounts and will not have a measurable effect on bull trout or their prey. Therefore, the effects to bull trout from increase sediments associated with the installation of drains in slopes are anticipated to be insignificant.

Removal of Beaver Activities

- The removal of beaver structures (such as dams) is proposed only for work conducted as part of Bridge Repair, Retrofit, Replacement, and Maintenance, and Drainage System Maintenance and Repair programs.

- Motorized equipment will not enter streams.

- Removal of beaver activities will not occur within streams used by bull trout for rearing and/or spawning or within 600 ft upstream of these waterbodies.

- Most beaver dams that impact WSDOT structures and require removal occur primarily in small, lowland streams. Although bull trout and bull trout prey may be affected due to increased sediment and loss of riparian vegetation, we expect that these effects are very limited in scope.

    - The removal of riparian vegetation is limited as most activities will occur from existing roadways or bridges. No trees greater than 4 inches dbh will be removed. Although some woody vegetation may be impacted, these would be replanted. Therefore, impacts to bull trout forage are likely to be short term and insignificant.
    - The removal of beaver dams must comply with the WDFW GHPA (#112548-1) developed for this activity. Conditions of this HPA include but are not limited to the following restrictions: revegetation of disturbed areas with cuttings and beaver dams will be removed gradually to provide a slow, controlled release of impounded water. Such restrictions and requirements will minimize the amount of sediment that is released and the potential for long-term impacts to riparian habitat.
    - Based on the limited vegetation removal that may occur and minimal sediment levels generated during and following removal, we do not anticipate that the proposed activities will result in measurable effects to bull trout or their habitat. Therefore, we anticipate that the removal of vegetation and increased sediment that may result from the proposed activities are not likely to significantly affect bull trout.

- Removal of beaver activity must occur by hand in waterbodies used by bull trout for foraging, migration, and overwintering if bull trout may be present during the in-water work. All in-water work must occur during the recommended in-water work window. Bull trout may be disturbed due to in-water work.

    - The removal of a beaver dam may result in temporary disturbance of bull trout. Due to the temporary and limited area of disturbance, we do not anticipate that the proposed activity will result in measurable effects to bull trout. Therefore, we anticipate that the disturbance associated with the removal of beaver activity will not significantly affect bull trout.

- The removal of a beaver dam may also result in a change in stream flow, especially within the area upstream of the dam.

    - Beaver dams that are removed are less than 1 year old. Therefore, they are not well established and will not have resulted in the extensive creation of wetlands and side channels associated with older structures. We do not anticipate that the effects of removal of beaver dams will measurably affect bull trout or their habitat. Therefore, we anticipate that any changes in stream flow associated with the removal of beaver activity will not significantly affect bull trout.

Installation of Bank Stabilization (including riprap) within Marine and Estuarine Waters. WORK IS LIMITED TO MARINE WATERS IN OR ADJACENT TO WILLAPA BAY (SR 101), GRAYS HARBOR (SR 105), HOOD CANAL (SR 101 AND SR 106), THE STRAIT OF JUAN DE FUCA (SR 112), AND THE MOUTH OF THE COLUMBIA RIVER (SR 401)

- All work will occur only where there is pre-existing bank hardening.
- Only one project per highway segment within these areas permitted over the 5 year consultation period.
- No more than 500 cy of riprap or other bank hardening material (approximately 1,200 ft^2) will be placed below mean lower low water as part of a proposed project.
- No more than 3,200 ft^2 (160 lineal ft) of riprap or other bank hardening material may be place along the bank per proposed project.
- All in-water work would occur during allowable in-water work windows to minimize impacts to bull trout and bull trout forage fish, except for emergency actions. Therefore, bull trout may be affected due to disturbance and prey species may be affected due to loss of spawning habitat and disturbance during spawning.
- Placement of bank material may occur during low tide, when all placements would occur in the dry. Placement of material in the dry would not be subject to an in -water timing window.
- No bank hardening would occur adjacent to known forage fish spawning beaches.
- Placement of bank hardening material will not affect eelgrass.
    - No new areas of marine or estuarine habitat will be hardened due to the proposed projects. Material placed will only be placed in areas that were previously stabilized. Although some bank vegetation may be impacted due to the proposed project, we anticipate that it would be primarily herbaceous or of small diameter (less than 4 inches dbh). We do not anticipate that the removal of this vegetation adjacent to marine waters to result in a measurable impact to bull trout or bull trout forage species due to a reduction of nutrients, cover, or large wood.
    - The proposed work will occur during the recommended in-water timing window, when bull trout and their forage fish are less likely to be present, except during emergency actions. Placement of bank hardening material is only permitted in marine areas that have a very low likelihood of bull trout exposure and are not adjacent to forage fish spawning areas. Placement of bank material may occur only during low tide, in the dry when fish would not be encountered. No excavation would be permitted outside of the in-water work window, reducing the potential effects of increased turbidity to bull trout and their prey. Turbidity that may occur due to placement of bank material is anticipated to be short term

and localized. Therefore, we do not anticipate that the effects to bull trout or their prey due to increased turbidity would be significant.

- Based on the limited work proposed within pre-existing impacted areas, minimization measures to address impacts to forage fish, and the use of an in-water timing window or no placement of material except in the dry, we do not anticipate that the effects to bull trout or their prey within these specific marine areas will be measurable due to the proposed project. We anticipate that the effects will be insignificant to bull trout.

Culvert Replacement and/or Installation; Culvert Extension; Culvert Repair; Culvert Cleaning; Repairing and Stabilizing Streambanks; Installation of Temporary or Permanent Retaining Walls/Shoring Walls in Uplands and in Water (H piles with sheet pile, wood or concrete as shoring); Removal of Debris (including sediment) from Flowing Waterbody or Lake; Placement of Slide Material into Waterways; Stabilization of Slide Areas; Placement of Slide Material (LWD only) into Waterways (streams); Slope Flattening/Shaping; Bridge Removal, Replacement, and Reconstruction; Temporary Bridge Construction and Removal; Bridge Widening; Temporary Work Platform Construction; Vegetation Removal; Placement of Instream Structures (riprap, barbs, groins); Correction of Fish Barriers (including installation of fish ladders and fishways); and Installation of Stormwater Outfalls

NOTE: THESE ACTIVITIES, WHEN IMPLEMENTED AS DESCRIBED BELOW, ARE ANTICIPATED TO RESULT IN INSIGNIFICANT IMPACTS TO BULL TROUT. THESE ACTIVITIES MAY ALSO RESULT IN ADVERSE EFFECTS, WHICH IS DISCUSSED IN THE FOLLOWING SECTION (MEASURABLE AND SIGNIFICANT EFFECTS TO BULL TROUT). THE PBA DETERMINATION FORM WILL PROVIDE THE RATIONALE FOR THE SPECIFIC EFFECT DETERMINATION.

- No work will occur in bull trout Local Populations.

- No work will be performed 1) in waterbodies used by bull trout, 2) within 600 ft upstream of waterbodies used by bull trout, or 3) due to the timing window when work or discharges to streams or marine waters will occur, the likelihood that bull trout would be exposed is extremely unlikely due to the temporary/short-term effects of the proposed project. Bull trout will not be exposed to the effects of the project later in time, when they may use the waterbody. If the project results in a permanent change (such as bank hardening), these effects are not expected to measurably affect bull trout behavior due to the limited habitat modifications on an individual and cumulative basis.

    - The proposed activities may result in an increase in sediment and contaminants generated during construction and/or maintenance of the above activities. Although bull trout may be present seasonally or downstream of the proposed projects during in-water work, due to the minimization measures proposed, the likelihood that contaminants and/or sediments would enter waterbodies occupied and/or used by bull trout when these discharges occur is considered low. Therefore, we anticipate that the proposed project will not have a measurable effect on bull trout.

- The proposed project may result in an increase in impervious surfaces including pollution generating. We anticipate that the amount of new impervious surface will be less than 200 ft^2 per project, and there would be no more than one project per subbasin (5th-field watershed) over the life of the programmatic.

    - Due to the limited amount of new impervious surface associated with each project, the limited acreage within a subbasin, and implementation of MM-104 (the action will not cause or contribute to bed or bank scour or erosion (channel instability), and will not measurably affect base, peak, or flow durations in any TDA or receiving waterbody, we anticipate that the effects associated with increased surface runoff to result in insignificant impacts to bull trout from changes in stream hydrology.
    - The proposed action will not create any new points of discharge (new stormwater outfall or structure) to waterbodies that may be used by bull trout.
    - The stormwater design for the proposed project is expected to achieve measurable reduction as documented by a p (exceed) value of less than or equal to 0.45 for dissolved zinc in annual stormwater pollutant loadings in all threshold discharge areas (TDAs) that discharge to waterbodies that may be used by bull trout[23,24]. The stormwater design for the proposed project will not result in discharges of treated or untreated stormwater runoff directly to receiving waterbodies that may be used by bull trout if there is a likelihood of exposure or will not discharge treated or untreated stormwater runoff exceeding known sublethal adverse effects thresholds for dissolved zinc or dissolved copper. Therefore, the effects to bull trout from increase contaminants associated with stormwater discharges from the proposed project are anticipated to be insignificant.

- The proposed project may result in in-water disturbance, including sound pressure, which that may affect bull trout and/or their prey within the action area.

- All piles driven as a result of the proposed activities will meet the criteria for pile driving provided in this effects section and listed above.

    - Although bull trout may be seasonally present, through the use of appropriate in-water timing windows and other minimization measures proposed, the likelihood that disturbance, including sound pressures, would occur in waterbodies occupied and/or used by bull trout is considered low. Therefore, we anticipate that the proposed activities will not have a measurable effect on bull trout.

[23] Loading concentrations will be based on pre- and post project loadings as determined using the Highway Runoff Dilution and Loading Model, Analysis of Highway Stormwater Water Quality Effects for Endangered Species Act Consultations.

[24] Project total loadings are a relevant consideration and WSDOT may, therefore, provide additional rationale in support of effect determinations for projects facing unique circumstances (e.g., minor amounts of new PGIS with no treatment).

- Although bull trout prey may be present and affected due to the proposed activities, due to the proposed minimization measures, impacts to prey will be localized. Use of recommended in-water work windows will limit the potential impacts to prey.

- The proposed activity may result in the removal of herbaceous and woody vegetation. The removal of living woody vegetation is anticipated to be less than 4 inches in diameter and would not exceed a total of 30 linear ft per streambank or waterbody within a 5th-field watershed. The removal of woody vegetation would not occur on streambanks used by bull trout, but may be removed from the top of the bank adjacent to the roadway.

  - The removal of vegetation will not be directly adjacent to waterbodies occupied by bull trout. Although there may be a loss of some shade and nutrients associated with this woody vegetation, due to the limited removal, its location and lack of effect to large woody vegetation, we anticipate that the effects to bull trout and their prey would not be measurable.
  - The removal of herbaceous vegetation may occur on streambanks. Due to the limited shade provided by this vegetation, we anticipate that the effects to bull trout will be insignificant.

Blasting

- No in-water blasting is proposed.

  - Although bull trout may be present in the area during blasting, as no blasting in proposed in-water, effects to bull trout due to disturbance are considered insignificant.

- Blasting may generate material, including sediments, that could enter waterbodies occupied by bull trout.

  - Although bull trout may be present during the proposed activity, due to the minimization measures proposed and the lack of in-water work, the likelihood that sediments would enter waterbodies is considered low. If these materials do enter the waterbody, we anticipate it will be in very small amounts and will not have a measurable effect on bull trout or their prey. Therefore, the effects to bull trout due to material entering the stream during blasting are anticipated to be insignificant.

Seismic Retrofit

- No in-water work will occur in bull trout local populations.

- No work in uplands adjacent to waterbodies will occur when bull trout are actively holding or spawning.

- Although bull trout may be present during the proposed activity, no in-water work will occur and no work will occur in adjacent uplands when bull trout are actively holding or spawning, significantly reducing the likelihood of disturbance.
- Additionally, minimization measures are proposed, including use of appropriate BMPs to control sediments and contaminants. Therefore, the likelihood that sediments or contaminants would enter waterbodies within local populations is considered very low.
- Therefore, the effects to bull trout within a local population due to seismic retrofit are anticipated to be insignificant.

- No work will be performed in waterbodies occupied by bull trout or due to the timing window when in-water work will occur, the likelihood that bull trout would be present is extremely unlikely.

- The proposed activities may result in an increase in sediment and disturbance during construction.

  - Although bull trout may be present during the proposed activity, due to the minimization measures proposed, including BMPs, timing of in-water work or the lack of in-water work in waterbodies bull trout may use, the likelihood of disturbance or that sediments would enter waterbodies is considered low. If these materials do enter the waterbody, we anticipate it will be in very small amounts and will not have a measurable effect on bull trout or their prey. Therefore, the effects to bull trout due to seismic retrofit are anticipated to be insignificant.

Hybridization and Increased Competition due to the Removal of Physical Barriers (e.g., culverts)

- The proposed project may remove instream barriers that are currently preventing non-native species, such as brook trout, from hybridizing or competing with bull trout.

- The WSDOT proposes to exclude culvert replacement activities that would permit brook and brown trout access to isolated (upstream) bull trout populations.

  - The risk of bull trout incurring long-term adverse effects from the introduction of a non-native competitive species, such as brook trout, will be avoided because culverts located in streams known or suspected to contain non-native, competitive species are not permitted under this programmatic.
  - Therefore, hybridization and competition as an effect of the activity on bull trout is unlikely. Thus the effects to bull trout due to the removal of physical barriers are considered discountable.

Measurable and Significant Effects to Bull Trout

The following proposed activities are anticipated to affect bull trout due to fish capture, handling, exclusion, and dewatering; increased sedimentation and turbidity; increased headcutting and slope failure; elevated underwater sound pressure levels from impact pile driving of steel piles; change in water quantity; exposure to contaminants; riparian vegetation removal; and bank hardening. Due to the overlap in the effects of many of the activities, we have listed those activities under each stressor below, as well as the programs they may occur under.

Effects due to Fish Exclusion, Capture, Handling, and Dewatering

The following programs may result in adverse effects to bull trout due to fish exclusion, capture, handling and dewatering:

- Slide Stabilization, Bank Stabilization and Flood Damage Repair; Bridge Repair, Retrofit, Replacement, and Maintenance; Mobility Improvement Program; Safety Improvement; Environmental Retrofit and Enhancement.

To reduce lethal impacts on bull trout from dewatering the stream, the WSDOT proposes to capture and relocate bull trout from project construction sites prior to the initiation of in-water construction activities. Fish capture/handling and exclusion protocols described in Appendix D (or most recent protocol) will be followed.

The WSDOT proposes to use block nets to isolate the work area prior to dewatering; seines and dip nets and/or electroshocking to capture fish; and buckets to transport fish. All bull trout captured and relocated prior to the onset of construction activities will be significantly disrupted from their normal behavior. Some capture methods may result in mortality.

WSDOT anticipates that a maximum of 20 projects per WSDOT Region per year will be associated with capture and disturbance to bull trout during fish handling and exclusion. No adverse effects are permitted under this programmatic within the Lower Columbia Interim Recovery Unit, which includes most of the Southwest Region, although handling of bull trout is not anticipated to occur in this Recovery Unit. We anticipate that due to the proposed in-water work windows for the fish exclusion actions that the Southwest Region may undertake within the Coastal-Puget Sound Interim Recovery Unit, there is a low probability of encountering bull trout. Therefore, only the Northwest and Olympic WSDOT Regions are allowed adverse effects associated with fish handling for a maximum of 40 projects per year, which equals up to 200 projects over the 5 years for these two regions. We anticipate that this activity will be used primarily for projects with dewatering that include culvert replacement, removal, or repair. Up to 150 culverts may be replaced that have measurable effects to bull trout under this PBO. Therefore, culvert replacements may account for up to 75 percent of the use of this activity. Other projects, such as bridge replacement, bank stabilization, flood damage repair, and environmental retrofit, would account for the remaining use of this activity (50 projects). For the purposes of this programmatic, we have assumed that the extent of effects associated with fish exclusion, capture, and handling are the same for each of the activity types (i.e., culvert replacement, bridge replacement, etc.). This may result in an overestimate or underestimate of

adverse effects depending on the actual proposed activity. Therefore, a specific project may exceed the anticipated effects stated; however, the yearly and sub-basin (5th-field watershed) effect thresholds cannot be exceeded by the WSDOT Region.

The actual number of bull trout present in a stream reach is difficult to determine, and varies from stream reach to stream reach. The Service estimates that an average maximum of 3 bull trout per project (120 bull trout annually associated with a total of 40 projects) will be captured and handled during the 5-year implementation period. Therefore, we anticipate that up to 600 bull trout may be exposed to capture, handling, electroshocking, or stranding due to the proposed projects over the life of the programmatic. This value does not include bull trout that may be impinged on block nets, which is discussed below.

Effects due to Block Nets

The Service expects the majority of bull trout injuries and death will be due to block nets and electroshocking. Prior to dewatering a stream section, block nets will be placed upstream and downstream from the culvert to prevent fish from entering the stream segment that will be dewatered. The use of block nets poses a mortality risk to fry and juvenile bull trout, even when monitored on a daily basis.

In 2000, the Service studied bull trout sampling efficiency in Washington streams, capturing 811 bull trout (2,364 salmonids total) with block nets. Total fish mortality was 92 (4 percent of the total captured). Bull trout accounted for 63 percent of all mortalities (n = 58) and 7 percent (58 of 811) of all bull trout captured died on the block nets due to impingement. All bull trout mortalities were either fry (n = 47) or juveniles (n = 11). Some fish (species unknown) were occasionally impinged on upstream block nets, although this did not necessarily result in mortality. However, significant numbers of bull trout were killed from impingement on downstream block nets after various instream sampling activities. Much of this mortality occurred during a single event when large number of fry were impinged when a block net remained unchecked overnight (Karen Myers, U.S. Fish and Wildlife Service, biologist, pers. comm. 2009).

Under the proposed action, the WSDOT will check the block nets at least three times daily for approximately the first 48 hours after installation (approximately), and for the first 24 hrs after a significant rainfall or change in stream volume or velocity. If fish are impinged on the nets or there are changes to the stream velocity or volume, the directing biologist will re-consider and adjust the frequency of net inspections. Monitoring of the block nets at night is generally not permitted by WSDOT; however, it may occur under unusual circumstances. Due to the lack of commitment to night monitoring, we anticipate that it will not occur as part of the proposed action.

Although WSDOT proposes to monitor the block nets during the day, we anticipate that injury and/or mortality to juvenile bull trout may increase over that which occurred in the Service's study due to the lack of night monitoring of the block nets. We anticipate that there will be additional injury and/or mortality of bull trout juveniles due to block nets with this lack of night monitoring. However, the majority of the proposed projects will not occur where bull trout

juveniles are present (within Local Populations) and will occur prior to when fry would be present. Therefore, injury and mortality of bull trout juveniles only is anticipated due to impingement on block nests. The Service's methods in the 2000 study resulted in stream flows continually passing through the block nets throughout the night with crews checking nets at least one time during the night (approximately every 4 hrs to 6 hrs), except in one case where it was not checked. Additionally, the nets were left in place for 3 to 4 days and the fish were retained within the stream reach during this timing. No dewatering or fish relocation occurred. WSDOT proposes to remove fish from the area to be dewatered, reducing the likelihood of juvenile fish impingement on the downstream block net.
The Service assumes the impingement of bull trout juveniles on block nets will be rare and result in few bull trout mortalities, though some are still likely to occur. The Service estimates a total of 50 bull trout juveniles will be impinged on block nets (approximately 10 per year) and up to 5 percent of the 50 bull trout juveniles (approximately 3 bull trout juveniles) will be killed due to the use of block nets during WSDOT's 5-year operational period.

Effects due to Seines, Minnow Traps, and Dip Nets

Seines, minnow traps, and dip nets will initially be used to capture and remove any fish trapped between the block nets in the portion of the stream to be dewatered. The use of seines and dip nets are expected to capture approximately 70 percent of the 600 bull trout encountered during the 5-year implementation (420 bull trout captured and handled with seines, minnow traps, and dip nets). No injury or death is anticipated due to the use of these capture methods. However, these methods will result in the significant disruption of normal behavior. We anticipate up to one bull trout per project (not to exceed 180 fish over the 5 year period) would not be captured within the stream segments to be dewatered, and would be subjected to the following capture and handling methods.

Effects due to Electroshocking

The Service estimates approximately 30 percent of the bull trout affected by a project (up to a total of 180 fish over the life of the programmatic) will avoid capture by minnow traps, seining, and dip netting techniques. Some of these fish will be captured through the use of electroshocking, placed in a bucket until recovered, and then relocated as near as possible to the isolated reach.

The capture and handling of bull trout through electroshocking is a short-duration activity, occurring intermittently over one day. However, it may result in up to 25 percent of the bull trout electroshocked remaining in the stream segment being killed or injured based on research by Nielson (1998). Although the risk of electroshocking injury increases with the size of the fish, we assumed no age/size-based differences in injury rates to simplify the mortality estimate. The Service estimates that up to 95 percent of the remaining bull trout in the project area (171 adult, subadult, and juvenile) will be exposed to electroshocking[25], of which approximately 43 will be killed or injured[26] (25 percent mortality rate (Nielsen 1998) over the 5-year life of the

[25] 95 percent of 180 bull trout equals 171 bull trout
[26] 25 percent of 171 bull trout equals 43 bull trout

proposed action. We assume that approximately 5 percent (9 fish total over the life of the programmatic) will not be captured or killed by electroshocking, and will be in the stream during dewatering.

Effects due to Stream Dewatering

During stream dewatering, including when sandbags are used to focus stream flows, there is a potential that a small number (up to nine) of bull trout may avoid being captured and relocated, and thus may die because they remain undetected in stream margins under vegetation or gravels. A gradual dewatering approach, as proposed, should enhance the efficacy of fish removal and thus reduce, but not eliminate this risk. The Service estimates the proposed capture methods will remove approximately 95 percent of the remaining fish prior to dewatering, leaving approximately 1 bull trout (5 percent) stranded in a dewatered stream segment.

The Service expects all of the adult or subadult bull trout to be rescued and removed during dewatering, but juvenile bull trout may not be detected in the dewatered segment due to their small size. Thus, the Service assumes that the death of up to one juvenile bull trout (0+ and 3 age) during the 5-year implementation period.

Summary - Lethal and Sublethal Effects to Bull Trout Effects due to Fish Exclusion, Capture, Handling, and Dewatering

The Service estimates that 50 juvenile bull trout total (up to one per project) may be removed from block nets that become impinged during the construction period. An additional maximum of 3 bull trout per project (120 bull trout annually) will be captured and handled during the 5-year implementation period due to the use of seines, dip nets, and electroshocking. This results in an estimated total of 650 bull trout being affected due to fish exclusion, capture, handling, and dewatering during the 5-year implementation period. Of this, mortality of up to 47 juveniles may occur due to impingement on block nets, electroshocking, or stranding during stream dewatering (Table 17).

Table 17. Estimate of bull trout effects due to exclusion, capture, handling, and dewatering.

Procedure	Estimated Maximum Number of Bull Trout Handled per project	Estimated Maximum Number of Bull Trout Handled per Year per Region	Total Maximum Estimated Number of Bull Trout Handled over the Life of the Programmatic	Total Maximum Estimated Mortality of Bull Trout Handled over the Life of the Programmatic[1]
Block Nets	1 (juvenile)	5 (juvenile)	50 (juvenile)	3 (juvenile)
Minnow Traps, Seines and Dip Nets	1 (juvenile, subadult, or adult)	42 (juvenile, subadult, or adult)	420 (juvenile, subadult, or adult)	0
Electroshocking	1 (juvenile, subadult, or adult)	18 (juvenile, subadult, or adult)	171(juvenile, subadult, or adult)	43 (juvenile, subadult, or adult)
Stream Dewatering	1 (juvenile, subadult, or adult)	1 (all age classes)	9 (juvenile, subadult, or adult)	1 (juvenile)
Total	**4**	**66**	**650**	**47**

[1] Estimated mortality calculated as follows: block nets (50 x 0.05); electroshocking (171 x 0.25); and stream dewatering (professional judgment).

Effects due to Increased Sedimentation and Turbidity

The following programs may result in adverse effects to bull trout due to increased sediment and turbidity:

- Slide Stabilization, Bank Stabilization and Flood Damage Repair; Bridge Repair, Retrofit, Replacement, and Maintenance; Mobility Improvement Program; Safety Improvement; Environmental Retrofit and Enhancement; and Drainage System Maintenance.

The following activities may result in increased sediments and turbidity at levels that would negatively affect bull trout and/or their prey.

- Culvert replacement and/or installation
- Culvert extension, repair, and/or cleaning
- Bridge removal, replacement, and/or reconstruction
- Bridge scour repair (including placement and removal of temporary access fills)
- Repairing and stabilizing streambanks
- Placement of instream structures (large woody debris, riprap, barbs, groins)
- Removal of debris (including sediment) from flowing waterbody or lake

- Stabilization of slide areas
- Seismic retrofit
- Temporary access fill
- Installation and/or removal of coffer dams
- Installation of stormwater outfalls
- Vegetation removal
- Construction of fish passage enhancement projects, including fishways and fish ladders

The proposed programmatic may result in increased sediment and turbidity due to the replacement and/or installation of up to 10 culverts, bridges, or other fishway improvements for fish passage enhancement as part of the Environmental Retrofit and Enhancement program and 5 culverts or bridges proposed under other programs (i.e., Bank Stabilization and Flood Damage Repair; Bridge Repair, Retrofit, Replacement, and Maintenance; Safety Improvement; and Drainage System Maintenance and Repair) per WSDOT Region per year. It may also result in increased sediment and/or turbidity due to up to five bridge scour repair activities (Bridge Repair, Retrofit, Replacement, and Maintenance Program), two emergency bank stabilization projects (Bank Stabilization and Flood Damage Repair Program), and two slide abatement and repair activities (Slide Abatement and Repair Program) per WSDOT Region per year. WSDOT may construct up to one new stormwater outfall per Core Area FMO or FMO outside of a Core Area during the life of the programmatic (up to 30 new outfalls). No new outfalls are permitted within local populations. The proposed PBO would result in up to 24 projects per year per WSDOT Northwest and Olympic Regions that may result in adverse effects to bull trout due to sediment and/or turbidity, for a total of 240 projects over the life of the programmatic. Only one project per year may result in adverse effects to a bull trout local population within the WSDOT Northwest Region[27].

These activities may result in increased sediment and/or turbidity due to excavation, placement, and/or removal projects. The Southwest Region is precluded from implementing activities that may result in adverse effects to bull trout as the majority of this region is within the Lower Columbia Basin Interim Recovery Unit. This programmatic does not address adverse affects within this interim recovery unit.

Effects of Increased Turbidity and Sediment

The introduction of sediment can have multiple adverse effects on channel conditions and processes resulting in effects on bull trout and prey species survival, the food web, and water quality conditions, such as water temperature and dissolved oxygen (Rhodes et al. 1994). Sedimentation can cause lethal, sublethal, and behavioral effects in juvenile and adult salmonids (Newcombe and Jensen 1996).

[27] No local populations are effected within the WSDOT Olympic Region; therefore, no limits are necessary.

The severity of the effect on bull trout from turbidity depends on numerous factors including the proximity of the work to surface water, amount of ground-disturbing activity, slope, amount of vegetation removed, and weather. The effects also depend on the extent, duration, timing, and frequency of increased suspended solids at the place where it will occur (Bash et al. 2001). Effects of suspended sediment on fish are well documented (Bash et al. 2001). Suspended sediment can affect fish behavior and physiology and result in stress and reduced survival. Suspended sediment can cause sublethal effects such as elevated blood sugar levels and cough rates (Servizi and Martens 1991), physiological stress, and reduced growth rates. Turbidity can reduce the ability of salmonids to detect prey, cause gill damage (Sigler et al. 1984; Lloyd et al. 1987; Bash et al. 2001), and cause juvenile fish to leave rearing areas (Sigler et al. 1984). Other behavioral effects in response to elevated suspended sediment levels include avoidance; sublethal effects include reduction in feeding rates, stress, gill flaring, and coughing (Spence et al. 1996).

Due to Service recommended and State-delineated timing restrictions for instream construction activities, input of sediment generated during project construction would generally occur prior to the bull trout spawning period when work is performed within a bull trout local population. The summer in-water work windows are designed to reduce impacts on redds (incubating eggs) and limit exposure to juvenile bull trout, thus reducing the likelihood for adverse effects from increased sedimentation to the most vulnerable life history stages. However, adult and subadult bull trout may be present at all times within FMO habitat so a timing restriction will reduce, but not eliminate the potential for exposure of bull trout to increased suspended sediment. Increased sedimentation in the summer, when in-water work is typically recommended, is thought to affect salmonids more severely than in winter because fish secrete less protective mucous during that time of year (Bash et al. 2001).

Sedimentation from natural causes, such as rainstorms and slope failure, is mostly correlated with high flow events that occur during winter. During construction, sediment and turbidity may be generated due to the excavation of materials and removal of vegetation in and adjacent to the waterbody. Following construction, a second pulse of turbidity with high fall/winter stream flows and velocities is anticipated. The magnitude of this increase in delayed turbidity is related to the composition of the substrate. Generally, the finer the substrate, the higher the delayed construction related turbidity.

Although in-water work is precluded during the spawning season, this second increase in turbidity may occur when eggs and/or fry are in the gravel. If this occurs, sediment deposited on redds could result in egg and alevin mortality, particularly where existing levels of fine sediment in the streambed (embeddedness) is high. Juveniles, subadults, and adult bull trout may also be exposed during and post-construction to increased sediment/turbidity, as they may be present within the project area when sediment is generated by the proposed action.

Fine sediments can influence incubation survival and emergence success (Weaver and White 1985). Emergence success of bull trout has been shown to be approximately 80 percent when no fine materials are present, and approximately 30 percent when 35 percent fine materials are present (Weaver and White 1985 in MBTSG 1998). Lapointe et al. (2004) conducted laboratory incubation experiments to test the relative sensitivity of incubating eggs to silt and sand. Their results showed that redds can be extremely sensitive to single digit and even less than 1 percent

increases in silt deposition. Silt loadings over 0.5 percent are detrimental to survival if sand concentrations are above 5 percent (Lapointe et al. 2004). At a concentration of 15 percent sand, mean survival decreases from 60 to 20 percent as silt content increases from 0 to 4 percent (Lapointe et al. 2004). Wu (2004) used data from previous publications to develop a model to predict embryo survival as a function of parameters that influence the hydraulic gradient and substrate permeability (gravel shape, gravel size composition, sediment deposition, and sediment size distribution). Wu's (2004) results show for a given content of fine deposition an increasing survival rate with increasing sediment diameter. Thus, depending on the sediment and spawning gravel composition, eggs may experience a reduced rate of hatching due to suffocation after mobilization of sediment during the first fall/winter rain events following project construction.

Substrate embeddedness is an indicator of the overall habitat condition and is evaluated at the stream-reach scale. This measure is particularly useful in assessing the quality of bull trout rearing areas. Rearing habitat within a reach of a given stream is considered to be functioning appropriately when the reach embeddedness is less than 20 percent; functioning at risk when reach embeddedness is 20 to 30 percent; and when over 30 percent, the rearing habitat is considered to be functioning at unacceptable risk (USFWS 1999).

The addition of fine sediment (less than 6.4 mm in size) to streams during the summer decreased abundance of juvenile Chinook salmon in almost direct proportion to the amount of pool volume lost to fine sediment (Bjornn et al. 1977; Bash et al. 2001). Similarly, the density of rearing Chinook salmon was inversely related to the abundance of fine sediment, illustrating the importance of winter habitat containing low sediment loads (Bjornn et al. 1977). As fine sediments fill the interstitial spaces between the cobble substrate, juvenile Chinook salmon were forced to leave preferred habitat and to utilize cover that may be more susceptible to ice scouring, predation, and decreased food availability (Hillman et al. 1987). Deposition of sediment on gravel substrates also may lower winter carrying capacity for juvenile bull trout (Shepard et al. 1984) and the abundance of aquatic invertebrates, an important food source for young bull trout.

Juvenile bull trout densities are highly influenced by substrate composition (Shepard et al. 1984; Rieman and McIntyre 1993; MBTSG 1998). During the summer, juvenile bull trout hold positions close to the stream bottom and often seek cover within the substrate itself. All bull trout, regardless of their life history/reproductive strategy, are associated with complex forms of cover including large woody debris, undercut banks, boulders, and pools. Therefore, channel and hydrologic stability are important to bull trout (Rieman and McIntyre 1993). When streambed substrate contains more than 30 percent fine materials, juvenile bull trout densities drop off sharply due to a reduction in interstitial spaces (Shepard et al. 1984). Any loss of interstitial space or streambed complexity through the deposition of sediment would result in a loss of summer and winter rearing habitats (MBTSG 1998). The reduction of rearing habitat will ultimately reduce the potential number of recruited juveniles and, therefore, reduce population numbers (Shepard et al. 1984).

Eggs and alevins are generally more susceptible to stress caused by suspended solids than are adults. Egg survival is dependent on a continuous supply of well-oxygenated water through the streambed gravels (Cederholm and Reid 1987). Accelerated sedimentation can reduce the flow

of water and, therefore, oxygen to eggs and alevins, which can decrease egg survival, decrease fry emergence rates (Cederholm and Reid 1987; Chapman 1988; Bash et al. 2001), delay development of alevins (Everest et al. 1987), and reduce growth and cause premature hatching and emergence (Birtwell 1999). Suspended sediment deposited in a redd reduces water flow, smothers eggs and alevins, or impedes fry emergence (Bjornn and Reiser 1991). Sediment particle size determines the pore openings in the redd gravel. Fine sediment deposited in small pore openings significantly reduces the flow of water through the redd. Low dissolved oxygen and reduced water exchange increase embryo mortality (Chapman 1988). Fry delayed in their timing of emergence are less able to compete for environmental resources than other fish that have undergone normal development and emergence (intra- or interspecific competition) (Everest et al. 1987).

Whether eggs/alevins are smothered or fry emergence is impeded is largely determined by sediment particle sizes of the spawning habitat (Bjornn and Reiser 1991). Sediment particle size determines the pore openings in the redd gravel and with small pore openings, more suspended sediments are deposited and water flow is reduced compared to large pore openings.

Several studies have documented that fine sediment can reduce the reproductive success of salmonids. Natural egg-to-fry survival of coho salmon, sockeye and kokanee has been measured at 23 percent, 23 percent, and 12 percent, respectively (Slaney et al. 1977). Substrates containing 20 percent fines can reduce emergence success by 30 to 40 percent (MacDonald et al. 1991). A decrease of 30 percent in mean egg-to-fry survival can be expected to reduce salmonid fry production to low levels (Slaney et al. 1977).

In-water work in streams with sandy and finer substrate is reasonably certain to expose juvenile salmonids and redds to increased levels of turbidity. Sediments may be generated during installation and removal of cofferdams, temporary fills, culverts, fishways, bridge repairs, and emergency bank stabilization activities during and after reintroduction of flow into the work area. The combination of fine substrates and larger flows will result in higher levels of turbidity that will extend further downstream than in situations where the substrates are larger and flows are lower. Generally, the increase in turbidity could last for as little as several hours but may last for several days on larger projects.

Rashin et al. (1999) studied the effectiveness of BMPs to control erosion and sediment delivery to streams associated with the installation of culverts and new roadways in western Washington during the first and second year following construction. New road construction BMPs for water crossing structures were generally found to be ineffective at preventing the erosion of culvert fills and chronic sediment delivery for practices occurring in the vicinity of streams. The culvert fill height appeared to have a strong influence on magnitude of erosion and sediment delivery. Additionally, rain events during and after the construction period may mobilize sediment into the stream, even with sediment control measures in place, because sediment control measures are not always effective at precluding sediment deposition into streams (Rashin et al. 1999).

Rashin et al. (1999) evaluated 42 new culvert installations in new forest roads for the effectiveness of sediment control and found 31 installations (74 percent) were sources of chronic sediment delivery to streams, primarily due to culvert fills. The evaluation of erosion severity

during the second year resulted in a strong correlation with the culvert-fill height and severity of erosion. Observations on the inflow end of culverts resulted in 88 percent of the culvert fills over 6 meters in height having moderate (25 to 50 percent of the fill area was actively eroding) or severe (greater than 50 percent of the fill area was actively eroding) erosion. Moderate and severe erosion were observed less frequently (39 percent) as fill height decreased. The culverts included in the Rashin et al. (1999) study did not have stream-simulation designs, so the results may not be fully applicable to the proposed action.

The Service expects BMP effectiveness in minimizing sediment delivery and slope stability to be higher with stream simulation and no-slope designs for stream crossings because the structures are not built within the bank-full width. In addition, the Service expects the WSDOT to maintain all the erosion control features of the project in a functional condition to fulfill program objectives of minimizing sediment delivery to streams. This should reduce sediment delivery and perhaps improve fill-slope stability by allowing for more moderate fill slopes. However, even with these measures, we anticipate a temporary increase in sediment delivery over baseline conditions.

As sediment enters a stream it is transported downstream by normal fluvial processes and deposited in areas of low shear stress (MacDonald and Ritland 1989). These areas are usually behind obstructions, near banks (shallow water), or within interstitial spaces. This episodic filling of successive storage compartments continues in a cascading fashion downstream until the flow drops below the threshold required for movement of the sediment or all pools have reached their storage capacity (MacDonald and Ritland 1989). As sediment loads increase, the stream compensates by geomorphologic changes such as increased slope, increased channel width, decreased depths, and decreased flows (Castro and Reckendorf 1995). These processes contribute to increased erosion and sediment deposition.

The soil type, topography, site geology, timing and amount of precipitation, and corresponding amount of material that will be disturbed or otherwise handled at each project site will determine the amount of sediment generated at each project site. While there may be a significant difference in the amount of material handled at each construction site, the Service estimates that typical results will yield up to an estimated 3 to 5 cubic yards (cy) of sediment discharged into the stream per project. These sediment yield estimates are our estimate based on those reported by Bakke et al. (2002) where 4.7 cy of sediment were mobilized from streambed and streambank erosion as a result of removing a 36-inch culvert associated with a road decommissioning project.

To estimate the effect of increased sediment, we estimated the amount of sediment that is generated as part of existing conditions in addition to that potential generated by a proposed action. Langbein and Schumm (1958) found that annual sediment production varied from a maximum of about 800 tons per square mile in areas that received about 15 inches of precipitation per year and declined to about 300 tons per square mile per year in areas with 40 to 60 inches of rain per year. In the Bull Run watershed, which provides drinking water to the city of Portland, Oregon, the sediment budget for this relatively intact watershed was estimated to be 79 cy per square mile per year (119 tons per year) (Ken Carlson, CH2M Hill, *in litt*. 2003).

Watersheds that have extensive road networks and past management activities, such as timber harvest, are expected to have greater sediment yields.

When considering the effects at the 5th-field watershed scale (20 to 200 square miles), the WSDOT has proposed a maximum of 5 projects (including culvert replacement, bridge removal and replacement, bridge scour repair, etc.) per year per 5th-field watershed to limit the additive effects of sediment in each watershed. This limits the amount of sediment released from the proposed projects into affected 5th-field watersheds during any given water year to a maximum of 17 cy or about 25 tons per watershed (assuming 4 projects yielding a total of 12 cy and 1 project yielding 5 cy of sediment). If 5 projects occurred in the smallest watershed of 20 square miles, with a sediment input in the entire watershed of baseline of 79 cy (119 tons) per square mile per year (Carlson, *in litt*. 2003) or 1,580 cy in the watershed (79 cy/square mile x 20 square miles), then the 5 projects could increase the sediment input in a small watershed by an estimated 1 percent (17 cy/1,580 cy). This represents a small effect at the watershed scale but potentially a measurable effect within the stream reach.

Consequently, sediment introduced into bull trout habitat on a watershed scale from the proposed projects implemented appears minor relative to the anticipated annual sediment budget of affected watersheds. However, the timing of the sediment input from construction-related activities would generally occur when backgrounds levels of sediment in the stream system are generally absent or in low quantities (i.e., lack of precipitation during this time period) whereas sediment generated during fall and winter rains or runoff would occur when background levels of sediment are higher. However, increased sediment delivery may also occur post-construction due to construction delayed turbidity associated with winter flows. Although the introduced sediment from the proposed projects would be relatively small in comparison to background levels, it would be additive to the background levels.

In addition to potential physical effects due to increased sediments, behavioral avoidance of turbid waters may be one of the most important effects of suspended sediments (Scannell 1988, p. 66). Salmonids have been observed to move laterally and downstream to avoid turbid plumes (Sigler et al. 1984; McLeay et al. 1984; McLeay et al. 1987; Servizi and Martens 1991). Juvenile salmonids tend to avoid streams that are chronically turbid, such as glacial streams or those disturbed by human activities, except when the fish need to traverse these streams along migration routes (Lloyd et al. 1987).

Increased turbidity and suspended sediment may result in an increased vulnerability of bull trout to stress and predation. Alteration in behavior includes avoidance, distribution, homing, and migration. Although an avoidance response may be an initial adaptive survival strategy, displacement could be detrimental. The consequences of fish moving from preferred habitat to avoid increasing levels of suspended sediment may be detrimental if displacement is to sub-optimal habitat or result in increased exposure to predation.

Sublethal levels of suspended sediment may cause undue physiological stress on fish, which may reduce the ability of the fish to perform vital functions. This stress may reduce the ability of the fish to feed or resist exposure to disease and toxicants (Waters 1995). Physiological stress in

fishes may decrease immunological competence, growth, and reproductive success (Bash et al. 2001).

Effects to Bull Trout due to Increased Sediments and Turbidity from the Proposed Project

As the suspended sediment from instream construction activities is transported downstream, the concentration levels will be diluted and heavier sediments will be deposited. To assess the sediment levels at which adverse effects will occur and determine the downstream extent of sediment impacts for this action, the Service was guided by the findings in Newcombe and Jensen (1996) on impacts to fish resulting from suspended sediment, and the Washington State Water Quality Standards to determine project related sediment impacts and their effects on bull trout.

Newcombe and Jensen (1996) developed a model using empirical data from the most sensitive individuals within species groups that included salmonids to estimate a severity-of-ill-effect rating from suspended sediment. The effects characterized by Newcombe and Jensen (1996) include a broad range of physiological and behavioral responses to suspended sediment and varies as a function of suspended sediment concentration and duration of exposure. We have used this model to assist us in determining the effects of increased sediment and turbidity on bull trout (Appendix H).

Sediment can modify stream morphology and function through the degradation of spawning and rearing habitat, simplification and damage to habitat structure and complexity, loss of habitat, and decreased connectivity between habitats (Bash et al. 2001). The biological implications of this habitat damage can include underutilization of stream habitat, abandonment of traditional spawning habitat, displacement of fish from their habitat, and avoidance of habitat (Newcombe and Jensen 1996).

The effect of sediment associated with the proposed projects is expected to adversely affect bull trout adults, subadults, juveniles, and eggs occurring in those streams. Increases in suspended sediment have been shown to affect salmonid behavior in several ways. Social behavior patterns may be altered by suspended sediment (Berg and Northcote 1985). Fish may avoid high concentrations of suspended sediments altogether (Hicks et al. 1991). Even small elevations in suspended sediment may reduce feeding efficiency and growth rates of some salmonids. At low concentrations of suspended sediment, fish may decrease feeding and at higher concentrations may cease feeding completely (Sigler et al. 1984).

High concentrations of suspended sediment can also affect survival, growth, and behavior of stream biota that serve as forage for salmonids (Harvey and Lisle 1998). Suspended sediment may alter food supply by decreasing abundance and availability of aquatic insects. However, the precise thresholds of fine sediment in suspension or in deposits that result in harmful effects to benthic invertebrates are difficult to characterize (Chapman and McLeod 1987).

The risk of sediment adversely affecting bull trout will occur during several construction phases. Depending upon the concentration and duration of exposure, sediment could directly affect the physiological condition and normal behaviour of bull trout (Newcombe and MacDonald 1991;

Waters 1995; Newcombe and Jensen 1996; Bash et al. 2001) or may degrade existing spawning habitat conditions to a point where bull trout reproductive success is temporarily reduced (Shepard et al. 1984).

The WSDOT proposes to limit their in-water construction activities to the Washington State-regulated and Service recommended work windows. However, with bull trout spawning occurring from August through November, and migrations beginning as early as April for migratory bull trout, the Service anticipates some impacts to migrating/spawning fish, even if instream construction activities are constrained by instream work windows. However, the PBO does not permit in-water work to occur if bull trout are found to be spawning. Therefore, direct effects on bull trout during spawning will not result from the proposed action.

Although bull trout have relatively specific spawning habitat requirements and thus spawn in a small percentage of the stream habitat available (MBTSG 1998) bull trout eggs/alevins appear to have a higher tolerance for sedimentation during development and emergence when compared to other salmonids. Survival of bull trout embryos through emergence appears to be unaffected when the percentage of fines comprise up to 30 percent of the streambed. However, at levels above 30 percent, embryo survival through emergence dropped off sharply with survival below 20 percent for substrates with 40 percent fine material (Shepard et al. 1984).

Following completion of construction, active redds (incubating eggs) and rearing areas within 600 ft downstream of the instream activities may be exposed to a pulse of suspended sediment due to precipitation and flow events that mobilize sediments from unrecovered streambanks and/or upland sites. Fine sediment mobilized during the wet season can have an impact on downstream streambed habitat and any fish/eggs associated with such habitat. As turbid water enters hyporheic pathways, it enters a zone of reduced velocity, reduced turbulence, and close proximity, which induces settling. This process ultimately results in pore space reduction and transmissivity to flow from embedded sediment, reducing egg survival and rearing habitat quality and effectiveness. Sediment-impacted spawning and rearing habitat may function at a lower level until the next freshet removes the fine sediment downstream.

Information is not available to determine if the proposed action may occur in designated bull trout local populations in stream reaches with 30 percent or greater embeddedness. Stream embeddedness is considered as part of the Habitat Elements indicator of baseline conditions[28]. However, other factors, such as lack of large woody debris and number of pools also are used to develop the final risk ranking for this habitat indicator. The actual factor (insufficient large woody debris, embeddedness) is not specified for the risk ranking. Although other factors may contribute to the Habitat Elements indicator, for the programmatic, we have assumed that a medium or high baseline habitat risk for Habitat Elements (Appendix G) may indicate a local population where stream embeddedness is currently functioning at risk or not properly functioning. The following local populations, therefore, may be at higher risk of having existing high levels of stream embeddedness and negatively affected due to increases in embeddedness: Middle North Fork Nooksack River, Upper North Fork Nooksack River, Lower North Fork

[28] Habitat Elements is based on the document "A Framework to Assist in Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Bull Trout Subpopulation Watershed Scale" (2005).

Nooksack River, Greenwater River, Upper White River, South Fork Skykomish River, and North Fork Stillaguamish River.

WSDOT has proposed to limit the number of projects that may adversely affect bull trout to 1 per year in a bull trout local population (Northwest Region). Based on Service analysis involving cofferdam removal, bank stabilization, and river scour protection (activities similar to those proposed for this project), the Washington State water quality standards were exceeded at 600 ft downstream from the work site (Appendix H, p. 19). In extreme cases, the turbidity exceeded the standard by as much as 25 Nephelometric Turbidity Units. Based on this information, the Service anticipates high turbidity levels resulting from the proposed project may significantly alter the breeding, feeding, and sheltering behavior of bull trout and their forage species up to 600 ft downstream of each of the instream activities. This distance may overestimate the effects associated with some of the proposed projects and underestimate it for others. Projects that may result in adverse impacts to bull trout due to increased sediment and/or turbidity will be monitored to determine the extent of the plume and where it reaches background turbidity levels.

We have assumed that at least one project will occur in each of following local populations over the life of the programmatic based on the number of fish passage barriers that occur within these local populations: Upper North Fork Nooksack River, Lower North Fork Nooksack River, Greenwater River, Upper White River, and South Fork Skykomish River. Therefore, the proposed project may result in up to 3,000 linear-ft (600 ft x 5 projects) of adverse effects to bull trout spawning and rearing habitat due to increased sediment and resulting embeddedness post-construction over the life of the programmatic. We anticipate that the effects will result in reduced egg survival, delay fry emergence, and reduce rearing habitat for juvenile bull trout. These effects will extend at least 600 ft downstream of each of the proposed projects. The effects are anticipated to be short-term, extending up to 1 year after the completion of project construction.

In addition to physical and habitat effects to bull trout due to increase sediment, the Service expects adult and subadult bull trout to leave and/or avoid areas with elevated levels of turbidity that would result in significant impairment of respiration and feeding. Thus, they would be mostly affected by the effects of temporary displacement, rather than the direct effects of exposure to increased turbidity. Based on work by Bakke et al. (2002), elevated levels of sediment were measured for up to 3 hours after flows were returned to a stream channel. Therefore, displacement of adult and subadult bull trout from suitable habitat may occur for up to 3 hrs for projects that included rerouting instream waters. We anticipate that other projects that involve increased sediment and/or turbidity due to instream work will not exceed the 3 hour duration.

Juveniles, on the other hand, are more likely to seek cover, rather than leave, and, because they are less mobile, are more likely to be exposed to construction and post-construction related turbidity. The Service estimates juvenile bull trout could be exposed to up to 2,000 mg/l of suspended sediment for up to 3 hours for projects that include rewatering of stream channels, based on work by Bakke et al. (2002). This sediment dose is expected to be at a level where serious physiological effects of disease, reduced growth, and hindered immunological response

are probably avoided (Newcombe and Jensen 1996). However, short-term reductions in oxygen uptake are likely until juvenile bull trout relocate to more suitable water.

Increased turbidity above background levels may also affect bull trout prey and bull trout foraging. Turbidity influences light penetration into the water column. This reduction results in reduced primary production, which affects the abundance of macroinvertebrates and salmonids as bull trout prey. Increased turbidity and suspended sediment can affect a number of factors related to feeding for salmonids, including feeding rates, reaction distance, and prey selection (Bash et al. 2001). Food abundance indirectly affects reproductive capability, growth rates, and feeding efficiency. Effects on feeding ability are important as bull trout must meet energy demands to compete with other fishes for resources and to avoid predators. Distance of prey capture and capture success both were found to decrease significantly when turbidity was increased (Berg and Northcote 1985). Waters (1995) reports that loss of visual capability leads to reduced feeding and is one of the major sublethal effects of high suspended sediment. Loss of visual capability leads to depressed growth and reproductive capability.

Increased sediment above background levels also affects bull trout prey. Bull trout are apex predators that prey on a variety of species including terrestrial and aquatic insects and fish (Rieman and McIntyre 1993). Fish are common in the diet of individual bull trout that are over 110 mm or longer. Large bull trout feed almost exclusively on fish. Therefore, increased sediment input into streams may temporarily affect the spawning habitat of other salmonids, which are potential prey species of bull trout.

Macroinvertebrates, essential food for bull trout prey and juvenile bull trout, are also affected by sediment. The degree to which substrate particles are surrounded by fine material was found to have a strong correlation with macroinvertebrate abundance and composition (Birtwell 1999). Turbidity and suspended solids can affect macroinvertebrates in multiple ways by increasing invertebrate drift, impacting feeding, and habitat loss. The effect of light reduction from turbidity results in increased invertebrate drift; however, it is thought that the overall invertebrate populations will not fall below the point of severe depletion (Waters 1995). Increased suspended sediment can also affect macroinvertebrates by abrasion of respiratory surfaces and interference with food uptake for filter-feeders (Birtwell 1999).

Based on the above studies and proposed action, Service concludes that adult and subadult bull trout may be significantly disrupted from their normal behavior patterns during periodic sediment pulses that could last up to 3 hours during any one pulse, with the highest concentration reached during the reinstatement of streamflow in the reconstructed channel. Lethal effects to these life stages are not expected. Specific effects to adult and subadult bull trout include: avoidance of otherwise suitable habitat, loss of feeding efficiency, loss of visibility, impacts to prey species (increased invertebrate drift, avoidance by salmon prey), disruption or delay in migratory behavior, and altered reactions to predators. In addition to these effects, we anticipate that juvenile bull trout will also experience short term physiological stress due to reduced efficiency in oxygen uptake. These effects will occur during the construction phase which includes placement and removal of instream structures, restoring streamflow to the streambed, and disturbance of the bank and riparian area by construction and restoration activities. The

response of adult, subadult, and juvenile bull trout to the effects of sediment is considered sublethal.

Summary

The mortality of eggs and normal behavior of any adult, subadult, or juvenile bull trout occurring within the exposure area downstream of each project may occur during the period of turbidity and sedimentation caused by construction activities in or adjacent to waterbodies.

Up to 100 fish habitat enhancement projects (including culvert replacement), 50 culvert or bridge repair/replacement projects, 20 slide abatement and repair, 50 bridge scour and seismic retrofit, and 20 emergency bank stabilization projects may occur within bull trout FMO habitat during the 5-year implementation period of this programmatic consultation. WSDOT has proposed to limit the number of projects per Olympic and Northwest WSDOT Regions that may adversely affect bull trout to at most 24 per year in bull trout Core/non-Core FMO habitat. Up to one project per year may occur within a bull trout local population (Northwest Region) outside of the Lower Columbia Interim Recovery Unit. Additionally, no more than five projects per 5th-field watershed may occur per year. Therefore, effects due to turbidity and sediment may impact up to a total of 14,400 ft (approximately 2.7 miles) of bull trout habitat within and outside core areas (24 projects x 600 ft) per year each for the WSDOT Northwest and Olympic Regions, or 144,000 ft (approximately 27.3 miles) over the life of the programmatic (Table 18). Of this, no more than 3,000 ft (5 projects x 600 ft) may occur across all local populations over the life of the programmatic.

Table 18. Effects to bull trout from sediment/turbidity associated with the proposed project.

WSDOT Region	**Bull Trout FMO habitat affected per project (ft)**	**Number of Projects per year per Core FMO/non-Core FMO Habitat**	**Projects per 5th-field watershed per year**	**Bull Trout FMO habitat affected per year (ft)**	**Bull Trout Local Population per project[1] (ft)**	**Bull Trout Local Population for life of programmatic (ft)**
Northwest	600	24	5	14,400	600	3,000
Olympic	600	24	5	14,400	0	0

[1] Projects within bull trout local populations count toward the maximum number of actions per 5th -field watershed permitted per year.

Effects of Increased Headcutting and Slope Failure

This proposed project may result in increased headcutting, erosion, and gullying that can lead to mass slope failures due to the replacement of culverts. The Service has assumed that new or replacement culverts will not be installed at sites where the stream gradient exceeds 6 percent stream slope. Sites exceeding a 6 percent stream gradient typically require bridges or open-bottomed arches, thereby reducing concerns over fill-heights associated with culverts.

Although the WSDOT's proposed sizing and installation of culverts based on stream simulation or no-slope designs will likely diminish the likelihood of slope failure (sheetwash and rill erosion leading to gully formation and mass erosion), a remote chance of slope failure remains. Information is currently not available to estimate the frequency, location, magnitude, or timing of slope failures associated with culvert replacement or removal projects. Therefore, the Service did not analyze fill slope failure as an effect of this action that may occur later in time (indirect effect).

Effects of Elevated Underwater Sound Pressure Levels from Impact Pile Driving

The proposed action may result in adverse effects from increased in-water sound pressure associated with the following programs: Bridge Repair, Retrofit, Replacement, and Maintenance Program; Bank Stabilization and Flood Damage Repair Program; Slide Abatement and Repair Program; and Environmental Retrofit and Enhancement Program. The Southwest Region may not implement activities that may result in adverse effects to bull within the Lower Columbia Basin Interim Recovery Unit.

The following activities may result in increased underwater sound pressure levels from impact pile driving of steel piles that would negatively affect bull trout and/or their prey.

- Installation of temporary in-water structures (including but not limited to bridges, work platforms).
- Installation of permanent in-water structures such as bridges.
- Installation of steel piles for bank stabilization.
- Installation of steel piles as part of coffer dam construction.

The proposed project includes installation of up to 24-inch diameter hollow steel pilings, sheet piles, and H piles as part of temporary or permanent structures. No in-water pile driving will occur within spawning areas during spawning, spawning migration, and early development. WSDOT proposes to restrict the number of projects that may result in adverse effects to bull trout to no more than five per 5th- field watersheds per year; they have estimated that no more than two pile driving projects per 5th- field watershed may occur per year. Up to 24 projects each for the Northwest and Olympic Region per year may result in adverse effects to bull trout. Of this, we have estimated that up five per year per WSDOT Region may result in adverse effects to bull trout due to pile driving. We have assumed that pile installation will be completed within one in-water work period per proposed project. Projects may result in elevated in-water sound pressures that extend for several hours over several days or weeks. The number of piles to be driven is unknown; however, we have assumed that up to 20 piles will be used per project. Assuming up to 30 minutes per pile of sound pressure levels that exceed injury and/or disturbance thresholds for bull trout, we anticipate up to 10 hours of sound pressures that exceed threshold levels for injury and/or behavior will occur per project. The actual number of piles installed per project may be more or less than the assumed value. However, no more than 100 piles may be installed within a 5th-field watershed that would result in adverse impacts to bull trout due to exceeding the sound threshold values.

WSDOT has provided Minimization Measures to reduce the potential effects of impact pile driving on bull trout. Confined bubble curtains will be used in rivers. The proposed project anticipates that an attenuation system will achieve a reduction of 10 dB in underwater sound pressure. However, attainment of this level of attenuation is likely to be variable. Due to the shallowness of streams, bubble curtains may do little to attenuate the sound pressure generated. Streams may also be dewatered; therefore, piles may be installed in the dry. However, sound pressure is still generated through the stream bottom. Although we do not have specific information regarding the sound levels generated subsurface due to pile driving, we do not anticipate that they will be at levels that will directly injure bull trout. However, subsurface sound pressure may be at levels that could temporarily disturb bull trout.

High underwater Sound Pressure Levels (SPLs) are known to have negative physiological and neurological effects on a wide variety of vertebrate species (Yelverton et al. 1973; Yelverton and Richmond 1981; Steevens et al. 1999; Fothergill et al. 2001; Cudahy and Ellison 2002; U.S. Department of Defense 2002). High underwater SPLs are known to injure and/or kill fishes, as well as causing temporary stunning and alterations in behavior (Turnpenny and Nedwell 1994; Turnpenny et al. 1994; Popper 2003; Hastings and Popper 2005). Risk of injury appears related to the effect of rapid pressure changes, especially on gas-filled spaces in the bodies of exposed organisms (Turnpenny et al. 1994).

High underwater SPLs can also cause a variety of behavioral responses that have not been thoroughly studied. Broadly, the effects of elevated underwater SPLs on organisms range from no effect to death. Over this continuum of effect, there is no easily identifiable point at which behavioral responses transition to physical effects.

The following is a discussion regarding the potential physical and behavioral effects to bull trout due to pile driving. Please note that the Service is transitioning over to a new metric (sound exposure level) for evaluating the effects of increases sound pressure to bull trout. This PBO does not include this new metric at this time. However, it may be implemented as part of a future revision of this document.

Effects from Impact Installation of Steel Piles Expected to Result in Mortality or Injury

Injury and mortality in fishes has been attributed to impact pile driving (Stotz and Colby 2001; John H. Stadler, NMFS, pers. comm. 2002; Fordjour 2003; Abbott et al. 2005; Hastings and Popper 2005). The injuries associated with exposure to high SPLs are referred to as barotraumas, and include hemorrhage and rupture of internal organs, hemorrhaged eyes, and temporary stunning (Yelverton et al. 1973; Yelverton et al. 1975; Yelverton and Richmond 1981; Turnpenny and Nedwell 1994; Hastings and Popper 2005). Death from barotrauma can be instantaneous, occurring within minutes after exposure, or can occur several days later (Abbott et al. 2002).

The most noticeable and well-documented effects of pile driving have been fish kills. However, it is important to note that not all fish killed by pile driving float to the surface and, therefore, they are likely to go undetected (Teleki and Chamberlain 1978; WSDOT 2003). With few

exceptions, fish kills are reported only when dead and injured fishes are observed at the surface. Thus, the frequency and magnitude of such kills are likely underestimated.

Physical injury to aquatic organisms may not result in immediate mortality. If an animal is injured, death may occur several hours or days later, or injuries may be sublethal. Necropsy results from Sacramento blackfish (*Othodon microlepidotus*) exposed to high SPLs showed fish with extensive internal bleeding and a ruptured heart chamber were still capable of swimming for several hours before death (Abbott et al. 2002). Sublethal injuries can interfere with the ability to carry out essential life functions such as feeding and predator avoidance (Popper 2003).

The potential for injury and/or mortality of any aquatic organism from pile driving depends on the type and intensity of the sounds produced. These are greatly influenced by a variety of factors, including the type of hammer, the type of substrate, and the depth of the water. Firmer substrates require more energy for pile driving, and produce more intense sound pressures. Biologically, key variables that factor into the degree to which an animal is affected include size, anatomical variation, and location in the water column (Gisiner et al. 1998). Any gas-filled structure inside an animal is particularly susceptible to the effects of underwater sound (Gisiner et al. 1998). Examples of gas-filled structures in vertebrate species are swimbladders, bowel, sinuses, lungs, etc. As a sound travels from a fluid medium into these gas-filled structures, there is a dramatic drop in pressure, which can cause rupture of the hollow organs (Gisiner et al. 1998).

Sound energy from an underwater source readily enters the bodies of animals because the acoustic impedance of animal tissue nearly matches that of water (Hastings 2002). This has been demonstrated in fishes with swimbladders (such as salmonids). As a sound pressure wave passes through a fish, the swimbladder is rapidly compressed due to the high pressure and then rapidly expanded by the underpressure. Exposure to this type of pneumatic pounding can cause rupture of capillaries in the internal organs, as observed in fishes with blood in the abdominal cavity, and maceration of kidney tissues (Abbott et al. 2002; Stadler, pers. comm. 2002).

Yelverton and Richmond (1981) and Yelverton et al. (1973) exposed many fish species, various birds, and terrestrial mammals to underwater explosions. Common to all the species that were exposed to underwater blasts were injuries to air and gas-filled organs, as well as eardrums. These studies identified injury thresholds in relation to the size of the charge, the distance at which the charge was detonated, and the mass of the animal exposed. Yelverton et al. (1973) and Yelverton and Richmond (1981) found that the greater the fish's mass, the greater impulse level needed to cause an injury. Conversely, a fish with smaller mass would sustain injury from a smaller impulse.

At Bremerton, Washington, approximately 100 surfperch (*Cymatogaster aggregata, Brachyistius frenatus*, and *Embiotoca lateralis*) were killed during impact driving of 30-inch diameter steel pilings (Stadler, pers. comm. 2002). The size of these fish ranged from 70-mm to 175-mm fork length. Dissections revealed that the swimbladders of the smallest of the fishes (80-mm fork length) were completely destroyed, while those of the largest individual (170-mm fork length) were nearly intact. Damage to the swimbladder of *C. aggregata* was more severe than to similar-sized *B. frenatus*. These results are suggestive of size and species-specific differences

and are consistent with those of Yelverton et al. (1975) who found size and/or species differences in injury from underwater explosions.

Another mechanism of injury and death resulting from high SPLs is "rectified diffusion," or the formation and growth of bubbles in tissue. Rectified diffusion can cause inflammation and cellular damage because of increased stress and strain (Vlahakis and Hubmayr 2000; Stroetz et al. 2001) and blockage or rupture of capillaries, arteries, and veins (Crum and Mao 1996). Crum and Mao (1996) analyzed bubble growth underwater by rectified diffusion caused by sound signals at low frequencies (less than 5,000 Hz), long pulse widths, and atmospheric pressure. Their analysis indicated that SPLs exceeding 190 dB_{peak} could cause bubble growth.

Due to differences between species and from variation in exposure type and duration, uncertainty remains as to the degree of potential adverse effects from SPLs between 180 and 190 dB_{peak}. Turnpenny et al. (1994) exposed brown trout (*Salmo trutta*) to SPLs greater than 170 dB with pure tone bursts for a duration of 90 seconds. This resulted in a mortality rate of 57 percent after 24 hours in brown trout and 50 percent mortality occurring at 176 dB (95 Hz) in bass (*Dicentrarchus labrax*) and whiting (*Merlangius merlangus*). The authors suggest that the threshold for continuous sounds was lower than for pulsed sounds such as seismic airgun blasts. Sounds from pile driving are more similar to that of airguns than to pure tone bursts. As such, we conclude that the 170 dB threshold for injury to brown trout identified by Turnpenny et al. (1994) is likely lower than the injury threshold level anticipated for pile driving from this project.

Based on the above, we anticipate the potential for barotrauma to occur in aquatic organisms, including bull trout, at SPLs of greater than or equal to 190 dB_{peak}. We anticipate other types of potential physical injury to occur above 180 dB_{peak}, based on the studies of both aquatic and terrestrial species discussed above. The 180 dB_{peak} threshold is probably at least somewhat conservative because most studies described evaluated transmitted signals of longer duration than what is anticipated to result from pile driving. The specific adverse effects anticipated for bull trout are described in more detail below.

Effects of Impact Installation of Steel Piles Expected to Result in Significant Alteration of Normal Behavior

No experimental data specific to bull trout response to underwater sound from pile driving are available. In fact, there is much uncertainty regarding the behavioral response of organisms to underwater sound in general. Further confounding the issue is that most of the information on the behavioral effects of underwater sound is from studies using pure tone sounds. Sounds generated by pile driving, however, are impulsive sounds and are made up of multiple frequencies/tones, making comparisons with existing sound data difficult.

Exposure to elevated SPLs can result in temporary hearing damage referred to as Temporary Threshold Shift (TTS). Most bioacoustic specialists consider TTS to be physiological fatigue, and not injury (Popper et al. 2006). However, an organism that is experiencing TTS may suffer consequences of not being able to detect biologically relevant sounds such as approaching predators or prey, and/or mates attempting to communicate. Mesa (1994) examined predator avoidance ability and physiological response of Chinook salmon subjected to various stressors.

The test fish were agitated to cause disorientation and injury. When equal numbers of stressed and unstressed fish were exposed to predators, there was significantly more predation of stressed fish.

Shin (1995) reports that pile driving may result in “agitation” of fish manifested in a change of swimming behavior. Turnpenny et al. (1994) attempted to determine a level of underwater sound that would elicit behavioral responses in brown trout, bass, sole, and whiting. With brown trout an avoidance reaction occurred above 150 dB_{rms} and other reactions (e.g., a momentary startle) were noted at 170 dB_{rms} to 175 dB_{rms}. The report references Hastings’ "safe limit" recommendation of 150 dB_{rms} and concludes that the Hastings’ “safe limit” provides a reasonable margin below the lowest levels where fish injury was observed. In an associated literature review, Turnpenny and Nedwell (1994) also state that the Hastings’ 150 dB_{rms} limit did not appear overly stringent and that its application seemed justifiable. Additionally, observations by Feist et al. (1992) suggest that sound levels in this range may also disrupt normal migratory behavior of juvenile salmon.

More recently, Fewtrell (2003) held fish in cages in marine waters and exposed them to seismic airgun impulses. The study detected significant increases in behavioral responses when sound pressure levels exceeded 158 dB_{rms} to 163 $dB_{rms.}$ Responses included alarm responses, faster swimming speeds, and tighter groups and movement toward the lower portion of the cage. It is difficult to discern the significance of these behavioral responses. The study also evaluated physiological stress response by measuring plasma cortisol and glucose levels and found no statistically significant changes. Conversely, Santulli et al. (1999) found evidence of increased stress hormones after exposing caged European bass to seismic survey noise.

Clearly, there is a substantial gap in scientific knowledge on this topic. The most recent study by Fewtrell (2003) presents, at least, some experimental data on behavioral responses of fishes to impulsive sounds above 158 dB_{rms}. Given the large amount of uncertainty that lies not only in extrapolating from experimental data to the field, but also between sound sources (airguns vs. pile driving), and also from one species to another, we conclude that it is appropriate to utilize a conservative known threshold. As such, for the purposes of this analysis, the Service anticipates that SPLs in excess of 150 dB_{rms} will cause significant behavioral changes in bull trout.

Methods to Reduce Underwater Sound Pressure Levels

Air bubbles can be used to attenuate underwater sound (Gisiner et al. 1998). Air bubbles are most effective at moderate to high frequencies but are also useful for low frequency sounds and have been known to reduce sound pressure levels at some frequencies by as much as 30 dB (Gisiner et al. 1998). During demolition of a dam on the Mississippi River, Keevin and others (Keevin et al. 1997) found a significant reduction in mortality of caged bluegill (*Lepomis macrochirus)* with use of a bubble curtain. Bubble curtains can also reduce particle velocity levels (MacGillivray and Racca 2005).

In recent years, bubble curtains have been required and used on an increasing number of pile installation projects, primarily on the west coast. Designs have varied and are largely experimental. Effectiveness has also varied widely and is likely to be influenced by factors such as design, site conditions, and the ability for construction contractors to correctly implement the

system. Improper installation and operation can decrease effectiveness. Problems with implementation have been observed on a number of projects (Laughlin 2005; Pommerenck 2006).

Impact installation of large (2.4 m diameter) piles with an isolation casing combined with an air bubble curtain resulted in significant sound pressure attenuation on a project in California. During impact pile driving in the San Joaquin River an attenuation system consisting of an isolation casing with a bubble curtain on the inside achieved much less attenuation (between 6 dB and 9 dB) (Pommerenck 2006). However, this project had problems correctly implementing the system. During impact installation of steel piles in an embayment on the Columbia River a bubble curtain built according using the Longmuir and Lively (2001) design achieved a maximum reduction of 17 dB, although the results were variable (Laughlin 2006). A test of bubble curtain effectiveness in Friday Harbor, Washington, found improvements were seen after the original design was modified on site to improve contact with the substrate. After modification, the bubble curtain was achieving a 12 dB reduction which equates to an 85 percent reduction in peak overpressure (Laughlin 2005). Use of a bubble curtain while installing 24-inch steel piles at a marina in Washington resulted in reductions of 10 dB to 15 dB (Houghton and Smith 2005). These examples illustrate the high degree of variability seen with use of air bubble attenuation systems and the influence of design, site conditions, and contractor implementation. When correctly implemented, however, bubble curtains significantly reduce the extent of potential adverse effects.

As the current velocities in the various stream systems during the recommended in-water work windows are unknown, the attenuation system proposed is one that is “confined” (e.g., by a fabric, plastic, or metal sleeve) such that air bubbles surround 100 percent of the piling perimeter for the full depth of the water column. Based on the monitoring information from impact pile driving of 24-inch pilings at two Washington State Ferries facilities, the corresponding rms SPL could be as much as 12 dB lower. The WSDOT, however, has assumed only a 10 dB reduction for this programmatic. For this programmatic, we will assume an average reduction of 10 dB due to the use of a confined attenuation system. This may in some situations result in a reduction of sound pressures to less than lethal levels.

Estimating the Extent of Effect

To estimate the geographic area in which effects to bull trout are expected, the distance at which transmission loss (TL) attenuates the pressures to below the thresholds must be estimated. Calculating TL is complicated, and is likely to be site-specific. In the past, the Service has relied on a cylindrical spreading model [TL = 10*Log (R), where R = range or distance from the source] or spherical spreading model [TL = 20*Log(R)] to estimate TL. However, Reyff (2003) provided hydroacoustic monitoring data which suggest that the actual spreading loss may be intermediate between cylindrical and spherical spreading. Therefore, a practical spreading model, as described by (Davidson 2004) [TL = 15*Log(R)] is more appropriate. The practical spreading model is used to estimate the distances at which injury and behavioral disruption are expected. This model assumes that SPLs decrease at a rate of 4.5 dB per doubling distance.

We expect that source level SPLs from impact pile driving of steel piles (including H piles) could reach 207 $dB_{peak.}$ Without sound attenuation measures, such as a bubble curtain, the extent

of impacts per pile is 0.4 mile for impacts that may result in injury and/or death. Using the expected average attenuation of 10 dB, we calculated that the extent of impacts per pile is a radius of 0.08 mile for impacts that may result in injury and/or death. Therefore, impacts associated with injury and/or death would only extend up to 0.08 mile per pile in all directions or up to 0.16 mile total upstream and downstream. Specific activities under this programmatic will need to calculate the actual distance, which may be less than this anticipated amount. This would be due to more frequent meanders in the waterway, thereby, limiting the distance the sound pressure wave would move through water before it hit the river or stream bank.

Effects to Bull Trout from Impact Installation of Steel Piles Expected to Result in Mortality or Injury

Based on the preceding information, we anticipate the potential for injury to occur at SPLs greater than or equal to 180 dB_{peak}. The 180 dB_{peak} threshold is conservative because most of the studies described evaluated transmitted signals of longer duration than are anticipated to result from pile driving. We anticipate that all impact pile driving of steel piles associated with the proposed project will result in adverse effects to bull trout. The Service expects that bull trout will be exposed to elevated underwater SPLs from impact pile installation during construction at levels that could result in mortality or injury.

Foraging, overwintering, and migrating adult and subadult bull trout are expected in the action area during the in-water work period. These subadult and adult bull trout would be exposed to elevated SPLs from impact pile installation for the amount of time they are in the action area. Due to their size, adult fish can likely tolerate higher SPLs (Hubbs and Rechnitzer 1952; Yelverton et al. 1975), and injury rates are expected to be less than those of juvenile fish. No impact pile driving is permitted within a bull trout local population; therefore, we do not anticipate injury to juvenile or younger age classes of bull trout.

Using the practical spreading model, described above, we have determined that SPLs above 180 dB_{peak} would occur as far as a radius of 0.08 mile from each pile and cause injury or mortality. All subadult and adult bull trout within this radius of each pile are expected to be exposed to injurious SPLs for the duration of impact pile driving not to exceed 10 hours per project[29] and no more than 2 projects per 5th-field watershed per year per WSDOT Region during the allowable in-water work window. No more than five projects per WSDOT Region per year are permitted.

Effects to Bull Trout from Impact Installation of Steel Piles Expected to Result in Significant Alteration of Normal Behavior

As described above, there are significant gaps in scientific understanding of the behavioral effects of impulsive underwater sound on aquatic organisms. The following summarizes those literature sources that the Service feels are most pertinent for anticipating potential effects to bull trout.

[29] 10 hours includes the total adverse effect from pile driving, including effects to behavior.

Popper (2003) suggests that behavioral response of fishes to loud sounds may include swimming away from the sound source, thereby decreasing potential exposure to the sound, or "freezing" (staying in place), thereby becoming vulnerable to possible injury.

Alternatively, responses to sound could affect behavior more extensively and result in the fish leaving a feeding ground (Engas et al. 1996) or an area in which it would normally reproduce or in some other way affect long-term behavior and subsequent survival and reproduction. The effect of these avoidance responses may range from insignificant, to permanent long-term effects if feeding or reproduction is impeded.

Feist et al. (1992) found that impact pile driving of concrete piles affected juvenile pink and chum salmon distribution, school size, and schooling behavior. In general, on days when pile driving was not occurring, the fish exhibited a more polarized schooling behavior (moving in a definite pattern). When pile driving was occurring, the fish exhibited an active milling schooling behavior (moving in an eddying mass). Fish appeared to change their distributions about the site, orienting and moving towards an acoustically-isolated cove side of the site on pile driving days more than on non-pile driving days.

Knudsen et al. (1992) studied spontaneous awareness reactions (consisting of reduced heart beat frequency and opercular movements[30]) and avoidance responses to sound in juvenile Atlantic salmon. This study evaluated the responses of these fish to frequencies ranging from 5 Hz to 150 Hz. With increasing frequencies, the difference between the threshold for spontaneous awareness reaction and the estimated hearing threshold also increased. At 5 Hz, 60 Hz, and 150 Hz, the signal had to exceed the hearing thresholds by 25 dB, 43 dB, and 73 dB, respectively, to elicit the reactions.

Most of the sound energy of impact hammers is concentrated at frequencies between 100 and 800 Hz. Salmonids can detect sounds at frequencies between 10 Hz (Knudsen et al. 1997) and 600 Hz (Mueller et al. 1998). Optimal salmonid hearing is thought to be at frequencies of 150 Hz (Hawkins and Johnstone 1978). Therefore, impact pile installation produces sounds within the range of salmonid hearing.

We expect that source level SPLs from impact pile driving of steel piles (including H piles) could reach 195 dB_{rms}. Without sound attenuation measures, such as a bubble curtain, the extent of impacts per pile is 5.3 miles radius for impacts that may result in behavioral disruption. Using the maximum expected attenuation of 10 dB, we calculated that the extent of impacts per pile is 1.2 miles radius for impacts that may result in behavioral disruption. However, we have assumed that sound pressure will only travel up to 1 mile before a meander in the stream stops the sound pressure wave. Therefore, we assume that all subadult and adult bull trout within 1 mile upstream and downstream of each pile will be exposed to SPLs above 150 dB_{rms} during impact pile driving. Therefore, impacts associated with changes in behavior would only extend up to 2 miles total per pile. Specific activities under this programmatic will need to calculate the actual distance, which may be less than this anticipated amount.

[30] Knudsen et al. (1992) assumed that stimuli that evoke these awareness reactions are adverse to fish.

Pile installation will occur during the recommended in-water work windows for bull trout. Anadromous adult and subadult bull trout are expected to use the action area where pile driving may occur for foraging, overwintering, and migration during the in-water work period. During that time, SPLs are expected to reach levels that can significantly alter the normal behavior patterns of bull trout.

Sound pressure levels in excess of 150 dB_{rms} are expected to cause temporary behavioral changes. They are not expected to cause injury. The Service expects that SPLs exceeding 150 dB_{rms} due to the proposed action will result in significant disruption of foraging and migrating behavior due to avoidance of the area or alteration of migration timing in bull trout within the action area. These temporary behavioral modifications would result in the measurable disruption of bull trout feeding, reproduction, and sheltering.

Conclusion – Sound Pressure Effects to Bull Trout

WSDOT has proposed up to five projects per year each (no more than two per 5th-field watershed) for the Northwest and Olympic Regions that may result in adverse effects to bull trout due to sound pressure. These effects may result due to activities under the following programs: Bridge Repair, Retrofit, Replacement, and Maintenance Program, Bank Stabilization and Flood Damage Repair Program, Slide Abatement and Repair Program, and Environmental Retrofit and Enhancement. Based on the anticipated extent of sound pressures generated from impact pile driving, effects to bull trout are as follows (Table 19).

Table 19. Underwater sound pressure effects to bull trout due to the proposed programmatic[1].

Region	**Projects per Year with Pile Driving**	**Miles of stream affected with sound pressure above 180 dB_{peak} per project**	**Miles of stream affected with sound pressure above 150 dB_{rms} per project**	**Miles of stream affected with sound pressure above 180 dB_{peak} per year**	**Miles of stream affected with sound pressure above 150 dB_{rms} per year**	**Miles of stream affected with sound pressure above 180 dB_{peak} over life of programmatic**	**Miles of stream affected with sound pressure above 150 dB_{rms} over life of programmatic**
Northwest Region	5	0.16	2	0.8	10	4	50
Olympic Region	5	0.16	2	0.8	10	4	50
Total	10	0.32	4	1.6	20	8	100

[1] Up to 10 hours of sound pressures that exceeds threshold levels for injury and/or behavior may occur per project. No more than 100 piles may be installed within a 5th-field watershed over the life of the programmatic.

No pile driving is proposed within bull trout Local Populations. Therefore, we assume that there will be no effects to bull trout eggs, fry, or juveniles. All effects are limited to adult and subadult bull trout. These effects are likely to occur as part of a larger project identified in this PBO

where other adverse effects may also result; however, in some cases the project may be limited to pile replacement only.

Effects due to Changes in Water Quantity

The proposed action may result in adverse effects from changes in water quantity due to the construction of new impervious surfaces associated with the following programs: Bridge Repair, Retrofit, Replacement, and Maintenance Program; Bank Stabilization and Flood Damage Repair Program; and Slide Abatement and Repair Program. The Southwest Region may not implement activities that may result in adverse effects to bull within the Lower Columbia Basin Interim Recovery Unit.

The following activities may result in changes to water quantity levels due to the construction of new impervious surfaces that may negatively affect bull trout and/or their prey.

- New or reconstructed interchanges
- New passing lanes
- New turn lanes
- New truck climbing lanes and acceleration lanes
- Widening an existing bridge
- New channelization (turn lanes)
- On- and off-ramp extensions
- Realigning/upgrading an intersection to improve the sight distance
- Bridge replacement and/or reconstruction

The actual amount of new impervious surfaces has been estimated by WSDOT to be approximately 172 acres total (Table 7). It is unknown what percentage of this would be pollution versus non-pollution generating, however, the majority of new impervious surfaces is associated with the Mobility and Safety programs (159 acres). We anticipate that the majority of new impervious acreage will occur within urban areas. No new pollution generating impervious surface will occur within bull trout Local Populations if discharges will enter a stream used by bull trout. Therefore, our analysis will focus on effects to bull trout within FMO habitat within and outside of bull trout Core Areas.

Increased impervious surface may cause additional stormwater runoff, decreased groundwater recharge, and other hydrologic impacts. However, the programmatic does not permit activities implemented to be implemented if they contribute to bed or bank scour or erosion (channel instability), or measurably and adversely affect base flows or flow durations in any TDA. Therefore, we do not anticipate that the proposed new impervious surfaces will result in measurable effects to water quantity within waterbodies used by bull trout. Thus, the effects to bull trout due to changes in water quantity associated with increased impervious surfaces associated with the proposed action are anticipated to be insignificant.

Effects from Exposure to Contaminants

The proposed action may result in adverse effects from changes in water quality due to the construction of new pollution generating impervious surfaces associated with the following programs: Bridge Repair, Retrofit, Replacement, and Maintenance Program; Bank Stabilization and Flood Damage Repair Program; and Slide Abatement and Repair Program. The Southwest Region may not implement activities that result in adverse effects to bull within the Lower Columbia Basin Interim Recovery Unit.

The following activities may result in increased exposure of bull trout to contaminants.

- New or reconstructed interchanges
- New passing lanes
- New turn lanes
- New truck climbing lanes and acceleration lanes
- Widening an existing bridge
- New channelization (turn lanes)
- On- and off-ramp extensions
- Realigning/upgrading an intersection to improve the sight distance
- Bridge replacement and/or reconstruction

Stormwater-Related Pollutants

The proposed project would create additional pollutant-generating, impervious surfaces, such as new climbing and passing lanes. The proposed action does not include activities that would result in indirect effects, such as increased growth or roads that would accommodate new and/or increased traffic. The HRM meets the level of stormwater management established by the WDOE to achieve compliance with Federal and State water quality regulations. Even with the proposed stormwater treatment, the new pollutant generating impervious surfaces and the attendant traffic would result in the delivery of pollutants to waterbodies (Geosyntec Consultants 2008), which may affect bull trout. Stormwater effluent within the action area would likely change the concentrations of zinc and copper that enter these waterbodies. Dissolved metals, such as zinc and copper, are known to negatively impact salmonids. Although discharges may meet WDOE water quality standards, the predicted discharged concentrations exceed thresholds of effects to bull trout as described below.

It is known that highways collect a variety of pollutants from traffic and are disproportionate contributors to overall pollutant loads in waterbodies (Wheeler et al. 2005). Pollutants are mobilized by runoff water and are transported to streams and rivers. Traffic residue contains metals including iron, zinc, lead, cadmium, nickel, copper, and chromium (Wheeler et al. 2005). These metals come off disintegrating tires, brake pads, and other vehicle parts and accumulate in

roadside dust and soil (Wheeler et al. 2005). The proposed new pollution generating impervious surfaces are anticipated to result in the contribution of pollutants to stormwater.

Stormwater runoff from roads conveys pollutants, sometimes at concentrations that are toxic to fish (Spence et al. 1996). The relative success of removing pollutants from stormwater runoff depends upon the treatment technology used and maintenance of treatment facilities. Studies indicate variability among different treatment applications (Schueler 1987; Hayes et al. 1996; Young et al. 1996).

Stormwater-delivered pollutants can affect the physiology and/or behavior of salmonids in ways that reduce growth, migratory success, reproduction, and cause death. The likelihood and extent of effects on bull trout from the discharge of roadway pollutants to surface waters can vary spatially and temporally. Effects are influenced by background water quality conditions, life stage of the fish, duration of exposure, concentration, and relative toxicity of the pollutants, and concurrent discharges and/or background levels of other contaminants.

Exposure of Bull Trout to Pollutants

The potential for exposure of adult and subadult bull trout to pollutants will vary depending on the time of year and instream flows. No new pollution generating impervious surfaces are proposed within bull trout Local Populations. Bull trout in the action area may encounter project-related stormwater outfall mixing zones when they pass through the project area to move upstream or when they forage or reside in FMO habitats. The risk from exposure is greatest during low flow periods when water quality tends to be poor and temperatures are higher. However, stormwater discharge is least likely during this time of year due to lower rainfall. Therefore, although some stormwater may be discharged during summer months, most would occur during other times of the year when flows are higher and water temperatures are lower.

Estimates of the Extent of Exposure

Existing pollutant-generating, impervious surfaces within the action area currently contribute concentrations of copper, zinc, and other contaminants. These pollutant concentrations would change with the addition of new pollutant generating impervious surfaces due to the proposed action.

Although a number of contaminants may occur in stormwater runoff, we will focus principally on the effects of heavy metals, specifically zinc and copper, on bull trout. These two metals are selected based on their known negative effects to salmonids and other fish species.

The discharge of stormwater to channel margins exposes fish to metal concentrations that (depending upon the duration of exposure, among other factors) may elicit effects such as avoidance of the plume or repressed olfactory performance and potentially lethal effects.

Discharges of treated stormwater into receiving waters within the action area would have a less severe effect on bull trout during periods of high flows due to greater dilution. However, bull trout may utilize some of the streams and rivers within the action area most of the year.

Additionally, rainfall events often generate a "first flush" of stormwater pollutants, increasing the likelihood of adverse effects to bull trout. However, concentrations of stormwater pollutants may exceed adverse effect levels as a result of other stormwater discharges.

Contaminants should be diluted once discharged into the receiving waterbodies due to dispersion in the water column. The amount of dilution has not been calculated and would vary based on a number of factors including discharge volumes and instream flows at the time of discharge. To account for dilution of these pollutants at the point of discharge, a distance of up to 300 ft is assumed to be the extent that measurable effects to bull trout would occur[31].

Types and Concentrations of Metals to Which Bull Trout May be Exposed

Stormwater from existing pollutant generating impervious surfaces within the action area is expected to already contain concentration of copper and zinc due to existing discharges from treated and untreated roadways. The baseline levels will vary by waterbody.

We rely on toxicity data for other salmonids when specific information on toxicity to bull trout is not available. Fish species in the Salmonidae family are considered more suitable as surrogates for bull trout than non-salmonids (due to their taxonomic similarity), although Hansen et al. (2002a, p. 67) demonstrated that even though other salmonids may be taxonomically similar to bull trout, their sensitivities to chemicals and/or chemical mixtures may differ. In general, however, we anticipate that other salmonids would react in a more similar manner to chemical exposure than non-salmonid species. Therefore, if no specific information is available regarding bull trout, we have assumed that those species which are most closely related to bull trout share similar sensitivities. We have relied on toxicity data for species in the following preferential order: species (bull trout) > genus (*Salvelinus*) > family (Salmonidae). Rainbow trout are the primary species used by the Environmental Protection Agency to develop toxicity data for regulatory purposes; hence, the majority of data generated are based on rainbow trout, which are in the family Salmonidae.

The most commonly reported end points in the toxicity literature are for concentration levels at which 50 percent of the organisms died (LC_{50}). This indicates that lethal concentrations, which affect a smaller (i.e., LC_{10}) percentage of the test population, may occur at lower/untested concentrations. A sublethal and/or lethal effect to only one bull trout would be considered an adverse effect to the species under the ESA.

[31] A distance of 300 ft is used as this is generally the distance at which stormwater discharges must meet WDOE water quality standards. Discharges that meet WDOE water quality standards may be at levels that negatively impact bull trout. However, we anticipate that there is sufficient dilution within 300 ft of the proposed stormwater discharges to reduce the effects to bull trout such that they are not measurable beyond this zone. This assumption is based, in part, on the effects analysis associated with stormwater discharges for the I-405, State Route 520 to I-5 improvement project (13410-2007-F-0641). The I-405 action included approximately 13.9 acres of new PGIS across more than three dozen TDAs and proposed the retrofit of 4.7 acres of previously untreated PGIS in addition to treatment of all new PGIS. Adverse effects due to this action were anticipated to occur at least 15 ft downstream of the proposed discharges in some of the effected waterbodies. Although this datum only represents the result from one action, it demonstrates that our use of 300 ft for potential adverse effect determinations is adequate.

Toxicity of many compounds to aquatic organisms varies with water hardness, alkalinity, the type and life stage of organisms, presence of organic matter, presence of other toxicants, and the duration of exposure. In addition, mixtures of compounds with the same toxic mechanism of action can have a combined effect on the test species, increasing or decreasing overall toxicity. However, chemical mixtures are rarely tested due to the complexity of responses to combinations of individual chemicals.

There are three known physiological pathways of metal exposure and uptake within salmonids: 1) gill surfaces can uptake metal ions which are then rapidly delivered to biological proteins (Niyogi et al. 2004), 2) olfaction (sense of smell) receptor neurons (Baldwin et al. 2003), and 3) dietary uptake. Of these three pathways, the mechanism of dietary uptake of metals is least understood. For dissolved metals, the most direct pathway to aquatic organisms is through the gills (WCC 1999).

Measurement of total recoverable metals concentrations includes a fraction of metal that is bound to suspended solids and/or is complexed with organic matter or other ligands and, therefore is not available to bind to gill receptor sites. As such, most metal toxicity studies are based on the dissolved fraction of the metal because it approximates the most immediately bio-available fraction and toxicity. Metals bound to sediment remain biologically relevant because they may be incidentally ingested by water column organisms or be accumulated by benthic organisms that are in turn prey sources for salmonids.

Water hardness affects the bio-available fraction of metals from gill surfaces; as hardness increases, metals become less bio-available, and therefore less toxic (WCC 1999; Hansen et al. 2002a; Hansen et al. 2002b; Niyogi et al. 2004). However, Baldwin et al. (2003) did not find any influence of water hardness on the inhibiting effect of copper on salmon olfactory functions. Olfactory inhibition can decrease the ability of salmonids to recognize predators and navigate back to natal streams for spawning (Baldwin et al. 2003).

Effects of Copper

Copper is acutely toxic to fish, even at low concentrations. Typical effects of copper exposure include 1) impaired disease resistance, 2) disrupted migration (via avoidance behavior of copper-contaminated areas), 3) hyperactivity, 4) impaired respiration, 5) disrupted osmoregulation, 6) pathology of kidneys, liver, and gills, 7) impaired function of olfactory organs and brain, 8) altered blood chemistry, and 9) enzyme activity that has been documented in fish exposed to copper (Eisler 1998). Table 20 provides information on the effects of various concentrations of copper on salmonids.

Table 20. Summary of toxicity literature for copper.

Constituent	Species (age class tested)	Concentration (µg/L)	Exposure Duration	Effect	Reference
Copper (dissolved)	Coho salmon (juvenile)	10	30 minute	Affected the olfactory sensory responsiveness	(Baldwin et al. 2003)
	Coho salmon (juvenile)	2	3 hr	Inhibited olfactory response (freeze response to predators)	Sandahl et al. (2007)
	Coho salmon (juvenile)	2.3	30 minute	olfactory inhibition	(Baldwin et al. 2003)
	Chinook salmon (juvenile)	25	4 hr	Neurophysio-logical and histological effects on olfactory system	Hansen et al. (1999)
	Rainbow trout (juvenile)	25	4 hr	Neurophysio-logical and histological effects on olfactory system	Hansen et al. (1999)
	Rainbow trout (fry)	0.1	1 hr	Avoidance by fry	EPA 1980 *in* Eisler 1998
	Rainbow trout (smolt)	7	LC_{10}	Lethality	EPA 1980 *in* Eisler 1998
	Rainbow trout (swim-up)	9	LC_{10}	Lethality	EPA 1980 *in* Eisler 1998
	Brook trout (age not reported)	9.5 -17.4[1]	Chronic	MATC	McKim and Benoit 1971 *in* Eisler 1998

[1]45 mg/L calcium carbonate

Baldwin et al. (2003) demonstrated that short pulses of dissolved copper at concentrations as low as 2 µg/L reduced olfactory sensory responsiveness by approximately 10 percent within 10 minutes and by 25 percent within 30 minutes. At 10 µg/L (a concentration that could occur in stormwater outfall effluent), responsiveness was reduced by 67 percent within 30 minutes, an exposure time that is less than the typical discharge times for best management practices outfalls. The effects of short-term copper exposure persist for hours and possibly longer. Although salmonids would actively avoid copper, if they are unable to do so, olfactory function would be impaired within minutes of exposure. Baldwin et al. (2003) identified a copper concentration

neurotoxic threshold of an increase of 2.3 µg/L to 3.0 µg/L when background levels were 3.0 µg/L or less, as sufficient to cause olfactory inhibition. This is equivalent to an exposure to a minimum of 5.3 µg/L of dissolved copper before olfactory inhibition was detected. They also referenced three studies that reported copper exposures of over 4 hours that resulted in cell death of olfactory receptor neurons in rainbow trout, and Atlantic and Chinook salmon. Baldwin et al. (2003) determined that water hardness did not influence the toxicity of copper to coho salmon sensory neurons.

The avoidance of a chemical plume can cause a fish to leave refugia and to occupy less suitable habitat, increasing the chances of predation and decreasing their ability to find prey. Folmar (1976) observed avoidance responses in rainbow trout fry when exposed to a Lowest Observed Effect Concentration of 0.1 µg/L of dissolved copper (hardness of 90 mg/L). The EPA (1980) also documented avoidance by rainbow trout fry of dissolved copper concentrations as low as 0.1 µg/L during a 1 hour exposure, as well as a LC_{10} for smolts exposed to 7.0 µg/L for 200 hours, and a LC_{10} for juveniles in the swim-up stage exposed to 9.0 µg/L for 200 hours.

Conclusion - Effects of Dissolved Copper on Bull Trout due to the Proposed Project

New pollution generating impervious surfaces that may result in adverse effects to bull trout are associated with the mobility and safety programs only. We anticipate that the stormwater discharge levels, even when treated, may exceed the dissolved copper concentrations known to temporarily impair olfactory function. This is due to existing baseline concentrations of dissolved copper in the receiving water and the difficulty in removing dissolved copper from stormwater with current treatment technology. Although we recognize that the existing concentrations of dissolved copper in receiving waters within the action area are variable, we have assumed for this programmatic that stormwater discharges associated with new PGIS will result in olfactory or plume avoidance effects to bull trout due to increased concentrations of dissolved copper. Effects of greater magnitude are not anticipated as we do not anticipate that the proposed discharges would reach more detrimental concentration levels. WSDOT proposes to install up to one new stormwater outfall per Core Area FMO or FMO outside of a Core Area during the life of the programmatic; no new outfalls are permitted within bull trout local populations under the programmatic. This would result in up to 30 new outfalls over the life of the programmatic. New and existing stormwater facilities may result in increased levels of dissolved copper discharges into receiving waters due to new pollution generating surfaces that result in adverse effects to bull trout. However, not all of the new outfalls are likely to discharge into waterbodies used by bull trout. Therefore, we anticipate that up to 30 outfalls (including existing) will result in levels of dissolved copper discharges into waterbodies that affect bull trout; no more than one discharge may adversely affect bull trout per FMO within and outside a Core Area in the action area. We anticipate that dissolved copper levels will result in adverse effects to adult and subadult bull trout at least 300 ft downstream of the discharge location into the receiving water. Therefore, up to 300 ft of stream per FMO may be affected over the life of the programmatic, for a total of 9,000 ft (1.7 miles) (Table 21). These effects would be in perpetuity.

Table 21. Effects of dissolved copper on bull trout due to the proposed action.

Bull Trout Habitat Classification	Number of New or Existing Stormwater Outfalls per FMO Over Life of Programmatic that Adversely Affect Bull Trout due to Discharges of Dissolved Copper	Number of FMO's per Habitat Classification Over Life of Programmatic	Area Affected due to Dissolved Copper Discharge per New or Existing Stormwater Outfall	Area Affected due to Dissolved Copper Discharge for New or Existing Stormwater Outfalls Over Life of Programmatic
FMO within a Core Area	1	13	300 ft	3,900 ft
FMO outside of a Core Area	1	17	300 ft	5,100 ft
Total	1	30	300 ft	9,000 ft

Effects of Zinc

Zinc occurs naturally in the environment and is an essential trace element for most organisms. Toxicity of zinc to aquatic organisms is dependent on water hardness, pH, dissolved oxygen, presence of mixtures, and trophic level (Eisler 1993). Toxicity of zinc can be altered by a number of factors including temperature, pH, organic matter, phosphate, suspended solid concentration, the presence of mixtures, and duration of exposure (Eisler 1993). Bioavailability of zinc is increased under conditions of high dissolved oxygen, low salinity, low pH, and high levels of inorganic oxides and humic substances (Eisler 1993). Most of the zinc introduced into aquatic environments is eventually partitioned into sediments (Eisler 1993). Table 22 provides information on the effects of various concentrations of zinc on salmonids.

Table 22. Summary of toxicity literature for dissolved zinc.

Constituent	Species (age class tested)	Concentration (µg/L)	Exposure Duration	Effect	Reference
Zinc (dissolved)	Bull trout (fry)	35.6 - 80 (56.1 mean)	120 days	LC_{50}	(Hansen et al. 2002a)
	Brook trout (age not reported)	534-1,360	Chronic exposure	MATC	EPA (1980); EPA (1987) both in Eisler (1993)
	Brook trout (adults)	630	14 days	LC_{17}	EPA (1980); EPA (1987) both in Eisler (1993)
	Brook trout (adults)	960	14 days	LC_{50}	Spear (1981); Nehring and Goettl (1974) both in Eisler (1993)
	Rainbow trout (complete life cycle)	140-547	Life cycle	MATC	EPA (1980); EPA (1987) both in Eisler (1993)
	Rainbow trout (adults)	1,120	85 days	Reduced growth in adults	Spear (1981) in Eisler (1993)
	Rainbow trout (juvenile)	5.6	10- to 20-rain tests	Avoidance	EPA (1980); EPA (1987) both in Eisler (1993); Sprague (1968)[1]

[1] Total hardness between 13-15 mg/L as $CaCO_3$

Zinc exposure has resulted in the destruction of gill epithelium, consequent tissue hypoxia, and potential lethality (Eisler 1993). In fish, sublethal effects of zinc have been associated with the following: altered behavior, blood and serum chemistry, and liver enzyme activity (Hilmy et al. 1987a; Hilmy et al. 1987b); interference with gall bladder and gill metabolism (Eisler 1993), and altered immune response (Ghanmi et al. 1989). Zinc has also resulted in reduced growth, altered avoidance behavior, impaired reproduction, increased respiration, decreased swimming ability, increased jaw and branchial abnormalities, hyperactivity, hyperglycemia, and reduced survival in freshwater fish (Eisler 1993).

Hansen et al. (2002a) measured the 120-day lethal concentrations of zinc to bull trout and rainbow trout fry. Multiple pairs of zinc tests were performed with a nominal pH of 7.5, hardness of 30 mg/L, and a temperature of 8 °C. The bull trout LC_{50} values under these

conditions ranged from 35.6 µg/L to 80 µg/L with an average of 56.1 µg/L. These tests determined that rainbow trout fry were more sensitive to zinc (lower LC_{50}) than bull trout fry. They also determined that older, more active juvenile bull trout were more sensitive than younger, more docile juvenile bull trout based on observed changes in behavior at the juvenile life stage. The authors concluded that the timing of zinc (and cadmium) exposure with the activity level of the fish is germane to predicting toxicity in the field. Since active feeding and increased metabolic activity are apparently related to sensitivity, we assume that adult and subadult bull trout would also be sensitive to zinc toxicity. However, it is unknown if there is a difference in sensitivity to zinc between adult, subadult, and juvenile bull trout. As noted above, activity level may be a better indicator of sensitivity than age.

The mode of action for zinc toxicity relates to net loss of calcium. Zinc appears to reduce calcium uptake, although this effect is reversible once the fish is placed in clean water. The apparent difference in sensitivity between rainbow trout and bull trout may be due to the lesser susceptibility of bull trout to calcium loss. Hansen et al. (2002a) state that differences in sensitivity between these two salmonids may relate to different physiological strategies for calcium regulation. These strategies may include structurally different gills, differences in calcium uptake mechanisms, or resistance to calcium loss.

Sublethal endpoints have been evaluated in toxicity tests with rainbow trout, but not with bull trout. These sublethal data are available for both juvenile and adult rainbow trout (EPA 1980, EPA 1987, Spear 1981, all in Eisler 1993). When comparing toxicity test results between juvenile and adult rainbow trout, it is apparent that juveniles are more sensitive. When making general comparisons between lethal and sublethal endpoints tested on juvenile rainbow trout, the sublethal effects occur at concentrations approximately 75 percent less (5.6 µg/L) than lethal effects (24 µg/L) (Eisler 1993; Hansen et al. 2002a).

The lowest sublethal zinc concentration (5.6 µg/L) resulted in avoidance of the plume by rainbow trout (Sprague 1968). Hansen et al. (2002a) identified the sensitivity ranges for bull trout and rainbow trout from 25 to 55 percent. Given this difference in sensitivity, one might expect bull trout to avoid a zinc plume if the zinc concentration ranged between 6.7 µg/L to 8.7 µg/L. However, because stormwater effluent contains a mixture of chemicals, some of which are known to affect the olfactory system (e.g., copper), we cannot assume that bull trout would be able to detect and potentially avoid the mixing zone.

As with other metals, the toxicity of zinc is related to water hardness. The higher the hardness the greater protective effect it provides for fish exposed to zinc and other toxic metals (Bradley and Sprague 1985). Water hardness in Sprague's (1968) study ranged from 13 mg/L to 15 mg/L. This hardness concentration will vary within the action area.

Discharges associated with "first flushes" are likely to contain the greatest concentrations of dissolved zinc. However, concentrations of zinc may exceed adverse effect levels as a result of other stormwater discharges. At these concentrations, bull trout would be precluded from a portion of the channel, reducing foraging opportunities, increasing the risk of predation, and/or creating thermal stress during warmer weather. Precluding bull trout use of a portion of a waterbody is anticipated to significantly impair normal behaviors.

Conclusion - Effects of Zinc on Bull Trout due to the Proposed Project

Based on the above rationale, we anticipate that adult and subadult bull trout may be exposed to concentrations of dissolved zinc that may result in measurable adverse effects to the species. New discharges from increased impervious surfaces and installation of new stormwater outfalls are not permitted within bull trout local populations; therefore, effects to bull trout juveniles and younger life stages are not anticipated. Discharge levels of zinc that may result in measurable effects to bull trout are more likely to occur after a first flush, but may occur during other discharges, as well. New pollution generating impervious surfaces that may result in adverse effects to bull trout are associated with the mobility and safety programs only. WSDOT also may install up to one new stormwater outfall per Core Area FMO or FMO outside of a Core Area during the life of the programmatic. This would result in up to 30 new outfalls over the life of the programmatic. New and existing stormwater facilities may result in increased levels of dissolved zinc discharges into receiving waters due to new pollution generating surfaces that result in adverse effects to bull trout. Also, not all of the new outfalls are likely to discharge into waterbodies used by bull trout. Therefore, we anticipate that up to 30 outfalls (including existing) will result in levels of dissolved discharges into waterbodies that affect bull trout; no more than one discharge that adversely affects bull trout may occur per FMO within and outside a Core Area in the action area. We anticipate that dissolved zinc levels will result in adverse effects to adult and subadult bull trout at least 300 ft downstream of the discharge location into the receiving water. Therefore, up to 300 ft of stream per FMO may be affected by dissolved zinc discharges over the life of the programmatic, for a total of 9,000 ft (1.7 miles) (Table 23). These effects would be in perpetuity.

Table 23. Effects of dissolved zinc on bull trout due to the proposed action.

Bull Trout Habitat Classification	**Number of New or Existing Stormwater Outfalls per FMO Over Life of Programmatic that Adversely Affect Bull Trout due to Discharges of Dissolved Zinc**	**Number of FMO's per Habitat Classification Over Life of Programmatic**	**Area Affected due to Dissolved Zinc Discharge per New or Existing Stormwater Outfall**	**Area Affected due to Dissolved Zinc Discharge for New or Existing Stormwater Outfalls Over Life of Programmatic**
FMO within a Core Area	1	13	300 ft	3,900 ft
FMO outside of a Core Area	1	17	300 ft	5,100 ft
Total	1	30	300 ft	9,000 ft

Effects of Exposure to Pollutant Mixtures on Bull Trout

Bull trout within the action area are already exposed to complex mixtures of metals and other contaminants from runoff resulting from existing roadways and parking areas, as well as pollution originating from other land uses within each sub-basin. We anticipate an increase in new pollutant generating impervious surfaces, including an increase in the discharge of dissolved zinc, copper, and other metals and contaminants as a result of the proposed action. As such, bull trout would be exposed to greater levels of some stormwater pollutants as a result of the proposed action, even with stormwater treatment.

Most published literature addresses the acute toxicity of metals on an individual basis, though in aquatic receiving bodies most metals typically exist in mixtures and are known to interact with each other (Niyogi et al. 2004). These mixtures interacting at gill (and olfaction) mediums likely result in adverse effects, and the physiological consequence of metal mixtures is a continuing area of study (Niyogi et al. 2004). However, individual metal concentrations, and some mixture concentrations and combinations have been tested with a variety of *Oncorhynchus* (i.e., Chinook, coho, and rainbow trout) and *Salvelinus* (bull and brook trout) species. Tested endpoints range from lethal to sublethal effects, which include reduced growth, fecundity, avoidance, reduced stamina, and neurophysiological and histological effects on the olfactory system. For example, mixtures containing copper and zinc were found to have greater than additive toxicity to a wide variety of aquatic organisms including freshwater fish (Eisler 1998), and other metal mixtures also yielded greater than additive toxic effects at low dissolved metal concentrations (Playle 2004).

Mixtures of copper and zinc have been determined to result in more than additive toxicity to a variety of organisms, including marine (Eisler and Gardner 1973, Eisler 1984 both in Eisler 1993) and freshwater fish (Skidmore 1964; Himley et al. 1987 both in Eisler 1993). These metals, added separately to water, depressed the accumulation or uptake of the other metal in catfish (*Clarias lazera*) (Hilmy et al. 1987 in Eisler 1993). This same reaction was reported in barnacles (*Elminius modestus*); however, the simultaneous exposure to copper and zinc resulted in the enhanced uptake of both metals (Elliot et al. 1985 in Eisler 1993).

Strong biological evidence of water quality degradation from untreated stormwater within urbanized watersheds discharging to Puget Sound has been recently observed. Death of adult coho salmon has been documented in some highly urbanized streams in Seattle and other areas of Puget Sound such as Longfellow, Thornton, Pipers, and Fauntleroy Creeks. Data summarized in 2002 showed that the adult coho salmon pre-spawn mortality rate was 60 percent for Longfellow Creek, 71 percent for Pipers Creek, 82 percent for Thornton Creek, and approximately 25 percent for Fauntleroy Creek (Longfellow Creek Community 2002).

These observations prompted a pilot study in 2004 by the Northwest Fisheries Science Center, which revealed significant pre-spawn mortality of coho salmon within Longfellow Creek, compared to a relatively non-urbanized stream within the Stillaguamish River Watershed (NMFS 2005a). Mortality in adult coho salmon was observed within hours of their return to the creek, often during, or soon after, rain events. Pollutant mixtures in stormwater are likely a primary

contributor to the high level of pre-spawn mortality, though the exact causes have not been fully determined to date (NMFS 2005b).

Recent studies have shown that salmonids that rear and migrate through contaminated waterways bioaccumulate pollutants, and have suppressed immune systems (Arkoosh et al. 1991; Varanasi et al. 1993). These sublethal effects can persist after fish leave the natal streams and enter the ocean (Arkoosh et al. 1998).

Conclusion - Effects of Pollutant Mixtures to Bull Trout due to the Proposed Project

Bull trout will be exposed to chemical mixtures, which may result in greater effects than anticipated from individual chemicals alone. Therefore, based on the potential effects from mixtures of chemicals, including the increased discharge concentrations of dissolved zinc and copper, we anticipate that the adverse effects to bull trout are likely to occur during all stormwater discharges into receiving waters within the action area. New discharges from increased impervious surfaces and installation of new stormwater outfalls are not permitted within bull trout local populations; therefore, effects to bull trout juveniles and younger life stages are not anticipated. Discharge levels of pollutant mixtures that may result in measurable effects to bull trout are more likely to occur after a first flush, but may occur as part of other discharges, as well. New pollution generating impervious surfaces that may result in adverse effects to bull trout are associated with the mobility and safety programs only.

WSDOT may install up to one new stormwater outfall per Core Area FMO or FMO outside of a Core Area during the life of the programmatic. This would result in up to 30 new outfalls over the life of the programmatic. New and existing stormwater facilities may result in increased levels of zinc and copper discharges into receiving waters due to new pollution generating surfaces that result in adverse effects to bull trout. Not all of the new outfalls are likely to discharge into waterbodies used by bull trout. Therefore, we anticipate that up to 30 discharges from existing and new stormwater outfalls may result in adverse effects to adult and subadult bull trout due to zinc and copper. We anticipate that these same discharges may contain chemical mixtures at levels that also disrupt the normal behaviors of adult and subadult bull trout. We anticipate that this exposure will occur within 300 ft downstream of the discharge location for stormwater outfalls into receiving waters. A distance of 300 ft is used as this is generally the distance required for compliance with WDOE water quality standards. Therefore, up to 300 ft of stream per FMO may be affected by chemical mixtures discharges over the life of the programmatic, for a total of 9,000 ft (1.7 miles) (Table 24). These effects will be in perpetuity.

Table 24. Effects of chemical mixtures on bull trout due to the proposed action.

Bull Trout Habitat Classification	Number of New or Existing Stormwater Outfalls per FMO Over Life of Programmatic that Adversely Affect Bull Trout due to Discharges of Chemical Mixtures	Number of FMO's per Habitat Classification Over Life of Programmatic	Area Affected due to Chemical Mixtures Discharge per New or Existing Stormwater Outfall	Area Affected due to Chemical Mixtures Discharge for New or Existing Stormwater Outfalls Over Life of Programmatic
FMO within a Core Area	1	13	300 ft	3,900 ft
FMO outside of a Core Area	1	17	300 ft	5,100 ft
Total	1	30	300 ft	9,000 ft

Herbicide Use

The proposed action may result in herbicide use associated with the Slide Abatement and Repair Program; Bank Stabilization and Flood Damage Repair Program; Bridge Repair, Retrofit, Replacement, and Maintenance Program; Mobility Improvement Program; Safety Improvement Program; Facilities Preservation and Construction Program; and Environmental Retrofit and Enhancement Program. Herbicides would be used at environmental mitigation sites and as part of roadside restoration activities associated with the above programs.

Herbicides are used to clear invasive or non-native vegetation from an area in preparation for planting, to control invasive species within mitigation areas, and adjacent to roadways. WSDOT proposes to uses glyphosate (trade name Aquaneat®, Aquamaster®, or Rodeo®) and the surfactant Agri-Dex or tryclopyr amine (trade name Garlon 3A) to control invasive plants. Only these products will be permitted for use under the programmatic. Glyphosate products identified as toxic to fish, such as Round-up®, and the surfactant LI-700 are not covered by the programmatic.

The glyphosate product is typically applied directly to plant foliage by wicking, spraying from a backpack sprayer, injecting, or by applying to cut stumps to inhibit the production of a growth enzyme. It is not applied directly to soil or water. All applications are in accordance with the NPDES aquatic noxious and nuisance weed permits issued by the WDOE, and all applications are in accordance with the product label requirements.

The use of chemical treatment is likely to directly affect fish and indirectly affect their food sources. The effects range from killing fish outright as a result of subtle, sublethal changes in behavior or physiology, to reductions in the availability of prey (Stehr et al.). Adverse effects

from the proposed action are anticipated to be short-term in nature and are caused by chemical treatments in or adjacent to a stream and other waterbodies.

The following summarizes the potential effects that glyphosate may have on listed bull trout and their habitat. A more detailed risk assessment and analysis of herbicides on salmonids and water quality can be found in the Gifford Pinchot and Olympic National Forest Biological Opinions for their noxious weed control programs (USFWS 2007d; USFWS 2007e).

The most sensitive effect (i.e., LOAEL) from the most sensitive species tested was used to determine the toxicity indices for glyphosate. Quantitative estimates of dose from each exposure scenario were compared to the corresponding toxicity index to determine the potential for adverse effect. Doses below the toxicity indices are predicted to result in insignificant effects. No specific data are available for bull trout; therefore, information available for other salmonids was used. Table 25 lists the toxicity indices for salmonids and summarizes the lowest observed adverse effects level (LOAEL) for glyphosate. Indices represent the most sensitive endpoint from the most sensitive species for which adequate data are available. Generally, the lowest toxicity index available for the species most sensitive to effects was used. Measured chronic data were used when they were lower than 1/20th of an acute LC_{50}[32] because they accounted for at least some sublethal effects. Additionally, doses that are protective in chronic exposures are more protective in acute exposures. Based on these findings, glyphosate with polyethoxylated tallow amine surfactant may cause acute adverse effects to bull trout. This surfactant is not permitted for use under the programmatic. Additionally, this study did not include the analysis of the surfactants that are part of the proposed action.

Table 25. Toxicity indices for salmonids for glyphosate.

Herbicide	**Duration**	**Normal Application Rate**	**Species**	**Lowest Observed Adverse Effect Level (LOAEL)**
Glyphosate (no surfactant)	Acute[1]	**0.1 mg/l** (LOAEL)	Rainbow trout	Olfaction impaired at 0.2 mg/l
	Chronic[2]	2.57 mg/l	Rainbow trout	Life-cycle study in minnows
Glyphosate with POEA[3] surfactant	Acute	**0.065 mg/l** (1/20th of LC_{50})	Rainbow trout	LC_{50} at 1.3 mg/l for fingerlings
	Chronic	0.36 mg/l	salmonids	Estimated from full life-cycle study of minnows

[1]Acute exposure - a single exposure or multiple brief exposures in a brief time (< 24 hrs)
[2]Chronic exposure - exposures that occur over the average lifetime of the organism
[3] POEA- polyethoxylated tallow amine. This surfactant is not permitted for use under the programmatic.

The U.S. Environmental Protection Agency classified technical grade glyphosate as non-toxic to practically non-toxic to freshwater fish and LC_{50} values for glyphosate are in the range of 70 to 170 mg/l (EPA 1993). In addition, the U.S. Environmental Protection Agency used the no

[32] A calculated concentration of a chemical in air or water to which exposure for a specific length of time is expected to cause death in 50 percent of a defined experimental animal or plant populations.

observed effect concentration (NOEC) of 25.7 mg/l from life cycle toxicity study on technical grade glyphosate using fathead minnow and concluded that technical grade glyphosate should not cause acute or chronic adverse effects to aquatic organisms or environments (EPA 1993).

Glyphosate is highly soluble in water but much less so in organic solvents. In general, it is very immobile in soil, being rapidly adsorbed by soil particles, and subject to some degree of microbial degradation. In aquatic species, the acute lethal potency of glyphosate and glyphosate formulations has been relatively well-defined. The formulation of glyphosate with surfactants, especially the polyethoxylated tallow amine surfactant commonly used in glyphosate formulations such as Roundup®, has a pronounced effect on the potency of this chemical.

The primary hazards to fish appear to be from acute exposures to the more toxic formulations of glyphosate. At high and typical application rates, the hazard quotients for the more toxic formulation at the upper ranges of plausible exposure indicate that the $1/20^{th}$ LC_{50} values for bull trout will be exceeded under worst-case conditions. The more toxic formulation did exceed the toxicity endpoints for invertebrates and aquatic plants at the highest permitted application rate (7 lbs acid equivalent/acre). In the worst-case scenarios, the exposure estimates are based on a severe rainfall (about 7 inches over a 24 hour period) in an area where runoff is most likely to occur – a slope toward a stream immediately adjacent to the application site (SERA 2003, p. 4-45 - 4-46). Thus, the risk of exposure of listed fish to glyphosate is likely to occur at those treatment sites that are located adjacent to perennial and wet intermittent streams

For chronic exposures to glyphosate, the most relevant study remains the life cycle toxicity studies done on fathead minnow. As summarized by the US Environmental Protection Agency (U.S. EPA/OPP 1993c in SERA 2003), no effect on mortality or reproduction was observed at a concentration of 25.7 mg/l using 87.3 percent pure technical grade glyphosate. It is important to note that the NOEC from this full life-cycle toxicity study not only indicates a lack of mortality, but also indicates that the fish were able to reproduce normally. The life cycle NOEC of 25.7 mg/l was used as the most appropriate basis for risk characterization in the SERA (2003, p. 4-52) risk assessment.

In typical backpack ground sprays, droplet sizes are greater than 100 µ, and the distance from the spray nozzle to the ground is 3 ft or less. For most applications, the wind velocity will be no more than 5 miles/hour, which is equivalent to approximately 7.5 ft/sec (1 mile/hour = 1.467 ft/sec). Assuming a wind direction perpendicular to the line of application, 100 µ particles falling from 3 ft above the surface could drift as far as 23 ft (3 seconds at 7.5 ft/sec). This suggests that there is a reasonable probability that some off-site drift from spot applications may occur. For spot applications, the amount of drift is likely to be significantly less than from broadcast applications; therefore, the magnitude of effects on fish, invertebrates, and aquatic plants as a result of drift is very low. When spot treatments of herbicide using hand-held equipment are made, the applicator has direct control of where the spray solution is applied and little, if any, herbicide is anticipated to come into contact with standing water.

The Washington State Department of Agriculture (WSDA) has been conducting water quality monitoring to record any residual concentrations of the aquatic herbicides that are used to treat various freshwater emergent noxious weed species in or near the waters of Washington (WSDA

2003; 2005; 2006). Eleven sites between 2003 and 2005 were monitored for glyphosate, which was applied from boat mounted power equipment, backpack sprayer, and hand held injection gun. Seven resulted in some level of detection below State standards and the remainder had no detection. No detection indicates that herbicide residue was not detected above the listed practical quantification limit. The practical quantification limit is the lowest level that can be achieved within specified limits of precision and accuracy during routine laboratory conditions.

The highest concentration detected was 0.343 mg/l, one hour after treatment in 2003 in a pond near the Yakima River. The area was treated less than 0.3 acre with 6 oz of glyphosate per gallon of water. These results indicate that very little, if any, glyphosate would remain in the water near treatment sites (WSDA 2003, p. 3) under spot and hand/select applications. Under the proposed action, aquatic formulations of glyphosate are proposed for treatment of invasive weeds growing along but not in the wetted channel. Most such treatments are, therefore, not likely to result in detectable levels of glyphosate entering the water.

Conclusion - Effect of Herbicide Use on Bull Trout due to the Proposed Action

Use of herbicides as part of the proposed action may only occur at environmental mitigation sites and as part of roadside restoration activities associated with projects addressed by this programmatic. Herbicides will be applied during the dry periods and in a manner to reduce the potential for runoff or drift into fish bearing streams. Exposure to sufficient levels of glyphosate that result in adverse effects is most likely to occur in small streams within spawning and rearing areas due to reduced dilution and sensitive life stage. However, impacts to spawning and rearing areas will be avoided as treatments will not be conducted within 300 ft of bull trout spawning and rearing areas unless site specific information indicates that contaminants are highly unlikely to enter these waterbodies. Therefore, we anticipate that affects due to the use of herbicide will be insignificant to bull trout.

Effects of Riparian Vegetation Removal

The proposed action may result in adverse effects from the removal of riparian vegetation due to activities associated with the following programs: Environmental Retrofit and Enhancement; Bridge Repair, Retrofit, Replacement, and Maintenance Program; Bank Stabilization and Flood Damage Repair Program; and Slide Abatement and Repair Program. The Southwest Region may not implement activities that may result in adverse effects to bull within the Lower Columbia Basin Interim Recovery Unit.

The following activities may result in removal of riparian vegetation that may negatively affect bull trout and/or their prey.

- Culvert replacement and/or installation
- Culvert extension
- New or reconstructed interchanges
- New passing lanes

- New turn lanes
- New truck climbing lanes and acceleration lanes
- Widening an existing bridge
- New channelization (turn lanes)
- On and off ramp extensions
- Realigning/upgrading an intersection to improve the sight distance
- Bridge removal, replacement, and/or reconstruction
- Bank stabilization and flood damage repair

The proposed action may result in removal of vegetation due to up to five bridge scour repair projects (Bridge Repair, Retrofit, Replacement, and Maintenance Program), two emergency bank stabilization projects (Bank Stabilization and Flood Damage Repair Program), two slide abatement and repair projects (Slide Abatement and Repair Program), and 10 projects under the Environmental Retrofit and Enhancement Program per WSDOT Olympic and Northwest Region per year. The proposed projects may result in the removal of up to 16.4 acres of riparian vegetation (Table 26) within the WSDOT Olympic and Northwest Regions, primarily due to slide abatement repair. Table 26 excludes those acres associated with paving and other minor vegetation losses that were addressed earlier in this document. The Southwest Region may not implement activities that may result in adverse effects to bull within the Lower Columbia Basin Interim Recovery Unit and, therefore, activities within this WSDOT Region are not addressed below.

Table 26. Potential riparian vegetation removal adjacent to bull trout habitat in the WSDOT Olympic and Northwest Regions.

Potential Vegetation Impacts	Olympic Region (per year)	Northwest Region (per year)	Total per Region for Programmatic	Total for Programmatic for the Olympic and Northwest Regions
5[1] bridge scour repairs per region within or adjacent to bull trout habitat[2]	3,810 ft^2	3,810 ft^2	19,050 ft^2 (0.44 acre)	38,100 ft^2 (0.88 acre)
2[3]slide abatement and repair projects per region within bull trout habitat	1.26 acre	1.26 acre	6.3 acres	12.6 acres
2[4] emergency bank stabilization projects per region within bull trout habitat	200 ft^2	200 ft^2	1,000 ft^2	2,000 ft^2
5[5] projects such as culvert replacement and road repair per region per year within bull trout habitat	2,500 ft^2	2,500 ft^2	12,500 ft^2	25,000 ft^2 (0.6 acre)
10[6] fish habitat and passage enhancement projects per year within bull trout habitat	10,000 ft^2	10,000 ft^2	50,000 ft^2	100,000 ft^2 (2.3 acres)
Total	1.64 acres	1.64 acres	8.2 acres	16.4 acres

[1] Bridge scour repair projects are assumed to average 726 ft^2 per project
[2] Bull trout habitat includes all habitat types (spawning, rearing, foraging, overwintering, and migration).
[3] Slide abatement and repair projects are assumed to average 0.63 acre per project.
[4] Emergency bank stabilization projects are assumed to average 100 ft^2 per project and less than 300 cy of material in streams.
[5] Culvert replacement and road repair projects are assumed to average 500 ft^2 per project.
[6] Fish habitat and passage enhancement projects are assumed to average 1,000 ft^2 per project.

Activities that include the removal of riparian vegetation are expected to reduce cover, future large woody debris recruitment, and leaf litter through the removal of trees and lack of regrowth. Additionally, solar radiation may increase instream due to the lack of overhanging vegetation providing shade.

Not all riparian vegetation removal will be adjacent to streams used by bull trout or their forage species. Additionally, some riparian vegetation will be replanted following construction. Even with revegetation, there will be a time delay of years before vegetation is able to provide its previous function, especially if it was a large diameter tree.

A healthy, fully functional riparian zone is necessary to maintain the cool, clear water vital for bull trout survival. Bull trout require a narrow range of cold water temperatures to rear, migrate, and reproduce. Increases in stream temperatures can cause increased susceptibility to disease or other sublethal effects such as displacement by avoidance, or can cause direct mortality (Bonneau and Scarnecchia 1996; McCullough et al. 2001). Water temperatures above 15 °C are believed to limit bull trout distribution, which partially explains their generally patchy distribution within a watershed (Fraley and Shepard 1989; Rieman and McIntyre 1995). Increased competition with species more tolerant of warm stream temperatures may also negatively impact bull trout (Rieman and McIntyre 1993; Craig and Wissmar 1993 in U.S. Fish and Wildlife Service 1997; MBTSG 1998). Shading provided by riparian trees and shrubs contributes to cooler summer water temperatures. Streamside vegetation also stabilizes the stream bank and filters runoff, thereby reducing turbidity and contaminant levels and helping to maintain water quality.

The removal of vegetation in the riparian zone will eliminate the benefits of shading and may cause increases in water temperature, particularly during the short term and until vegetation is reestablished. Erosion may increase, with resultant turbidity and siltation effects, and contaminant loading and effects from flashy discharges from impervious surfaces, such as roadways, may become more of a severe. The contribution of large woody debris will be reduced or delayed, resulting in less cover and complexity. The abundance of prey species may also be affected.

Trees in the riparian zone eventually contribute large woody debris to the stream, providing cover and complexity required by all bull trout life stages. The proposed action would reduce the availability of large woody debris due to its removal. Sufficient large wood is lacking in many western Washington streams and rivers, reducing pool habitat, cover, and the complexity of these aquatic systems. We anticipate that the loss of large woody debris due to the removal of riparian vegetation will have a measurable effect on bull trout due to the loss of in-water structure and pool formation provided by this woody material. A reduction in pools and in-water structures may result in less cover and cool water refugia for bull trout. We anticipate that the effects will primarily result in physiological stress to bull trout due to their potential use of less suitable habitats or increased movement to find more suitable areas with adequate cover and cooler water temperatures. Therefore, the removal of up to 16.4 acres of riparian vegetation may result in measurable effects to bull trout that significantly impair bull trout sheltering behaviors.

Conclusion - Effect of Riparian Vegetation Removal on Bull Trout due to the Proposed Action

Although some streamside shade could be reduced due to the removal of riparian vegetation, water temperature is not expected to be affected within any 5th-field watershed or bull trout local population given the localized and relatively small loss of riparian shade that may be removed. WSDOT proposes to restrict the number of projects that may result in adverse effects to bull trout to no more than five per 5th- field watersheds per year, and no more than one project per year is permitted within a local population (Northwest Region only).

The removal of riparian vegetation in the form of trees (greater than 4 inches dbh) is anticipated to result in measurable effects to bull trout due to the loss of future large woody debris. The

effect of the removal of trees may be a temporary at some sites, but long-term impact due to the time delay in any growing trees to pre-project conditions. Between 100 ft^2 to 0.63 acres of riparian vegetation may be removed per project. As stated above, not all of this may occur near streams used by bull trout or their prey. However, we have assumed due to the programmatic nature of this project, that this would be the maximum removed due to the proposed action. Therefore, we anticipate the removal of up to 16.4 acres of riparian vegetation may result in adverse effects to juveniles, adults, and subadult bull trout due to the loss of large woody debris that will affect their ability to find suitable cover. These effects are considered long-term due to the time delay in obtaining riparian trees of sufficient diameter to function as large woody debris.

Effects of Bank and Streambed Hardening to Instream Habitat

The proposed action may result in adverse effects due to bank and streambed hardening of instream habitat associated with the following programs: Environmental Retrofit and Enhancement; Bridge Repair; Retrofit, Replacement, and Maintenance Program; Bank Stabilization and Flood Damage Repair Program; and Slide Abatement and Repair Program. The Southwest Region may not implement activities that may result in adverse effects to bull within the Lower Columbia Basin Interim Recovery Unit.

The following activities may result in the placement of bank hardening materials that may negatively affect bull trout and/or their prey.

- Culvert replacement and/or installation
- Culvert extension
- Widening an existing bridge
- Bridge removal, replacement, and/or reconstruction
- Bank stabilization and flood damage repair
- Slide abatement

The proposed project may result in up to 2.6 miles and 4.1 acres of new armoring (Table 27). Some of the armoring will occur along the toe of the slope as well as within scour holes adjacent to bridge piers. No more than 300 cy (approximately 750 ft^2) of riprap or other bank hardening material may be placed below ordinary high water as part of a proposed project or within a stream reach. No more than 100 linear ft of streambank may be impacted per project or stream reach.

Table 27. Approximate proposed bank and stream bed hardening.

Activity	Number of Proposed Projects per Year per Northwest and Olympic WSDOT Region	Total Number of Projects Over Life of Programmatic	Linear Ft of Bank Affected per Project or Stream Reach	Linear Ft of Bank Affected Over Life of Programmatic	Square Ft of Stream Bed Affected per Project or Stream Reach	Square Ft of Stream Bed Affected Over Life of Programmatic
Bridge scour	5	50	100	5,000	750	37,500
Bank stabilization	2	20	100	2,000	750	15,000
Culvert replacement, installation, or extension	15	150	33.6[1]	5,040	750	112,500
Slide abatement	2	20	100	2,000	750	15,000
Total	24	190	333.6	14,040 (2.6 miles)	3,000	180,000 (4.1 acres)

[1] Value base one the maximum culvert diameter anticipated (32 ft plus 5 percent). This likely is an over estimate of potential impacts as some culverts would be smaller and require less bank hardening.

Impacts to hydrology due to placement of directional barbs, riprap, or other in-water structures may occur due to the proposed action. Additionally, there will be a reduction in rock and gravel depositions into stream and river systems due to bank hardening and slide abatement activities. Placement of riprap in pools associated with bridge scour will result in loss of cover and cold water refugia for bull trout, especially where pools are limited.

The proposed bank hardening activities are similar to those that occur during channelization. Bolton and Shellberg (2001) describe channelization as the deliberate or indeliberate alteration of one or more of the interdependent hydraulic variables of slope, width, depth, roughness, or size of sediment load. Thus the effects of the habitat alteration within the action area related to bank hardening are evaluated here as channelization.

Channelization activities, such as the placement of riprap, have immediate and direct effects on stream processes because these involve direct modification of the river channel. These effects result in both physical and biological changes that lead to various alterations of biological systems. The changes affect benthic macroinvertebrates, fish, and aquatic riparian vegetation from algae and macrophytes to riparian shrubs and trees, as well as terrestrial animals such as amphibians, reptiles, birds, and mammals.

A typical sequence of events that occurs after a channelization activity leads to immediate changes in physical aspects of the channel. These physical changes lead to longer-term biotic responses that extend over space and time (Simpson et al. 1982 in Bolton and Shellberg 2001). The biological effects may be in response to the physical changes in depth, shade, sediment, temperature, altered hydrology, isolation of floodplain habitats, etc., or they may be in response to changes in nutrient cycling and changes in populations of various trophic levels that are transmitted throughout the biological system. Streamflow, stream velocity, channel morphology, vegetation, and channel substrate are all affected by channel activities. The physical nature of stream channels reflects a continuous re-adjustment of the interrelated variables of discharge, slope, channel width and depth, flow velocity, channel roughness, and sediment characteristics (Brookes 1988 in Bolton and Shellberg 2001). Stream bank hardening (also known as hydromodification) prevents channel migration and reduces large woody debris recruitment into the aquatic system.

The effects of streambank alteration are not limited to the wetted stream channel itself. Connectivity longitudinally (up and downstream), laterally (floodplain and uplands), and vertically (groundwater, hyporheic, and phreatic) are major features of stream corridors (Stanford and Ward 1992 in Bolton and Shellberg 2001). The temporal nature of the system adds a fourth dimension (Ward 1989 in Bolton and Shellberg 2001). These linkages mean that the effects of channelization can be transmitted over areas far beyond the actual work zone. Impacts include changes in hydrology, biology, morphology, and water quality (Brookes 1988 in Bolton and Shellberg 2001).

Typically, changes due to human activities in the channel migration zone result in a reduction in habitat diversity, which affects the numbers and kinds of animals that can be sustained (Schenberger and Funk 1971; Hahn 1982; Simpson et al. 1982; all in Bolton and Shellberg 2001). As the physical habitat changes, stresses are placed on individual plants and animals. These stresses, depending on the tolerance of the species and individual, may limit growth, abundance, reproduction, and survival (Lynch et al. 1977 in Bolton and Shellberg 2001). Biologically important parameters that change following channel activities include water temperature, turbidity, flow velocity, variable water depths, hydrologic regime, a decrease or change in vegetation, changes in storage of organic matter and sediment, and changes in the size and stability of channel substrate (Hahn 1982 in Bolton and Shellberg 2001). These changes can decrease habitat connectivity and the exchange of energy and matter between habitats. The direction of change varies by site and circumstance.

There are studies that have looked at the biological effects of specific structures and bank stabilization techniques, such as riprap, spur dikes, and revetments. Hjorte et al.(1984 in Bolton and Shellberg 2001) looked at fish and invertebrates along revetments and natural channel areas of the Willamette River, Oregon. Hjorte et al. (1984 in Bolton and Shellberg 2001) found different numbers and species of fish and invertebrates in natural stream areas compared to riprap banks. Fewer fish species used riprap areas in high densities than used natural areas. Fish found in revetment areas tended to be species that fed on algae or diatoms growing on the stones or that fed on bottom dwelling invertebrates. Invertebrates found in the revetments were species that preferred a very stable bottom and either clung to the stones or hid in crevices. More fish

species were found in areas with natural banks due to the greater diversity of habitat in these areas.

Peters et al.(1998) looked at seasonal fish densities in Washington at sites with various bank stabilization structures. They conducted a survey of typical bank stabilization methods and found that 496 of 667 projects used riprap or riprap with deflectors. Only 29 projects used bioengineering or large woody debris. Of all project types (riprap, riprap with large woody debris, rock deflectors, rock deflectors with large woody debris) surveyed by Peters et al. (1998), only sites stabilized with large woody debris consistently had higher fish densities in spring, summer, and winter than the control sites without any stabilization structures. Riprap sites consistently had lower densities than control sites. At all sites, fish densities were generally positively correlated with increasing surface of large woody debris and increasing amounts of overhead riparian cover within approximately 12 inches of the water surface.

Conclusion - Effects of Bank Hardening on Bull Trout due to the Proposed Action

The effects of the proposed habitat alterations on bull trout would occur at the time of placement of riprap and other in-water structures. These alterations are permanent. As bull trout must pass these areas to go to and from their spawning grounds, it is likely that thousands of bull trout would be affected to varying degrees by this habitat alteration over the life of each project. The actual number of bull trout that would be adversely impacted by bank hardening is probably a small percentage of the individuals that would be exposed to this action. Channel morphology and natural sediment regime (i.e., filling potential holding pools) would be further degraded and further disrupt normal bull trout migration and overwintering. Additionally, the riprap and in-water structures would further degrade the existing habitat conditions, reducing the ability of the waterbodies to support bull trout prey. We therefore anticipate that adult, subadult, and juvenile bull trout associated with riprap and other bank/bed hardening material of up to 2.6 miles of stream bank and up to 4.1 acres of stream bed would be adversely impacted due to the loss of pools, foraging, rearing, and overwintering habitat, and further degradation of the existing habitat. The majority of bull trout that may be impacted are likely to be adult and subadults rather than juveniles as only one project per year is permitted within a local population (Northwest WSDOT Region only). These impacts would result in measurable effects of feeding and sheltering behaviors of individual bull trout. However, these effects to bull trout will be limited in scope due to the small area impacted per project, and the number of projects permitted under this programmatic.

Beneficial Effects

In addition to adverse impacts to bull trout, we also anticipate some beneficial affects due to the proposed action, primarily due to the removal of culverts that create barriers to fish movement. The long-term beneficial effects of the proposed action may aid bull trout recovery and enhance the likelihood of survival for bull trout in the interim recovery unit. For those culverts that are currently functioning as fish barriers, beneficial effects are anticipated by restoring access for bull trout to FMO and spawning/rearing. The Service expects this action will:

- Restore passage for all life stages of bull trout through culverts resulting in improved upstream access to spawning, rearing, foraging, migration, and over-wintering habitat;
- Increase distribution of bull trout within and between populations;
- Increase abundance and reproductive potential of bull trout at the local and population levels;
- Improve population viability through enhanced resilience against disease, drought, hybridization, small-scale habitat loss, and other stochastic events at the local and population scales;
- Improve stream function, particularly sediment and debris conveyance, which should result in the near-normal function of natural processes to greatly improve habitat conditions for bull trout habitat;
- Enhance genetic exchange potential at the population and local population scales.

Cumulative Effects - Bull Trout

Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this PBO. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

The effects of non-Federal actions on bull trout and bull trout critical habitat cannot be precisely estimated or quantified due to the variety of State, Tribal, and local actions that may occur over the time-period covered by this PBO (5 years). There are generally four broad categories of impacts that could occur within the action area: 1) growth and development, 2) forest management, 3) habitat rehabilitation and restoration projects, and 4) other habitat-altering activities.

<u>Growth and Development</u>

Washington's population grew from 4.1 million people in1980 to 6.4 million people in 2006 (WSDOT 2007b). Growth on the west side of the Cascades in the Puget Sound area accounted for 50 percent of the total population growth in the 1990s down from 75 percent in the 1980s (U.S. Census Bureau 2000). Clark, San Juan, and Grant Counties had the fastest growing populations. San Juan County grew by 40 percent (U.S. Census Bureau 2000). In Washington, the top 10 counties with regard to highest populations in 1999 are the following in order, highest to lowest: King, Pierce, Snohomish, Spokane, Clark, Kitsap, Yakima, Thurston, Whatcom, and Benton (U.S. Census Bureau 2000). Since January of 1990, 14 new cities have been created in Washington State (U.S. Census Bureau 2000). It is likely that population growth and development since 1999 has continued to exhibit a similar pattern and will continue to do so into the future. On the western side of Washington, population growth and residential development are centered in the Puget Trough area in Seattle, Tacoma, Olympia, and Vancouver. These areas will continue to expand east toward the foothills of the Cascade Mountains, west toward the Kitsap Peninsula and north and south along the I-5 corridor.

Residential and commercial development tends to occur in low elevation, low gradient floodplains, or foothills, following highway corridors. This type of development permanently converts suitable habitats and provides little to no benefits to bull trout. Habitat fragmentation, habitat loss, and habitat degradation are expected to continue as development creates a demand for new public services and facilities. Impacts caused by human development have had, and will continue to have adverse impact on bull trout.

Forest Management

Washington State encompasses 66,582 square miles. Approximately 14,063 square miles are under Federal management, including 13,811 square miles covered under the Northwest Forest Plan in Washington State. Approximately 9.3 million acres are covered under the WDNR FPHCP, of which 6.1 million acres occur on the west of the Cascade Crest. The Federal lands and lands covered by HCPs are considered part of the environmental baseline.

Intensive forest management generally results in adverse impacts such as loss of older forest habitats and habitat structures, increased fragmentation of forest age classes, loss of large contiguous and interior forest habitats, decreased water quality, degradation of riparian and aquatic habitats, and increased displacement of individuals.

WDNR has transferred authority for Class IV-General forest practices, for Thurston, King, and Clark Counties, and Port Townsend, where the forestland is likely to be converted to non-forest uses. In other parts of the State, WDNR addresses Class IV-General forest practices, although other counties are actively working on obtaining authority from WDNR in the near future. These activities could affect aquatic resources and would not be considered Forest Practices HCP covered activities or lands. Also, timber harvest under the 20-acre exemption rule that is outside of the proposed FPHCP permit coverage (e.g., conversions) would have a cumulative effect on bull trout.

Non-Federal landowners may take steps to curtail or avoid land management practices that would harm or harass bull trout, or seek incidental take exemptions through section 10(a)(1)(B) of the ESA. However, there is no certainty that this will occur. Therefore, the Service assumes future non-Federal actions in Washington are likely to continue over the next several years, and these actions will cumulatively affect bull trout. The Service anticipates the majority of cumulative effects will occur within bull trout foraging, migratory, and overwintering habitats where the greatest concentration of non-Federal lands occur.

Habitat Rehabilitation and Restoration Projects

Since 1999, salmon and bull trout restoration efforts have removed approximately 3,538 barriers to fish passage, opening up more than 3,658 miles of streams, and have protected approximately 37,000 acres of habitat to protect and conserve salmonids (Drivdahl 2008, pp. 24-26). It is likely that both Federal and State funding for salmon and bull trout habitat restoration will continue into the future. Local groups are starting to take a watershed approach to understanding what habitat related issues exist in their watersheds and how to effectively address these issues. Additionally, local groups are identifying and acquiring key parcels of land that support salmon

habitat and removing the potential for future development of those parcels. This effort and the funds provided for it should lead to an improvement in riparian and aquatic habitats in Washington, and over the long-term should benefit the riparian- and aquatic-dependent species, including bull trout. Because State and Federal funding is co-mingled in this process, it is difficult to distinguish between State and federally-funded actions. A significant number of these habitat restoration and rehabilitation projects will require Federal permits and will be reviewed through section 7 of the ESA, and would not be considered under the cumulative effects section.

Other Habitat-Altering Activities

Agriculture

Farmlands tend to occur in low elevation, low gradient areas in the action area. In Western Washington it is likely that most habitat conversion to agricultural lands occurs along valleys and in the Puget Trough. However, from 1969 to 2002, farmland acres decreased from 17,559,187 acres to 15,318,008 acres, a decrease of 2,241,179 acres (WSDOT 2007b). Residential and commercial development will likely continue to occur in current agriculture areas, resulting in a permanent loss of those habitats to development. Conversion of agricultural land to residential and commercial uses will likely result in changes in water quality and quantity. As more impervious surfaces are created, chemicals associated with urban stormwater runoff rather than agricultural lands will enter waterbodies that are used by bull trout.

Other

Other management actions can occur in and adjacent to suitable habitats. These activities include recreation, grazing, fishing, hunting, gathering, water withdrawal, effluent discharges, and mineral extraction. Various impacts to bull trout and their habitat from these activities include removal of native vegetation; changes in vegetation composition; introduction of invasive nonnative species; degradation of water quantity and quality; erosion of streambanks; and declines of salmon carcasses for nutrient cycling. These effects further degrade bull trout habitat and negatively impact bull trout individuals.

Summary of Cumulative Effects

Increasing development and sprawl in Western Washington will continue to be a contributor to the decline of bull trout in the action area. Forest habitat conditions will improve in some places. Habitat rehabilitation and restoration projects will likely have some short-term negative impacts; however, over the long-term these activities are likely to benefit bull trout habitat. Actions on State, Tribal and private lands such as urban development and the associated increase in impervious surfaces, logging, road building, agricultural conversion, water withdrawals, fishing, mineral extraction, and recreation will continue to contribute to population declines and degradation of bull trout and their habitat.

Integration and Synthesis - Bull Trout

The above analysis forms the foundation for our jeopardy analysis, which is intended to determine whether we would reasonably expect threatened or endangered species to experience reductions in reproduction, numbers, or distribution that would appreciably reduce the species' likelihood of surviving and recovering in the wild and/or the destruction or adverse modification of designated critical habitat. We identify reductions in the bull trout's likelihood of surviving and recovering in the wild by qualitatively analyzing the probable effect of changes in reproduction, numbers, and distribution based on the probability of the species to persistence over time, at the scale of the coterminous range. While modeling efforts can be helpful in analyzing these relationships, in this case, the lack of abundance, demographic, and fecundity data for bull trout in the action area, coupled with the fact that the majority of the expected effects are sublethal, made this impracticable. Below, we describe how the expected effects of the project will relate to the survival and recovery of bull trout at the project, local population, core area, and interim recovery unit scales.

The proposed project will result in the following adverse effects to bull trout and their habitat (Table 28).

Table 28. Effects to bull trout due to the proposed WSDOT Programmatic.

ACTIVITY	**Extent of Effects to Bull Trout Over Life of Programmatic (5 years) (number of total individuals)**	**Extent of Effects to Bull Trout Over Life of Programmatic (5 years) (number of total individuals by effect type)**	
Capture and Handling of Bull Trout		**Death or Physical Injury**	**Harassment**
Block nets	50 juveniles	3 juveniles	47 juveniles – capture and handling
Minnow traps, seines and dip nets	420 juveniles, subadults, adults	0	420 juveniles, subadults, adults – capture and handling
Electroshocking	171 juveniles, subadults, adults	43	128 – capture and handling
Stream Dewatering	9 juveniles, subadults, adults	1 juvenile	8 juveniles, subadults, adults – capture and handling
Total Individuals	**650**	**47**	**603**
Construction Activities	**Extent of Effects to Bull Trout Habitat Over Life of Programmatic (5 years)**	**Death or Physical Injury**	**Harassment**
Sediment and Turbidity	3,000 ft (0.6 mile) juveniles/fry/eggs 285,000 ft (54 miles) adults/subadults	0.6 mile associated with juveniles/fry/eggs	54 miles associated with adults/subadults – displacement; disruption of normal behavior
Stormwater Contaminants[2]	1.7 miles associated with adults/subadults	0	1.7 miles associated with adults/subadults - displacement; disruption of normal behavior
Bank hardening	14,040 ft (2.6 miles) associated with adults/subadults and juveniles	0	14,040 ft (2.6 miles) associated with adults/subadults and juveniles- displacement; disruption of normal behavior
Stream bed hardening	180,000 ft^2 (4.1 acres)	0	180,000 ft^2 (4.1 acres)
Riparian vegetation removal	16.4 acres associated with adults/subadults and juveniles	0	16.4 acres associated with adults/subadults and juveniles - displacement; disruption of normal behavior
Pile driving activities	108 miles associated with adults/subadults	8 miles associated with adults/subadults	100 miles associated with adults/subadults - displacement; disruption of normal behavior
Total Miles/Acres of Habitat Impacts	166.9 miles 20.5 acres	8.6 miles	158.3 miles 20.5 acres

Up to 650 individual bull trout may be captured and handled over the 5 years of implementation of the programmatic. Fish capture and handling will primarily result in sublethal effects to individuals (up to 603 over 5 years). Sublethal effects due to fish handling are anticipated to be short-term, resulting in temporary changes in movement and other non-breeding behavior. In addition, some mortality or physical injury is expected due to block nets, electroshocking and stranding (up to 47 total individuals).

Also, bull trout associated with up to 8.6 miles of stream associated may experience physical injury or death to bull trout. Of this, 0.6 mile is within spawning and rearing habitat, the remainder is in foraging, migration, and overwintering habitat. An additional 158.3 miles and 20.5 acres of instream and riparian habitat may be affected where bull trout experience significant modification of foraging, migration, and sheltering behaviors. Some of these effects will be periodic but in perpetuity, such as effects due to stormwater discharges; others will be short-term and temporary, such as increased sound pressure. Due to the patchy nature of bull trout use in streams, we are unable to determine the actual number of individuals that may be affected due the proposed action, and will use habitat as a surrogate.

The effects proposed will be distributed among the 13 core areas and 17 FMOs outside of core areas within the Olympic and Puget Sound Management Units of the Coastal Puget Sound Draft Interim Recovery Unit. Up to 240 construction related and 200 fish capture and handling activities that result in these adverse effects to bull trout may occur over the 5 years that the programmatic is in place. The WSDOT Northwest and Olympic Regions are limited to five projects per 5th-field watershed per year, including one project per year within a local population (Northwest Region). The regions cannot exceed a total of 20 capture and handling and 24 construction projects per year each for these two WSDOT Regions if they result in adverse effects to bull trout.

The majority of the proposed projects will occur in Core Area FMO and FMO outside of Core Areas, as projects that may adversely affect bull trout in a local population are limited to 1 per year, for a total of 5 projects within the WSDOT Northwest Region. There are over 80 5th-field watersheds, 12 local populations, 13 Core Areas, and 17 FMOs outside of Core Areas where adverse effects may occur within the action area. No local populations within the Olympic Management Unit will be affected due to the proposed action.

The Service conducted a GIS based risk assessment (Appendix G) to evaluate the potential risk of bull trout exposure to the proposed project at the local population and core area scale. This analysis also looked at the baseline conditions within these areas to evaluate the additive effects of the proposed action.

The Service looked at the risk of exposure, baseline habitat risk, and baseline population risk within a local population. Exposure risk was determined based on the percentage of stream habitat within 300 ft of WSDOT roads and stream crossings within a local population. Baseline habitat risk used spatial and non-spatial information and was assessed through the bull trout "Matrix of Pathways and Indicators" (USFWS 1998). Baseline population risk was estimated using the number of adult spawners and trend status within a local population. Table 29 summarizes the results of this analysis. Although two local populations were determined to be at

a “high” exposure risk due to the high percentage of WSDOT roadways and/or stream crossings (i.e., Upper North Fork Nooksack and Ruby Creek), none of the local populations was deemed at a high overall risk due to the proposed action and existing baseline conditions.

Table 29. Overall potential risk rankings for local populations with moderate to high exposure risk.

Core Area	Local Population	Exposure Risk	Habitat Risk	Population Risk	Overall Potential Risk
Nooksack	Upper NF Nooksack	H	M	M	M
Nooksack	Middle NF Nooksack	M	M	M	M
Nooksack	Lower NF Nooksack	M	M	M	M
Puyallup	Greenwater River	L	H	M	M
Snohomish/Skykomish	SF Skykomish River	M	M	M	M
Lower Skagit	Goodell Creek	L	L	H	ML
Puyallup	Upper White River	M	L	M	ML
Upper Skagit	Ruby Creek	H	L	L	ML
Puyallup	Carbon River	L	L	M	L
Stillaguamish	NF Stillaguamish	L	M	L	L
Lower Skagit	Bacon Creek	L	L	L	L
Nooksack	Glacier Creek	L	L	L	L

The proposed action allows up to one project to occur per year in a local population. No pile driving, new stormwater outfalls, or new pollution generating impervious surfaces that may result in increased contaminants entering these waterbodies are permitted within local populations. Up to 600 ft of stream may be affected per project due to sediment pulses occurring post-construction affecting egg survival, fry emergence, and juvenile rearing habitat. No more than 600 ft of stream within a local population may be affected due to sediment and/or turbidity. Although these impacts may result in injury or death to these early life stages, the effects are likely to be temporary (up to 1 year). Some activities, such as bank stabilization and riparian vegetation removal, may occur within a local population, resulting in long-term impacts. However, these impacts are limited in scope (no more than 100 ft of bank stabilization and 0.63 acre of riparian vegetation removal per local population). Based on the bull trout risk analysis and this information, while we anticipate some mortality of individuals within a local population, we do not anticipate that this loss will be significant at the local population scale.

A Core Area risk analysis was also performed for the proposed action, focusing on those Core Areas that had at least one local population at moderate to high exposure risk due to the proposed project (Table 30). FMO exposure risk was defined as the percent FMO stream habitat within 300 ft of a WSDOT road. FMO habitat risk was based on use of the “Matrix of Pathways and Indicators (USFWS 1998).” Core Area population risk was based on average, annual spawner abundance in the core area.

Table 30. Overall potential risk rankings for core areas with at least one local population at moderate to high exposure risk.

Core Area	FMO Exposure Risk	FMO Habitat Risk	Core Area Population Risk	Overall Potential Risk
Puyallup	M	H	M	M
Snohomish/Skykomish	M	M	M	M
Nooksack	L	M	M	ML
Upper Skagit	H	L	L	ML

Integrating the results of the core area and local population overall potential risk rankings indicate that none of the core areas are at major levels of risk from WSDOT programmatic activities. However, the Puyallup core area appears to be at the highest risk of all core areas exposed to WSDOT programmatic activities, followed by the Snohomish-Skykomish core area.

Some mortality and physical injury of bull trout are anticipated within FMOs, primarily due to pile driving (up to 8 miles of bull trout associated with instream habitat). Mortality and injury may also occur within FMOs due to capture and handling activities. The remainder of the effects are due to changes in foraging, migration, and sheltering behavior. Some of these effects will be short-term, such as sediment production; others long-term, such as loss of large woody debris associated with riparian vegetation removal, increased contaminants from stormwater, and changes in flow and hydrology. However, these effects are limited in scope within the FMO and Core Areas due to the proposed number and limited extent of impacts associated with the proposed action. This includes no more than five projects per 5th-field watershed, no more than one new stormwater outfall per FMO, and limited riparian removal and bank protection per stream reach over the 5 years. While we anticipate some loss of individuals and long-term behavioral changes to bull trout due to the proposed action, based on this information and the risk analysis, we do not anticipate that this loss will be significant at the Core Area scale.

Additionally, there is a potential long-term net benefit associated with some of the proposed activities implemented as a result of the proposed action that may aid the recovery of bull trout by improving the number, distribution, and reproductive potential of bull trout. These actions include removal of instream fish barriers and wetland and instream restoration activities. However, sublethal and lethal effects to bull trout will result from implementation of the proposed action in those streams where existing culverts currently pose a barrier to movement.

Interrelated or Interdependent Actions

The only interrelated or interdependent actions anticipated are associated with the relocation of utility lines. We anticipate that these actions will occur within bull trout habitat already affected as part of the proposed action and no further habitat removal would be required. Therefore, we do not anticipate that utility relocation actions will result in additional effects to bull trout or their habitat beyond those considered as part of the proposed action.

Conclusion - Bull Trout

The purpose of consultation under section 7(a)(2) of the ESA is to ensure that agencies do not carry out actions that would jeopardize a listed species. After reviewing the current status of bull trout, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the WSDOT Western Washington Regions programmatic consultation, as proposed, is not likely to jeopardize the continued existence of the bull trout.

Although the loss of eggs, fry, juveniles, subadults, and adult bull trout is detrimental, the Service concludes the losses will not appreciably affect the survival and recovery of bull trout because:

- No mortality is anticipated to occur to adult spawning fish, which will maintain the reproductive potential during the 5-year implementation period, even in depressed core areas.

- Potential injury and/or mortality associated with the temporary (construction-related, including fish capture and handling) effects of the proposed project are expected to impact so few individual bull trout within each core area that the effects will not be measurable at this scale.

- The long-term, sublethal effects are not expected to measurably reduce productivity at the scale of each core area.

- The Service expects a long-term increase in bull trout population viability and resilience to stochastic events due to improved connectivity within and between core areas that should result in increased genetic exchange with the removal of fish-blocking culverts.

- The Service expects that the reproductive potential of the affected bull trout core areas will gradually increase during and after the implementation period due to the increase in available spawning and rearing habitat provided by removing fish-blocking culverts.

- Because negative effects will not be discernable at a core area scale, we do not expect that the effects of the proposed project will reduce the species' likelihood of survival and recovery in the wild. Additionally, the proposed action may improve the likelihood of recovery due to the removal of instream barriers and potential for increased genetic exchange.

Effects to Bull Trout Critical Habitat

The proposed action may affect bull trout critical habitat within the Coastal-Puget Sound Interim Recovery Unit, including Puget Sound Critical Habitat Unit (Unit 28) and the Olympic Peninsula Critical Habitat Unit (Unit 27). The following minimization measures are proposed in the PBA and will minimize impacts of the proposed action to bull trout critical habitat. These measures

are considered part of the proposed action, and are taken into account in determining the effects of the proposed action on bull trout critical habitat.

MM-1	MM-2	MM-6	MM-21	MM-27	MM-28	MM-29	MM-30
MM-31	MM-32	MM-33	MM-34	MM-35	MM-36	MM-37	MM-38
MM-39	MM-40	MM-41	MM-42	MM-43	MM-44	MM-45	MM-46
MM-47	MM-48	MM-49	MM-50	MM-51	MM-52	MM-53	MM-54
MM-55	MM-56	MM-57	MM-58	MM-59	MM-60	MM-61	MM-62
MM-63	MM-64	MM-65	MM-66	MM-67	MM-68	MM-69	MM-70
MM-71	MM-72	MM-73	MM-74	MM-75	MM-76	MM-77	MM-78
MM-79	MM-80	MM-81	MM-82	MM-83	MM-84	MM-85	MM-86
MM-87	MM-89	MM-90	MM-91	MM-92	MM-93	MM-94	MM-95
MM-96	MM-97	MM-98	MM-99	MM-100	MM-103	MM-104	

We have analyzed the activities listed in Table 1 that may affect bull trout critical habitat in Units 27 and 28 of the Coastal-Puget Sound IRU due to the proposed action. Not all of the activities identified will result in measurable impacts or occur within bull trout critical habitat.

WSDOT proposes the following activities within bull trout critical habitat annually per WSDOT Northwest and Olympic Regions, adverse effects for up to 5 bridge scour repairs, 2 slide abatement and repair projects, 2 emergency bank stabilization projects, 5 projects such as culvert and bridge replacement, and 10 fish habitat and passage enhancement projects outside of the Lower Columbia Basin IRU.

In- and near-stream construction activities and the discharge of stormwater may affect bull trout critical habitat through the following stressors:

- Change in water temperature
- Change in water quantity
- Change in available instream habitat due to streambank and riparian habitat removal and restoration, and fish passage modifications.
- Increased sedimentation and turbidity
- Change in prey base
- Exposure to contaminants during construction and/or post-construction, including stormwater related pollutants
- Increased headcutting and slope failure

The following sections will describe the potential effects to bull trout critical habitat.

Insignificant and Discountable Effects to Bull Trout Critical Habitat

Some of the proposed activities are likely to result in insignificant or discountable effects to bull trout critical habitat, both individually and cumulatively. We have not specifically identified these activities, but instead have provided the conditions that must be met to demonstrate that the activity would not have measurable effects on bull trout critical habitat. The PBA determination form will provide the specific information regarding the effects of the specific activity and consistency with the described effects determination below.

Activities that are consistent with the following descriptions are unlikely to result in significant or discountable effects to bull trout critical habitat.

PCE #1: *Water temperatures that support bull trout use. Bull trout have been documented in streams with temperatures from 32 ºF to 72 ºF (0 ºC to 22 ºC) but are found more frequently in temperatures ranging from 36 ºF to 59 ºF (2 ºC to 15 ºC). These temperature ranges may vary depending on bull trout life-history stage and form, geography, elevation, diurnal and seasonal variation, shade, such as that provided by riparian habitat, and local groundwater influence. Stream reaches with temperatures that preclude bull trout use are specifically excluded from designation.*

- The proposed project does not include any activities that would directly or indirectly alter water temperature, such as the release of heated or cooled water, the extraction or addition of water, the increase or decrease of water depth, or the removal of shading vegetation.

  - The proposed project would be implemented such that water temperature would not be affected. Therefore, the effects to PCE #1 are considered discountable.

or

- The proposed project may alter the water temperature in the immediate vicinity of the project area, but the increase or decrease would be short-term, difficult to detect, and/or limited in extent.

  - The proposed project would be implemented such that effects to water temperature would not be difficult to detect and unlikely to measurably affect the function of PCE #1. Therefore, the effects to PCE #1 are considered insignificant.

PCE #2: *Complex stream channels with features such as woody debris, side channels, pools, and undercut banks to provide a variety of depths, velocities, and instream structures.*

- The proposed project site is located in a lake and would not result in direct or indirect effects to PCE #2 in stream reaches elsewhere in the watershed.

- Therefore, no effects to PCE #2 are expected to occur.

or

- The proposed project site is located in marine waters where this PCE does not occur.

  - Therefore, no effects to PCE #2 will occur.

or

- The proposed action would not include any activities that would increase or decrease channel complexity in the action area. No large woody debris or other habitat-forming components would be removed from or adjacent to the stream, and the project would have no measurable effect on any existing side channels, pools, undercut banks or other features in the action area that provide complex habitat for bull trout or their prey species.

  - As the proposed action would not measurably change the stream complexity, the effects to PCE #2 are expected to be insignificant.

or

- The proposed project would improve channel complexity in the action area through the addition of large woody debris and/or other habitat-forming structures, pools, side channels, and/or other stream features.
- No measurable short- or long-term construction-related impacts to PCE #2 are anticipated.

  - These improvements are expected to enhance existing habitat for bull trout and/or their prey species.
  - The effects to PCE #2 are expected to be wholly beneficial.

or

- The proposed project would improve channel complexity in the action area through the addition of large woody debris and/or other habitat-forming structures, pools, side channels, and/or other stream features.

  - These improvements are expected to enhance existing habitat for bull trout and/or their prey species. Short-term construction-related impacts to PCE #2, such as through sediment releases, are anticipated; however, such impacts are expected to be minor and are not expected to measurably impact the function of bull trout critical habitat.
  - Therefore, effects to PCE #2 are anticipated to be insignificant.

PCE #3: *Substrates of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. This should include a minimal amount of fine substrate less than 0.25 inch (0.63 centimeter in diameter).*

- The proposed project site is located in a lake and would not result in direct or indirect effects to this PCE in stream reaches elsewhere in the watershed.
    - Bull trout spawning and early rearing do not occur in this habitat.
    - Therefore, no effects to PCE #3 will occur.

or

- The proposed project site is located in marine waters.
    - Bull trout spawning and early rearing are not expected to occur in this habitat.
    - Therefore, no effects to PCE #3 will occur.

or

- The proposed project would not alter the amount, size, or composition of substrate in the action area via the removal, addition, or displacement of substrate or other materials.
    - Therefore, effects to PCE #3 are expected to be discountable.

or

- The proposed project may alter the amount, size, or composition of substrate, but the action area is not expected to support bull trout spawning or early rearing due to unsuitable water temperatures.
    - Although subadult and/or adult bull trout may use the action area (for foraging, migration, or overwintering), the effects to PCE #3 from the proposed project would not impact the suitability of the habitat for use by these life stages.
    - Therefore, effects to PCE #3 are expected to be discountable.

PCE #4: *A natural hydrograph, including peak, high, low, and base flows within historic ranges or, if regulated, currently operate under a biological opinion that addresses bull trout, or a hydrograph that demonstrates the ability to support bull trout populations by minimizing daily and day-to-day fluctuations and minimizing departures from the natural cycle of flow levels corresponding with seasonal variations.*

- The proposed project site is located in marine waters where PCE #4 does not occur.

    - Therefore, no effects to PCE #4 will occur.

or

- The proposed action would not alter the natural or regulated hydrograph of the water body. No water would be added or withdrawn as a direct or indirect result of this project.

    - The proposed project is not expected to measurably affect surface or subsurface flows to the waterbody via runoff from impervious surfaces, stormwater flows, watershed alteration, or other sources.
    - Therefore, effects to PCE #4 are expected to be discountable.

or

- The proposed action may temporarily alter the natural or regulated hydrograph of the waterbody via the pumping or diversion of flows during dewatering of a stream reach or other waterbody. However, the water would be returned to the system after settling or other filtration to remove suspended sediments.

    - The effects from the pumping or diversion of flows would be temporary and of short duration and are not expected to measurably affect bull trout critical habitat.
    - Therefore, effects to PCE #4 are expected to be insignificant.

PCE #5: *Springs, seeps, groundwater sources, and subsurface water to contribute to water quality and quantity as a cold water source.*

- The proposed project site is located in marine waters where PCE #5 does not occur.

    - Therefore, no effects to PCE #5 will occur due to the proposed project.

- The proposed action would not impact springs, seeps, groundwater sources, and/or subsurface water via extraction of water, interruption, or inhibition of subsurface water movement, or introduction of contaminants.

    - Therefore, no effects to PCE #5 will occur due to the proposed project.

- The proposed action may impact springs, seeps, groundwater sources, and/or subsurface water through the creation of impermeable surfaces or other activities.

    - The proposed project would not measurably alter the ability of such features to contribute to water quality and/or water quantity as a cold

water source through the obstruction of all or part of the connection between these sources and streams and/or other waterbodies in the action area.

- ➢ Therefore, effects to PCE #5 would be insignificant.

PCE #6: *Migratory corridors with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and foraging habitats, including intermittent or seasonal barriers induced by high water temperatures or low flows*.

- The proposed project would not impact the migratory corridor between spawning, rearing, overwintering, and/or foraging habitats via the introduction of physical, biological, or water quality barriers, including, but not limited to, high stream temperatures, suspended sediment releases, or releases of contaminants or other pollutants.

  - ➢ Therefore, effects to PCE #6 would be discountable.

- The proposed project may temporarily impact the migratory corridor as a result of suspended sediment releases, diversion of flows, and/or isolation of the work area during construction.

  - ➢ Impacts to the migratory corridor would be short-term and are not expected to measurably affect bull trout migration or movement through the action area. No other physical, biological, and/or water quality barriers to the migratory corridor are anticipated as a direct or indirect result of the proposed project.
  - ➢ Therefore, effects to PCE #6 would be insignificant.

PCE #7: *An abundant food base including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.*

- The proposed project may impact the food base of the bull trout through a small reduction of prey individuals, degradation of freshwater or marine habitat, and/or removal or alteration of riparian vegetation.

  - ➢ The impacts are not expected to be measurable due to the inclusion of Best Management Practices, conservation measures, mitigation, and/or other components of the project design that are expected to avoid, reduce, or compensate for the effects from these impacts.
  - ➢ Therefore, effects to PCE #7 would be insignificant.

PCE #8: *Permanent water of sufficient quantity and quality such that normal reproduction, growth, and survival are not inhibited.*

- The proposed project would not impact water quantity or water quality via the addition/extraction of water, introduction of contaminants or other pollutants, elevation of water temperatures, or through other pathways.

  - Therefore, effects to PCE #8 would be insignificant.

- The proposed project may impact water quantity and/or water quality via the addition/extraction of water, introduction of contaminants or other pollutants (e.g., suspended sediments), high water temperatures, or other pathways.

  - The impacts are not expected to be measurable due to the inclusion of Best Management Practices, conservation measures, and/or other components of the project design that are expected to avoid, reduce, or compensate for the effects from these potential impacts.
  - Therefore, effects to PCE #8 would be insignificant.

Potential Adverse Effects to Bull Trout Critical Habitat

This section analyzes the potential adverse effects of the proposed action to bull trout critical habitat. Potential direct effects include vegetation removal, increased sediment and temperature, and loss of instream habitat. We have calculated the potential impacts to bull trout critical habitat (Table 31) based on the number of proposed activities within critical habitat and the anticipated effects of each activity, as previously described. Please note that an activity may not adversely affect one or more PCE's; however, even if only one PCE is adversely affected, the project as a whole would be considered to have an adverse effect on critical habitat.

Table 31. Potential effects to bull trout critical habitat due to the proposed project.

Construction Activities	**Effects to Bull Trout Critical Habitat**	
	Annual	**5-year Total**
Sediment and Turbidity	600 ft (within spawning and rearing habitat) 28,800 ft (within FMO)	3,000 ft (within spawning and rearing habitat) 285,000 ft (within FMO)
Stormwater Contaminants[1]	unknown	1.7 miles (within FMO)
Bank hardening	2,808 ft	14,040 ft (2.6 miles)
Stream bed hardening	36,000 ft^2 (0.83 acre)	180,000 ft^2 (4.1 acres)
Riparian vegetation removal	3.28 acres	16.4 acres

[1] Includes effects from zinc, copper, and contaminate mixtures.

PCE # 1: Water temperatures that support bull trout use.

The proposed action would result in increased impervious surfaces and loss of riparian vegetation within the Olympic and Puget Sound CHUs. WSDOT proposes up to 172 acres of new impervious surfaces that may result in adverse effects due to changes in stream temperature. Additionally, WSDOT proposes the following riparian vegetation removal within bull trout critical habitat (Table 32). The WSDOT Olympic Region falls mostly within the Olympic CHU, with some overlap into the Puget Sound CHU. The WSDOT Northwest Region falls entirely within the Puget Sound CHU.

Table 32. Potential riparian vegetation removal within the WSDOT Olympic and Northwest Regions.

Potential Riparian Vegetation Impacts	**Olympic Region (per year)**	**Northwest Region (per year)**	**Total per Region for Programmatic**	**Total for Programmatic for the Olympic and Northwest Regions**
5 bridge scour repairs per region within bull trout critical habitat	3,810 ft^2	3,810 ft^2	19,050 ft^2 (0.44 acre)	0.88 acre
2 slide abatement and repair projects per region within bull trout critical habitat	1.26 acre	1.26 acre	6.3 acres	12.6 acres
2 emergency bank stabilization projects per region within bull trout critical habitat	200 ft^2	200 ft^2	1,000 ft^2	2,000 ft^2
5 projects such as culvert replacement and road repair per region within bull trout critical habitat	5,000 ft^2	5,000 ft^2	25,000 ft^2	50,000 ft^2
10 fish habitat and passage enhancement projects per region within bull trout critical habitat	10,000 ft^2	10,000 ft^2	50,000 ft^2	100,000 ft^2 (2.3 acres)
Total	1.64 acres	1.64 acres	8.2 acres	16.4 acres

Project elements such as the removal of upland vegetation, loss of riparian vegetation, and addition of new impervious surface are known to increase runoff and decrease infiltration. Reduced infiltration inhibits groundwater recharge, subsurface water exchange, and results in decreased baseflows. Reductions in baseflow, loss of shade from riparian vegetation, and reduced groundwater recharge and subsurface flows (as cold water sources) can lead to warming of the surface water in the critical habitat within the action area. In addition, as water moves

downstream through urbanized watersheds, heat accumulates unless there are downstream conditions (i.e., riparian vegetation) present to allow the accumulated heat to dissipate out of the system (Poole and Berman 2001). Project impacts may lead to slight localized temperature increases in the action area during low stream flows and when air temperatures are higher (e.g., summer). Additionally, discharge from springs and seeps into waterbodies within the action area may be disrupted and or reduced due to the construction of new impervious surfaces, further affecting water temperature. However, the proposed action will not result in measurable changes to instream flows, including baseflows, significantly reducing the likelihood that changes in stream temperature would occur as a result of the proposed action.

Additionally, although some streamside shade could be reduced due to the removal of riparian vegetation, water temperature is not expected to be affected within any 5th-field watershed or bull trout local population given the localized and relatively small loss of riparian shade that may be removed.

Minimization measures, such as the enhancement and revegetation of wetlands and riparian zones, help to minimize these impacts. However, there is no information regarding the location of wetland and riparian enhancement activities in relation to new impervious surface and vegetation removal activities.

In conclusion, effects to PCE #1 are not expected to measurably affect the function of PCE #1 within the action area. The effects are anticipated to be insignificant to the function of this PCE.

PCE #2: Complex stream channels with features such as woody debris, side channels, pools, and undercut banks to provide a variety of depths, velocities, and instream structures.

The proposed project would result in the removal of riparian vegetation, including trees, due to construction and/or safety requirements adjacent to critical habitat. Over 16 acres of riparian vegetation may be removed over the life of the programmatic within the Puget Sound and Olympic CHU. Loss of riparian vegetation precludes recruitment of large woody debris. Additionally, bank protection is proposed as part of emergency actions. Bridge scour actions may also result in additional use of hardened features, including riprap and concrete mattresses within the flowing channel. Filling of scour holes with riprap or other material will reduce the number of deep pools available to bull trout. Bank hardening is also likely to be placed adjacent to culverts and bridges. Bank hardening will preclude the reestablishment of large trees, simplifying the stream channel. Up to 2.6 miles of bank hardening and 4.1 acres of stream bed hardening may occur due to the proposed action. We therefore anticipate that the proposed riparian vegetation removal and banking and streambed hardening will measurably affect stream function. Therefore, adverse effects to PCE #2 are expected in bull trout critical habitat within the action area.

The proposed wetland mitigation, riparian plantings and placement of large woody debris is proposed as part of the action. However, information is not available on the location, amount, or timing of this work. Therefore, although beneficial affects may also result due to the proposed action, they are not fully known or committed to at this time. We are therefore unable to factor in the beneficial effects these projects may have on PCE #2.

PCE #3: Substrates of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. This should include a minimal amount of fine substrate less than 0.25 inch (0.63 centimeter) in diameter.

The increased turbidity caused by this proposed project may increase the percent of fines in the substrate within critical habitat in the action area. Although all instream work will incorporate timing windows to reduce impacts to spawning and rearing areas, post-construction rains and instream flows may result in the discharge of fines into spawning and rearing areas until disturbed areas are fully stabilized. Up to five projects may occur within local populations where this critical habitat function may occur. We anticipate that up to 3,000 ft of stream within critical habitat may be temporarily affected due to fines over the life of the action. The proposed project is therefore anticipated to have adverse effects on PCE #3 in the action area.

PCE #4: A natural hydrograph, including peak, high, low, and base flows within historic ranges or, if regulated, currently operate under a biological opinion that addresses bull trout, or a hydrograph that demonstrates the ability to support bull trout populations by minimizing daily and day-to-day fluctuations and minimizing departures from the natural cycle of flow levels corresponding with seasonal variation.

Project components, such as removal of vegetation and addition of new impervious surface are known to increase runoff and decrease infiltration. Increased runoff results in increased peak flows of surface water and reduced infiltration inhibits groundwater recharge and subsurface flow with the river, and consequently decreases base flow. However, due to the sideboards included in the programmatic, projects that cause or contribute to bed or bank scour or erosion (channel instability), and measurably and adversely affect base flows or flow durations in any TDA are not anticipated. Therefore, we do not anticipate that the proposed action will measurably affect PCE #4.

PCE #5: Springs, seeps, groundwater sources, and subsurface water to contribute to water quality and quantity as a cold water source.

Constant temperatures above 16 °C are not tolerated for bull trout (Poole et al. 2001, p. 5), but bull trout may migrate through these higher temperatures by utilizing areas of thermal refuge, such as a confluence with a cold water tributary, deep pools, or locations with surface and groundwater exchanges. Temperatures in some waterbodies within the action area may be at the high end of the range that bull trout are found. Therefore, continued groundwater flows from these underground sources are important to the continued use of these waterbodies by bull trout.

It is well understood that impervious surface and vegetation removal decreases infiltration, resulting in decreased groundwater recharge and loss of subsurface flow from the river. Given the degraded nature of the baseline in many stream systems within the action area, existing cold water sources provide critical “stepping stones” to upstream habitat. As these “stepping stones” are degraded, the ability of the waterbodies to support migratory bull trout is reduced. However,

due to the sideboards contained in this programmatic, projects that measurably and adversely affect base flows or flow durations in any TDA are not anticipated. Therefore, we do not anticipate that the proposed action will measurably affect PCE #5.

Also, wetland mitigation and enhancement are proposed as part of the proposed project, though specific details on location, type, and amount are not provided. Creation and enhancement of wetlands could have long-term beneficial effects to PCE #5 by improving floodplain connectivity and restoring subsurface water exchange, thereby acting as a cold water source.

PCE #6: Migratory corridors with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and foraging habitats, including intermittent or seasonal barriers induced by high water temperatures or low flows.

No permanent physical impediments to migration are expected to result from activities associated with the proposed project. However, increases in water temperature would be considered an impediment to use of a migratory corridor. The final listing rule for bull trout (64 FR 58910 [November 1, 1999]) documented steady and substantial declines in abundance in stream reaches where water temperature ranged from 15 °C to 20 °C. Temperatures in the waterbodies within the action area vary, with some already at the high end of the range that bull trout are found.

Project components such as removal of upland vegetation and addition of new impervious surface increase runoff and decrease infiltration. Reduced infiltration inhibits groundwater recharge and results in decreased baseflows. Low baseflows and reduced groundwater recharge (as a cold water source) can lead to warming of the surface water. However, due to the sideboards included in this programmatic, projects that measurably and adversely affect base flows or flow durations in any TDA are not anticipated. Therefore, we do not anticipate that the proposed action will measurably affect PCE #6 due to changes in flows.

Additionally, although riparian habitat may also be removed due to the proposed action, we anticipate that the impacts to temperature will be localized and difficult to detect due to the limited amount of vegetation that may be removed within a 5th-field watershed.

Temporary impacts to migration may also occur due to increased sediment during and post-construction. Sediment may be generated over several days, especially during and following the removal of coffer dams and other structures. We anticipate that effects due to sediment may impact up to 54 miles of critical habitat within the action area. These effects are expected to adversely affect the function of PCE #6; however, these effects would be temporary (up to 1 year).

The proposed action also includes the replacement of fish passage barriers. Replacement of these structures would result in improved passage at those locations that currently reduce or preclude bull trout movement. This would result in a long-term net beneficial effect to the function of PCE #6 for these activity types.

PCE # 7: An abundant food base including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.

The removal of riparian vegetation and the impacts to the substrate from increased fine sediment during and post-construction could decrease the invertebrate forage base for juvenile bull trout. However, considering the limited vegetation removal per proposed action and temporary nature of the impacts to sediment (1 year), the Service expects that the reduction in invertebrate forage base will not measurably affect the function of PCE #7, and will therefore be insignificant.

The aquatic action area contains forage fish (e.g., juvenile salmonids) for subadult and adult bull trout. These forage fish could be negatively impacted by the increased turbidity and disturbance in a similar fashion as bull trout. However, as with bull trout, these impacts are expected to be sublethal and temporary. The sublethal effects to forage fish (e.g. reduced health, displacement from optimal habitats, etc.) may make them temporarily more vulnerable to predation from bull trout. We, therefore, anticipate the effects to bull trout prey due to sediment and disturbance will be insignificant to the function of PCE #7.

PCE #8: Permanent water of sufficient quantity and quality such that normal reproduction, growth, and survival are not inhibited.

Due to the sideboards included in this programmatic, projects that cause or contribute to bed or bank scour or erosion (channel instability), and measurably and adversely affect base flows or flow durations in any TDA are not permitted under this PBO. Therefore, we do not anticipate that the proposed action will measurably affect PCE #8 due to changes in water quantity.

The short-term, adverse effects to water quality from increased turbidity and sediment associated with instream construction and post-construction is likely to occur. Water quality is expected to be negatively affected due to increased runoff from new impervious surface. The water quality impacts from some, but not all stormwater discharges, are likely to contain metals and other contaminants, even if treated, and may significantly degrade water quality within the mixing zone up to 300 ft downstream of stormwater outfalls. Up to 30 discharge locations may result in discharges that significantly affect water quality within critical habitat, or up to 9,000 ft (1.7 miles) of stream. Measurable effects from degraded water quality are expected to PCE #8 within the action area due to the concentration of contaminants in the discharge and/or the cumulative concentration within the waterbody. Therefore, adverse effects to PCE #8 due to changes in water quality are expected as a result of the proposed action.

Interrelated or Interdependent Actions

The only interrelated or interdependent actions anticipated are associated with the relocation of utility lines. We anticipate that these actions will occur within bull trout critical habitat already affected as part of the proposed action, and no further habitat removal would be required. Therefore, we do not anticipate that utility relocation actions will result in additional effects to bull trout critical habitat beyond those considered as part of the proposed action.

Cumulative Effects - Bull Trout Critical Habitat

Cumulative effects for bull trout critical habitat within the action area are discussed under "Cumulative Effects - Bull Trout." We anticipate that future forestry practices, agriculture, and urban development will result in continued degradation of bull trout critical habitat through the modification of water quality from discharges of contaminants in stormwater and runoff, change in stream hydrology due to water withdrawals and new impervious surfaces, impacts to forage fish due to changes in stream water quality and quantity, and loss of riparian and upland vegetation which contribute large woody debris to these aquatic systems, and loss of stream complexity through bank hardening. These impacts to critical habitat are more likely to occur in urban and urbanizing areas; however, critical habitat within spawning and rearing areas are also subject to negative impacts, primarily due to forest-related actions[33]. Therefore, we anticipate that PCE #1, 2, 3, 4, 5, 6, 7, and 8 continue to be negatively impacted due to cumulative affects within the action area. However, due to restoration activities including, but not limited to the removal of instream barriers to fish migration and wetland mitigation, some improvements in the functions of bull trout critical habitat are likely to occur in the future.

Integration and Synthesis - Bull Trout Critical Habitat

The Service expects adverse effects to bull trout critical habitat PCEs # 1, 2, 3, 4, 5, 6, 7, and 8 due to the direct and indirect impacts associated with habitat removal. In the Status of the Critical Habitat and Environmental Baseline, we established that the critical habitat units 27 and 28 have been significantly modified. Although the proposed action will result in minimal improvement in these conditions within critical habitat, due to the removal/replacement of instream barriers to migration (e.g., culverts), we do not anticipate that the proposed habitat degradation will preclude the functions provided by the critical habitat to bull trout.

The proposed project will result in the up to 16.4 acres of riparian vegetation removal affecting stream temperature and complexity (PCE #1 and #2), 2.6 miles of bank hardening and 4.1 acres of stream bed hardening affecting stream complexity (PCE #2), 3,000 ft of turbidity and sediment affecting spawning and rearing areas (PCE #3), unknown changes to the natural hydrograph to due increased impervious surfaces (up to 159 acres) (PCE #4), unknown changes to seeps and springs due to new impervious surfaces (up to 159 acres) (PCE #5), an unknown change to water temperature and up to 54 miles of increased sediment and turbidity affecting migration (9,000 ft) (PCE #6), and (1.7 miles) of increased stormwater contamination (PCE #8). Although the magnitude of several of these effects cannot be determined, we do not anticipate that they will occur at levels that preclude their functions as critical habitat due to the small amount of impacts proposed at the landscape scale.

Due to the temporary construction effects associated with many of the activities (i.e., sediment), limits on the number of projects per 5th-field watershed proposed, within a local population, and the limit on habitat affects permitted within critical habitat, we do not anticipate the affects will preclude the use of critical habitat within a stream reach, local population, or Core Area.

[33] Some, but not all forest-related actions, are address in existing HCPs, and are therefore, considered part of the baseline rather than a cumulative effect.

Conclusion - Bull Trout Critical Habitat

The proposed project is expected to adversely affect PCEs #2 (complex stream channels), 3 (substrates of sufficient amount, size, and composition), 6 (migratory corridors), and 8 (water quality). Net beneficial effects to PCE 6 are also expected due to the removal of instream fish passage barriers. The construction-related effects to critical habitat are expected to be temporary while the long-term effects associated with riparian removal, new impervious surfaces, bed and bank hardening, and stormwater runoff will continue in perpetuity. While effects to these PCEs are expected to degrade their condition, we anticipate that each of the PCEs will still be able to serve their intended conservation role for bull trout.

After reviewing the current status of bull trout critical habitat, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's Biological Opinion that the WSDOT Western Washington Regions programmatic consultation, as proposed, is not likely to destroy or adversely modify designated critical habitat for the following reasons:

- The recovery role of bull trout critical habitat units is to support viable core area populations of the bull trout (USFWS 2004a). PCEs within Units 27 and 28 will be adversely affected due to the proposed action.

- Although several PCEs would be degraded, each of the PCEs would still be able to serve their intended conservation role for bull trout, but to a lesser degree. Some PCEs (such as PCE #6) may be improved in the long-term for those activities that remove barriers to bull trout movement.

- Water quality impacts associated with discharge of stormwater are expected to be localized and would reduce, but not preclude, the use by bull trout of designated critical habitat throughout the action area.

- Water quality impacts associated with sediment and turbidity are expected to be localized and short-term. It would reduce but not preclude use by bull trout of designated critical habitat throughout the action area.

- Passage for bull trout and their prey will be improved when current fish passage barriers are removed. This may increase opportunities for bull trout spawning and rearing, as well as increased forage availability.

- The anticipated direct and indirect effects of the action, combined with the effects of interrelated and interdependent actions, and the cumulative effects associated with future State, tribal, local, and private actions will not prevent the PCEs of critical habitat from being maintained and functional at the scale of the action area. We therefore anticipate that critical habitat within the action area will continue to serve the intended conservation role for the species at the scale of critical habitat unit.

Effects to Marbled Murrelets

This section analyzes the potential effects of the proposed action on murrelets through direct and indirect effects and interdependent actions. Potential direct effects include sound and visual disturbance and habitat modification within or adjacent to their nesting habitat. Indirect effects include increased predation risk, windthrow, and microclimate changes. Adverse effects associated with an activity project could result from disturbance, habitat loss, or both.

WSDOT has limited their request for coverage within suitable nesting murrelet habitat as follows (Table 33).

Table 33. Anticipated impacts to murrelets per WSDOT region per year and total for the programmatic duration of 5 years.

Impacts	Southwest Region (per year)	Olympic Region (per year)	Northwest Region (per year)	Total per Region for Programmatic	Total for Programmatic
Visual and/or Sound Disturbance (early nesting season)[1]	1 project	1 project	1 project	5 projects	15 projects
Visual and/or Sound Disturbance (late nesting season)	1 project	3 projects	2 projects	Southwest – 5 projects Olympic – 15 projects Northwest – 10 projects	30 projects
Removal of understory vegetation (includes trees less than 14 inches dbh) from murrelet nesting habitat	5 acres	5 acres	5 acres	25 acres (not to exceed 5 acres per project or stand)	75 acres
Removal of understory vegetation and trees from 14 inches dbh to less than 19 inches dbh within 150 ft of murrelet suitable nest trees	0.5 acre	0.5 acre	0.5 acre	2.5 acres (not to exceed 0.5 acre per project or stand)	7.5 acres
Removal of non-potential nest trees 19 inches dbh and greater from murrelet nesting habitat	50 trees (no more than 25 trees per project or stand over the life of the programmatic)	50 trees (no more than 25 trees per project or stand over the life of the programmatic)	50 trees (no more than 25 trees per project or stand over the life of the programmatic)	250 trees	750 trees
Removal of potential nest trees from murrelet nesting habitat	15 trees (no more than 5 trees per project or stand over the life of the programmatic)	15 trees (no more than 5 trees per project or stand over the life of the programmatic)	15 trees (no more than 5 trees per project or stand over the life of the programmatic)	75 trees	225 trees

[1] Pile driving - up to once each in Conservation Zones 1 and 2 over the life of the programmatic.
Blasting - up to once each in Conservation Zone 1 and 2 over the life of the programmatic.

The specific location of proposed projects to implement under the programmatic is unknown. Based on previous data provided by WSDOT (Sharon Vecht, *in litt*. 2005), 19 projects occurred in a total linear distance of 77.5 miles of potential suitable murrelet nesting habitat. Suitable habitat for this calculation was defined as all areas in National Park, National Forest, and murrelet critical habitat (15 projects) and projects that were in areas of high concentrations of "high quality" murrelet nesting habitat (4 projects). The average distance for each project was approximately 4.08 miles. We anticipate that the majority of WSDOT activities under the programmatic will be not be measurable or will be discountable to the murrelets or their habitat based on the proposed minimization measures and location of activities proposed (e.g., outside of suitable nesting habitat).

Summary of Minimization Measures Specific to Murrelets

The following measures are proposed in the PBA to specifically minimize impacts of the proposed action to murrelets. These measures are considered part of the proposed action, and are taken into account in determining the effects of the proposed action on murrelets.

MM-7	MM-8	MM-9	MM-10	MM-11
MM-12	MM-13	MM-14	MM-15	MM-16
MM-17	MM-18	MM-19	MM-20	MM-21

We have analyzed the activities listed in Table 1 that may affect murrelets due to the proposed projects/programs covered by the PBO. Not all of the activities identified in the PBO will result in measurable impacts to murrelets. The proposed action may result in the following impacts to murrelets and their habitat:

- disturbance from project-generated sound and visual stimuli
- the permanent loss of forested habitat
- increased threat of predation
- degradation of habitat from microclimate change
- increased threat of windthrow

The following sections will describe the potential effects to murrelets, including their habitat.

Effects to Marbled Murrelets

Sound and Visual Disturbance

How sounds and human presence disturb nesting murrelets are not well known. To date, there have been no tests of the visual or dB levels or distances from sounds and visual stimuli at which murrelets react or flush from the nest or the effect of such disturbance on productivity. Typically, we have positive data (instances of reactions) but no negative data (number of times an action was done near a nesting murrelet with no reaction by the murrelet). Sound levels as

low as 92 dB to 95 dB can cause birds of all tested taxa to flush, so we set the sound-only injury threshold at 92 dB. Virtually all of the available information concerning disturbance of murrelets is obtained from observations of murrelets incidental to other surveys and research.

We have assumed that murrelets (and northern spotted owls) would not detect a change in sound pressure until it was at least 4 dB above ambient levels. This is based on a study by (Dooling 1980 in Saunders and Henry 1989) that found that 16 species of birds had an average sensitivity of 4 dB to detect a sound. Therefore, in areas where sound pressure levels differ from ambient conditions, an effect to the species would not be anticipated until the sound pressure exceeded the ambient condition by at least 4 dB.

Murrelets may be susceptible to sound and visual disturbance that occur during the nesting season (April 1 to September 15). The majority of the proposed activities will include the use of machinery that generates sound pressure above the disturbance threshold of 92 dBA at 25 ft (Table 34). Most activities will occur outside the early nesting season (April 1 to August 5), reducing, but not eliminating the likelihood of negatively impacting individual nesting murrelets due to increased sound pressure or visual disturbance. Additionally, some activities [i.e., those that must be constructed during the early nesting season due to their location (high elevation that limits the construction season due to adverse weather conditions and snow), low temperatures and/or coastal fog (for paving) or emergency in nature] may result in measurable effects to murrelets due to sound pressure and/or visual disturbance. Additionally, some actions may proceed during the late nesting season (August 6 to September 15), when most but not all murrelets have hatched. Blasting during the nesting season would only be allowed if needed as part of emergency slide removal projects, and may occur once per conservation zone over the life of the programmatic. Pile driving is also assumed to occur only once per conservation zone during the early nesting season over the life of the programmatic. Also, in those circumstances where sound pressure disturbance levels are not exceeded, the increase in activity level associated with construction may occur at measurable levels that would negatively impact nesting murrelets.

Table 34. Maximum sound pressure anticipated for proposed equipment at 25 ft and if disturbance threshold is reached, based on state route.

Equipment Description	**Maximum Sound Pressure Anticipated at 25 ft (dBA) (calculated)**	**Sound Pressure Exceeds Disturbance Threshold at 25 ft**
Auger Drill Rig	93	Yes
Backhoe	99	Yes
Blasting (mitigated rock fracturing)	107	Yes
Boring Jack Power Unit	92	No
Chain Saw	113	Yes
Clam Shovel (dropping)	96	Yes
Compactor (ground)	92	No
Compressor (air)	97	Yes
Concrete Mixer Truck	97	Yes
Concrete Pump Truck	90	No
Concrete Saw	99	Yes

Equipment Description	Maximum Sound Pressure Anticipated at 25 ft (dBA) (calculated)	Sound Pressure Exceeds Disturbance Threshold at 25 ft
Crane	98	Yes
Dozer	91	No
Drill Rig Truck	88	No
Drum Mixer	89	No
Dump Truck	85	No
Excavator	106	Yes
Flat Bed Truck	83	No
Front End Loader	99	Yes
Generator	91	No
Generator (<25KVA, VMS signs)	81	No
Gradall excavator	91	No
Grader	102	Yes
Grapple (on backhoe)	96	No
Grinder	98	Yes
Heavy Trucks	99	Yes
Horizontal Boring Hydraulic Jack	91	No
Impact Pile Driver	119	Yes
Jackhammer	108	Yes
Man Lift	84	No
Mounted Impact Hammer (hoe ram)	99	Yes
Pavement Scarifier	99	Yes
Paver	98	Yes
Pickup Truck	84	No
Pneumatic Tools	94	Yes
Pumps	90	No
Refrigerator Unit	81	No
Rivet Buster/chipping gun	88	No
Rock Drill	108	Yes
Roller	89	No
Sand Blasting (single nozzle)	105	Yes
Scraper	93	Yes
Shears (on backhoe)	105	Yes
Slurry Plant	87	No
Slurry Trenching Machine	89	No
Tractor	93	Yes
Vacuum Excavator (Vac-truck)	94	Yes
Vacuum Street Sweeper	91	No
Ventilation Fan	88	No
Vibrating Hopper	96	Yes
Vibratory Concrete Mixer	89	No

Equipment Description	Maximum Sound Pressure Anticipated at 25 ft (dBA) (calculated)	Sound Pressure Exceeds Disturbance Threshold at 25 ft
Vibratory Pile Driver	110	Yes
Warning Horn	92	No
Water Jet Deleading	101	Yes
Welder/Torch	83	No

The following is a description of sound pressure and the potential effects to murrelets due to the proposed action. A discussion regarding visual disturbances follows this section.

Sound Pressure

In-air sound is measured on an A-weighted scale and is denoted as dBA. This is the frequency-weighted scale used to approximate human hearing. The following discussion addresses effects to murrelets due to in-air sound disturbance and is based on this A-weighted scale. This information is also applicable to northern spotted owls, which are discussed later in this document. No impacts to murrelets due to underwater sound pressure are permitted under this programmatic; therefore, no underwater effects due to sound are addressed.

Although an activity (such as road grinding) may generate a specific sound pressure, a number of variables may result in either an increase or decrease of sound pressure at the receptor site (i.e., nest site). The following is a brief discussion on some of these factors.

Due to the nature of the proposed projects, we assumed that at least two machines would be operating at the same time, and therefore each would be generating sound. Different or similar decibel levels may be generated by each of the machines. Although multiple sound generating sources may have a greater sound pressure than one sound source, due to the logarithmic nature of sound pressure, decibel levels are not added by standard addition (WSDOT 2007a, pp. 7-14). The rules for combining the sound pressure levels generated are provided in Table 35. Due to the lack of specific information available for the programmatic activities at this time, we anticipate that sound pressures will be a minimum of 3 dBA higher than those values listed in Table 36 (original sound table). This is the maximum decibel level that would be added when one or more machines are operating at the same time. This may be an overestimate in some circumstances.

Table 35. Rules for combining different sound pressure levels (USDOT 1995 in WSDOT 2007a, pp. 7-14)

When Two Decibel Values Differ by:	Add the Following to the Higher Decibel Value:
0 dBA or 1 dBA	3 dBA
2 dBA or 3 dBA	2 dBA
4 dBA to 9 dBA	1 dBA
10 dBA or more	0

Table 36. Maximum sound pressure from equipment in air (based primarily on WSDOT 2007a, p. 7-11).

Equipment Description	Maximum Sound Pressure Anticipated at 50 ft (dBA)	Equipment Description	Maximum Sound Pressure Anticipated at 50 ft (dBA)	Equipment Description	Maximum Sound Pressure Anticipated at 50 ft (dBA)	Equipment Description	Maximum Sound Pressure Anticipated at 50 ft (dBA)
Generator (<25KVA, VMS signs)	73	Pumps	81	Vibrating Hopper	87	Excavator	97
Refrigerator Unit	73	Dozer	82	Compressor (air)	88	Blasting (mitigated rock fracturing)	98
Flat Bed Truck	74	Generator	82	Concrete Mixer Truck	88	Jackhammer	99
Welder/Torch	74	Horizontal Boring Hydraulic Jack	82	Crane	89	Rock Drill	99
Man Lift	75	Vacuum Street Sweeper	82	Paver	89	Vibratory Pile Driver[34]	101
Pickup Truck	75	Boring Jack Power Unit	83	Backhoe	90	Chain Saw[35]	104
Dump Truck	76	Compactor (ground)	83	Concrete Saw	90	Impact Pile Driver	110
Slurry Plant	78	Gradall Excavator	83	Front End Loader	90		
Drill Rig Truck	79	Warning Horn	83	Heavy Trucks	90		
Rivet Buster/Chipping Gun	79	Auger Drill Rig	84	Mounted Impact Hammer (hoe ram)	90		
Ventilation Fan	79	Scraper	84	Pavement Scarifier	90		
Drum Mixer	80	Tractor	84	Water Jet Deleading	92		
Roller	80	Pneumatic Tools	85	Grader	93		
Slurry Trenching Machine	80	Vacuum Excavator (Vac-truck)	85	Heavy Equipment[36]	96		
Vibratory Concrete Mixer	80	Clam Shovel (dropping)	87	Sand Blasting (single nozzle)	96		
Concrete Pump Truck	81	Grapple (on backhoe)	87	Shears (on backhoe)	96		

[34] Rainsberry *in litt.* 2008
[35] Appendix K, p. 11.
[36] Appendix K, p. 15.

Sound pressure attenuation will vary depending on whether it is a point source or a line source (Table 37). Point sources attenuate by 6 dBA per doubling distance, while line sources attenuate by 3 dBA per doubling distance. An example of point source sound is that generated by a stationary machine, such as a generator, excavator working in one location, or the sound from a single traveling vehicle. A line source is generated by moving objects along a linear corridor, such as highway traffic. The proposed activities are typically considered point sources rather than line sources of sound. Therefore, our analysis for murrelet (and northern spotted owl) is based on the use of point source attenuation.

Table 37. Sound pressure reduction comparing point source and line sources (WSDOT 2007a, p. 7-6).

Distance from Source (ft)	**Sound Attenuation**	
	Point Source (-6 dBA)	**Line Source (- 3 dBA)**
50	95	95
100	89	92
200	83	89
400	77	86
800	71	83
1,600	65	80
3,200	59	77
6,400	53	74

Depending on the surrounding land use (paved versus forested) sound may attenuate at greater or lesser distances from the source. "Hard surfaces" such as roads and water bodies do not attenuate sound pressure. In vegetated or uncompacted "soft surface" environments, sound pressure is attenuated at 1.5 dBA per doubling distance. For the purposes of this PBO, we have assumed that all adjacent land use beyond 25 ft is composed of "soft surfaces." This assumption is deemed reasonable especially for those activities proposed within or adjacent to suitable murrelet habitat as these sites are in rural areas that are more likely to be vegetated with ground cover. This assumption does not consider attenuation due to forested conditions; therefore, it is considered a conservative approach to assessing effects of the proposed action at the programmatic level. See Appendix I for further information regarding our analysis.

Additionally, there are other site specific and temporal variables that may attenuate sound pressure that have not been taken into account in this analysis. These include but are not limited to the following: temperature, wind, rain, streams, and topographic relief. We anticipate that the sound pressures used in our analysis for effect determinations may over-estimate the sound pressures generated by the proposed activities.

During construction, we anticipate that sound will be generated at essentially a constant level. However, impact equipment (e.g., pile drivers, jackhammers, pavement breakers, rock drills, and other pneumatic tools) result in variable sound pressures depending on the type and condition of the material being hit. Additionally, blasting is likely to occur sporadically as part of some projects.

Based on the above values and assumptions, we have used the highest values described for the equipment likely to be used as part of the proposed action to estimate the distance at which disturbance levels for murrelets are exceeded during the nesting season (Table 33). We have assumed that the majority of suitable nesting habitat, including nest trees, occurs beyond 25 ft of the location that sound would be generated to account for areas cleared adjacent to highways. There is a higher likelihood that suitable habitat is adjacent to the roadway in national parks and national forests. A site specific determination of sound pressure generated and distance to suitable nesting habitat will be required for each proposed action under this programmatic.

Sound pressure levels associated with state routes and other roadways are a function of several factors including volume of traffic, speed of traffic, and number of trucks (USDOT 2005 in WSDOT 2007a). Sound levels tend to increase when traffic is heavier, speed is faster, and there are more heavy trucks. For example, 2,000 vehicles per hour would sound twice as loud (or 10 dBA higher) as 200 vehicles per hour; traffic at 65 mph sounds twice as loud as traffic at 30 mph; and one truck at 55 mph sounds as loud as 28 cars at 55 mph (USDOT 2005 in WSDOT 2007a). Pavement type, road grade, and the type and condition of vehicle tires also contribute to the loudness of traffic noise. Existing sound pressure levels associated with state routes and roadways will, therefore, vary over the action area. WSDOT has summarized the expected sound pressures currently anticipated adjacent to its roadways within the action area (Figure 4). For the purpose of determining the disturbance effects of the proposed action on murrelets (and northern spotted owls), the lowest value of sound pressure generated on these roads was used to provide the anticipated ambient sound level conditions. We have assumed for our analysis that ambient sound levels adjacent to suitable nesting habitat range from 62 dBA to 77 dBA. These values may, therefore, over-estimate the effects of the action in some circumstances.

Figure 4. State routes and estimated existing sound pressures

Due to the large scale of the action area, more site specific detail was not warranted for our analysis. Site specific details regarding ambient sound pressure and anticipated sound pressure due to a proposed activity will be described and provided in the PBA Determination Form submitted to the Service for each activity when it is applicable.

Based on the information above regarding the existing sound pressures associated with WSDOT roadways and the sound pressures anticipated at 25 ft from the proposed activities, all proposed activities are anticipated to exceed ambient sound pressures. However, not all proposed

activities would reach or exceed the sound disturbance threshold level (92 dB) for murrelets. In those circumstances where sound pressure does not exceed 92 dBA at 25 ft, effects due to visual disturbance only would need to be assessed.

Visual Disturbance

The sight-only injury threshold - the distance at which a murrelet would be flushed from its nest or cause it to miss feeding its young by the sight (not sight *and* sound) of human activity - was estimated using the incidental and experimental experiences of murrelet researchers as described in USFWS (2007c). Overall, the furthest distance at which murrelets were flushed from perches or nests due to the presence of thousands of pedestrians (without motorized equipment) was 33 ft, other than the unusually situated nest at Ruby Beach, Washington where flushing occurred when pedestrians were at a distance of 40 meters (109 ft) (USFWS 2007c). People walking within 40 meters of the nest in clear view of the nest caused the adults to abort nest visits or flush from the nest 27 percent of the time (n = 30) (Hamer and Nelson 1998, p. 9)[37]. A distance of 33 ft from suitable habitat is used to determine if the proposed action would result in a measurable visual disturbance to murrelets.

Combined Sound and Visual Disturbance

Evaluating sound and visual disturbance injury thresholds concurrently corresponds to the typical exposure that murrelets (and northern spotted owls) may encounter due to the proposed activities in the programmatic. We anticipate that there is a synergistic effect between such activities, and murrelets (and northern spotted owls) could react to such activities at farther distances than those merely heard or seen. We expect that most activities could be both seen and heard by murrelets (and northern spotted owls) at these relatively short sight-only and sound-only injury thresholds.

Previous analyses (USFWS 2007c) have increased the distance for these combined disturbance thresholds for ground disturbing operations only[38]. This resulted in an increase in threshold distances to 35 yards (105 ft) for heavy construction equipment with regard to murrelets and 60 yards (180 ft) for chainsaws with regard to northern spotted owls. The thresholds we have calculated (Appendix I) do not include an additional distance to account for this potential synergistic effects of sound and visual disturbance since the distances provided in Appendix I are similar to or exceed the values stated in USFWS (2007c). For example, for the WSDOT programmatic, we calculated sound attenuation to 92 dBA for heavy machinery (such as backhoes and front end loaders) at 100 ft and chainsaws at 200 ft. These distances are similar to and/or more limited than those described in the USFWS (2007c) document for sound and visual disturbance (105 ft and 135 ft, respectively). Due to the similarities in the values calculated and the conservative assumptions in this PBO, we assume that the distance values listed in Appendix I are likely to account for any synergistic effect between sound and visual disturbance that may occur.

[37] Hamer and Nelson (1998, p. 9) states “40 in” in two places, but it should be “40 m” (Tom Hamer, *in litt*. 2009).
[38] Aircraft did not include any change in threshold values due to combining sound and visual disturbance distances. No aircraft are proposed in the WSDOT programmatic.

Insignificant and Discountable Effects to Marbled Murrelets

Activities that result in adverse effects to murrelets, including in-water blasting and pile driving, in the marine foraging habitat are excluded from this programmatic; therefore, no determinations have been made for murrelets that may be impacted in that environment. An individual consultation would be required for those projects affecting murrelets in their foraging habitat.

Based on the above information, including conservation measures, the Service has determined that the following types of activities will result in insignificant and/or discountable effects to murrelets.

1. Activities that are located more than 55 miles from the marine environment are likely to result in discountable effects.

    - Murrelets are known to primarily nest within 55 miles of the marine environment. It is considered unlikely that murrelets would be nesting beyond this range. The exception is within the North Cascades National Park, Ross Lake Recreation Area, where all suitable murrelet habitat, including that beyond 55 miles of the marine environment, may be used for nesting by murrelets.

        - Therefore, the effects of activities located more than 55 miles from the marine environment, except within the Ross Lake Recreation Area, are anticipated to be discountable to murrelets.

2. Activities that produce a sound greater than ambient sound levels and are less than 92 dBA within suitable nesting habitat April 1 through September 15 (nesting season), occur between two hours after sunrise and two hours before sunset, do not remove suitable habitat, and do not occur within 33 ft of suitable nesting habitat. With the implementation of these measures effects to murrelets and their chicks are likely to be insignificant.

    - Sound levels less than 92 dBA are likely to be detected by murrelets, but do not result in a measurable disturbance of the individual (USFWS 2007c, Appendix G; USFWS 2007d, Appendix G).

    - Visual disturbance is unlikely due to the sight distance from nesting habitat during the nesting season; therefore, a missed feeding or flushing from the nest is highly unlikely.

    - Murrelet chicks are fed predominately during the early morning and evening (2 hours after dawn and 2 hours before dusk). Chicks are unlikely to miss a feeding and adults are less likely to miss feeding a chick due to implementation of this timing restriction for visual and sound disturbance activities.

- ➢ Therefore, the effects of activities that occur during the murrelet nesting season that are less than 92 dBA, are at a distance of at least 33 ft from suitable nesting habitat, and include the 2 hour timing restriction at dawn and dusk are unlikely to measurably disturb murrelets, and effects are anticipated to be insignificant.

3. Blasting more than 200 ft from nesting habitat during the nesting season.

    - Blasting that occurs greater than 200 ft from nesting habitat during the nesting season is unlikely to produce sound pressures that exceed 92 dBA within this habitat.

        - ➢ Therefore, effects to murrelets are anticipated to be insignificant.

4. Removal of understory vegetation [including small trees (less than or equal to 14 inches dbh) and shrubs] within suitable murrelet habitat outside the murrelet nesting season (September 16 through March 31).

    - Management activities that meet the above criteria would not result in the loss of potential nest trees or trees adjacent to potential nest trees within suitable habitat during the murrelet breeding season.

        - ➢ Therefore, implementation of these measures will result in insignificant effects to murrelets

    - The removal of vegetation that does not or will not provide suitable nesting habitat, including buffer habitat, is unlikely to reduce the quality of habitat used by murrelets.

        - ➢ Therefore, effects of this habitat removal are likely to be insignificant.

    - Removal of vegetation within murrelet suitable habitat is not permitted during the nesting season. This reduces the likelihood of disturbance of nesting murrelets to visual and sound disturbance

        - ➢ Therefore, effects to murrelets associated with disturbance from vegetation removal conducted outside the nesting season are likely to be discountable.

<u>Measurable Effects from Sound and Visual Disturbance</u>

WSDOT proposed activities could adversely affect murrelets through exposure to increased sound levels and visual stimuli during the murrelet nesting season. The proposed action may result in a postponed or missed feeding of a chick or the flushing of an adult from the nest due to sound or visual disturbance. These responses are anticipated to result in measurable effects to individuals.

The Service completed an analysis of the potential for injury associated with sight- and sound-caused disturbance to murrelets in the terrestrial environment (USFWS 2007c, Appendix G; USFWS 2007d, Appendix G). In that analysis, we concluded that that the behaviors indicating potential adverse effects include flushing from the nest, aborted feeding attempts, and postponed feedings. These behaviors and their potential consequences are described below.

Scientific data related to injury threshold distances associated with sound and visual disturbance are limited, and we continue to collect pertinent data related to the issue. Consequently, the injury threshold distances used in this PBO may be adjusted in the future, when warranted.

Flushing of an adult or juvenile murrelet from the nest site or a perch site in the immediate vicinity of the nest.

Flushing exposes the adult and the nest to any predator in the vicinity. Awbrey and Bowles (1990) presume this to be the most important consequence of flushing. Raptor research utilizes flushing to indicate a high-level of disturbance (e.g., Awbrey and Bowles 1990; Brown 1990; Stalmaster and Kaiser 1997). Additionally, premature departure (flushing) of a juvenile murrelet can increase the risk of predation and physical harm to the young.

Aborted feeding(s) of a nestling, in which the adult abandons the feeding attempt and must return to foraging habitat to obtain new prey.

Hull et al. (2001) reported that murrelets spend 0.3 hr to 3.5 hr per day (mean 1.2±0.7 hr per day) commuting to nests during the breeding season. They estimate roughly 30 days are spent for incubation and 28 days for chick rearing, totaling 58 days for the breeding period. During incubation, adults make about 15 round trips. During chick rearing, adults return to feed young up to 8 times daily, with an average of 2.8 feedings per day or 1.4 round trips per day per adult (average between findings of Nelson and Hamer (1995b) and Hull et al. (2001). Therefore, the Service assumes a total of 53.6 (i.e., 15 days plus 38.6 days) round trips per adult during the incubation and chick-rearing periods.

If an adult aborts a feeding, returns to foraging habitat, captures another prey item and returns to the nest for prey delivery[39], there is a likelihood of significantly disrupting normal behavior patterns. If each adult normally makes 1.4 round-trip feeding attempts/day during the breeding season, then there are some days an adult may make 2 round trips/day (there are no partial round trips). A single unsuccessful trip, therefore, can constitute a 50 to 100 percent reduction or increase in that day's feeding effort, depending on whether the adult returns to foraging habitat for another feeding attempt. Both of these scenarios can be considered a likelihood of potentially significantly disrupting normal behavior as they cost the adult both energy and time that may have been spent on other life-sustaining activities such as foraging.

Multiple delayed feeding attempts, in which adult delivery of food to the nestling is delayed multiple times, either within a single day, or across multiple days, due to human-caused disturbance at or near the nest site.

[39] Assuming there is no cost to the chick in a single instance of delayed feeding.

Nelson and Hamer (1995a) state that murrelet chicks grow rapidly compared to most alcids, gaining 5 g to 15 g per day during the first 9 days after hatching. The missing of a single feeding may disrupt normal behavior and create the likelihood of injury in the form of development risk to the chick. The average daily increase for the first 9 days of neonate development is 10.9 percent, while the percentage of increase for the next 16 days is 2.2 percent (modified from (Simons 1980). While Simons (1980) documented negative daily growth rates of over 10 percent, none of the days of negative growth occurred during the first 9 days. Further, Ricklefs (1983) states, in regard to avian postnatal development, "although daily food deprivation is easily compensated by increased feeding rate, chronic deprivation for periods of 1 out of 2 days or 2 out of 3 days cannot be fully compensated." An increased feeding rate may not be possible for murrelets that must travel long distances between foraging and nesting areas.

Extent of Exposure to Murrelets due to Disturbance

Proposed activities that exceed 92 dBA sound pressures in suitable murrelet nesting habitat may occur during the early and late nesting seasons. Only those activities that, due to their location (high elevation), low temperatures and/or coastal fog (for paving only), or emergency nature, may be conducted during the early nesting season for murrelets. High elevation construction activities may be conducted during the nesting seasons for murrelets due to the limited construction season due to adverse weather conditions and snow at those locations. Paving actions may also need to occur during the early nesting season due to minimum temperatures needed for this work. Additionally, paving cannot occur unless roads are dry, further limiting the work window within coastal areas of high fog. Emergency actions covered in this PBO may occur at any time, including the early nesting season, due to the urgency of implementing these activities to protect human life and property.

Other activity types may occur during the late nesting season (August 6 to September 15). These include paving projects (not restricted by weather or temperature) as well as other activities. These types of activities will expose murrelets to sound and/or visual disturbance through blasting, pile driving, jackhammers, guardrail post drivers, rock drills, chainsaws, batch plants, and heavy equipment operation during the murrelet breeding season. Blasting during the early nesting season would only be allowed if needed as part of emergency slide removal projects. Unlike normal traffic, these activities will result in heavy machinery advancing slowly along the road corridor, with many starts and stops. In addition, there will be a number of workers outside their vehicles causing increased visual disturbance.

WSDOT has requested one project per WSDOT region per year (for a total of 15 projects over 5 years) be permitted to disturb murrelets during the early nesting season over the life of the programmatic for activities associated with emergencies or that cannot be delayed until outside of the early nesting season due to adverse weather conditions. These projects may include up to one blasting and one pile driving project per conservation zone over the life of the programmatic. These 15 projects are likely to include several types of sound generating equipment, some that may not exceed the 92 dBA sound pressure during the entire duration of the work, while others may include blasting and pile driving in addition to construction equipment that exceeds 92 dBA. We anticipated that visual disturbance will occur as part of each of the proposed 15 projects.

In addition, approximately six projects per year may occur during the late nesting season. Most of these activities may be paving projects. It is anticipated that approximately 4 projects may occur within Conservation Zone 1 and 2 projects within Zone 2 per year, for a total of 30 projects over 5 years.

Because of the programmatic nature of this consultation, the FHWA and WSDOT were not able to identify the specific timing and locations of the activities or the level of disturbance that could be caused by the work. Therefore, the largest threshold distance (i.e., 400 ft for pile driving, 200 ft for chain saws, etc.) has been applied for work in or near murrelet suitable habitat. Because some of the potential projects may use less disturbing equipment, the extent of the impacts is considered to be conservative (over-estimated). Therefore, the actual number of acres affected, and presumably the number of individual murrelets that may be disturbed, is likely to be lower than anticipated.

To determine the extent of exposure of sound and visual disturbance that may result from the proposed 15 projects, we assumed that most projects would result in disturbance extending from the project site up to 200 ft into murrelet nesting habitat during the nesting season. All activities, except those that included impact pile driving, would attenuate to below 92 dBA within 200 ft of the sound-creating event. Impact pile driving was anticipated to attenuate to less than 92 dBA at 400 ft.

We expect the proposed action may cause some adult murrelets to flush from the nest due to disturbance during the nesting season. Long and Ralph (1998, p. 21), in their summary of all available information concerning disturbance of murrelets, reported that "[Marbled] murrelets appeared generally undisturbed by passing vehicles, or sharp or prolonged loud noise" and "Overall, it appears that murrelets are not easily disrupted from nesting attempts by human disturbance except when confronted at or very near the nest itself." Although, based on the literature there appears to be a low likelihood of flushing, due to the programmatic nature of this analysis, we cannot exclude it as a potential impact. However, we anticipate that few nests are located directly adjacent to roads within the action area, reducing the likelihood of flushing. Sound and visual disturbance activities are anticipated to be at least 25 ft from suitable habitat (due to existing road clearing and maintenance). The greatest potential of suitable habitat being less than 25 ft from construction activities is on roadways that go through Federal forests and National Parks. Projects that result in adverse effects to murrelets are precluded from occurring within Mount Rainier National Park, further reducing the likelihood of disturbance exposure to nesting murrelets.

Although murrelets concentrate their activities in the early morning and early evening, murrelets feed chicks throughout the day (Nelson and Hamer 1995b, p. 62). Therefore, sound and visual disturbance from construction activities conducted during the nesting season within the disturbance thresholds will likely significantly disrupt feeding, potentially resulting in delayed development of chicks.

Increased sound and visual disturbance may result in an adult flushing from the nest. However, we expect that adult murrelets can flush from the nest without crushing their eggs or hurting their young. Adults are expected to return to the nest when the disturbance has subsided. Flushing

from the nest infrequently and for a short duration is unlikely to result in a failed nest during incubation. However, we anticipate measurable levels of disturbance to nesting murrelet chicks prior to fledging. Although the majority of murrelets have hatched by August 5 in Washington, fledging is not complete until September 15. Therefore, effects due to flushing of the adult from the nest may result in delayed fledging due to the inability of the adult to adequately nourish the young (missed feedings), premature fledging, and an increase risk of predation on the young due attraction of corvids to the nest. As some, but not all feedings of young will be postponed or missed, we assume that young murrelets can miss a feeding without dying.

As stated earlier, an average of 2.8 feedings per day of nestlings occurs during the chick-rearing period. Some of the suitable habitat within the action area is located up to the outer limits of murrelet distribution and a great distance from suitable foraging habitat. Because of the distance from foraging habitat and the energy required by the adult to make the foraging runs, the Service assumes that it is less likely that multiple feedings may occur for nests located further from their foraging areas. With a lower chance of multiple feedings/foraging runs for these individual, it becomes difficult to compensate for even a single missed/aborted feeding.

Additionally, in some cases, adult murrelets may return to foraging habitat after an aborted feeding to capture another prey item and return to the nest for prey delivery. Under these circumstances, there is a likelihood of significantly disrupting adult murrelet normal behavior patterns due to both energy and time that may have been spent on other life-sustaining activities such as foraging to feed itself.

The Service expects that construction activities will disrupt normal breeding and foraging behaviors, specifically prey delivery. The disruption of prey delivery may also result in missed feedings of murrelet chicks. These disruptions are expected to occur only when construction activities are underway. We anticipate that there will be a likelihood of adverse effects to adult murrelets and their chicks due to the significant annoyance such that normal feeding behavior is affected. However, we do not anticipate death or physical injury to this species as a result of the proposed disturbance.

The action area contains 182,700 acres of suitable murrelet habitat (Table 11) within one mile of state routes within the action area, of which 48,220 acres included detections (status 1 through 4). State routes abut suitable habitat for approximately 680 miles. Using 200 ft for the combined injury threshold distance for murrelets for construction activities other than pile driving, approximately 16,485 acres of suitable nesting habitat may be exposed to measurable levels of sound and visual disturbance from WSDOT activities along the 680 miles of state roadway. Of this, approximately, 3,359 acres includes status 1 through 4 detection areas within 180 ft of the state roadway. However, as surveys are unlikely to be current or performed for the entire 680 miles of roadway, we assume for this programmatic that the entire 16,485 acres may be occupied.

WSDOT will construct projects along only a portion of the 680 miles during the life of this programmatic. Construction activities will be scheduled outside of the early nesting season for all but up to 15 projects and outside the late nesting season for all but 30 projects over 5 years. Therefore, the above acreage (16,485 acres) vastly over estimates the actual amount of suitable

habitat that may be exposed to measurable levels of disturbance. Based on WSDOT's past types and volume of projects in the action area during the early and late nesting periods, average miles per project in suitable habitat (4.08 miles), and their planned projects from July 2007 to June 2009, the Service expects approximately 2,967 acres of suitable habitat to be exposed to measurable levels of sound and visual stimuli during the early nesting season over the five year span of this PBO for all projects excluding pile driving activities. This assumes that suitable murrelet habitat occurs on both sides of the roadway and will be subject to sound levels resulting in disturbance up to 200 ft on each side. We have estimated that of the 15 projects, 2 may include pile driving within or adjacent to nesting habitat during the nesting season for murrelets. Based on Appendix I, we have estimated that sound pressure from pile driving will attenuate to less than 92 dBA by at least 400 ft. Therefore, up to 792 acres of murrelet suitable nesting habitat may be disturbed during the early nesting season, assuming pile driving occurs along the entire 4.08 miles for 2 projects. As some of the acreage associated with pile driving will overlap the area affected by other sound and visual disturbance activities (assuming a distance of 200 ft of overlap in all directions), we have estimated that an additional 396 acres would be impacted during the early nesting season due to pile driving over the life of the programmatic, for a total acreage of 3,366 acres.

The Service anticipates that of the 3,366 acres, 2,574 acres will be in Conservation Zone 1 [12 projects (no more than 3 per year) of approximately 198 acres of disturbance each, excluding pile driving] and 792 acres [3 projects (no more than 1 per year) of approximately 198 acres of disturbance each, excluding pile driving] will be in Conservation Zone 2. Up to one pile driving and one blasting action may occur during the early nesting season per conservation zone over the life of the programmatic.

Activities that occur during the late nesting season will also have a similar area of impact per project (approximately 198 acres excluding pile driving). It is unknown how often pile driving may occur during the late nesting season. We have assumed that it will occur once per Conservation Zone over the life of the programmatic. As stated earlier, two projects per year are anticipated in Conservation Zone 1 and four projects per year in Conservation Zone 2 during the late nesting season. Therefore, visual and disturbance effects to murrelets during the late nesting season are anticipated to occur on approximately 396 acres per year and 2,178 acres over the life of the programmatic in Conservation Zone 1 and 792 acres per year and 4,158 acres over the life of the programmatic for Conservation Zone 2. Table 38 summarizes the effects due to sound and visual disturbance for the proposed action.

Table 38. Adverse effects anticipated to murrelets in Conservation Zone 1 and 2 due to sound and visual disturbance.

Conservation Zone	Impact	Per Year	Over Life of Programmatic (5 years)
Conservation Zone 1	Visual and sound disturbance of habitat associated with nesting murrelets and their young during the nesting season resulting in flushing from the nest or missed feedings	Early Nesting Season: Approximately 594 acres[1] (3 projects)	Early Nesting Season: 2,574 acres[2] (12 projects)
		Late Nesting Season: Approximately 396 acres[1] (2 projects)	Late Nesting Season: 2,178 acres[2] (10 projects)
Conservation Zone 2	Visual and sound disturbance of habitat associated with nesting murrelets and their young during the nesting season resulting in flushing from the nest or missed feedings	Early Nesting Season: Approximately 198 acres[1] (1 project)	Early Nesting Season: 792 acres[2] (3 projects)
		Late Nesting Season: Approximately 792 acres[1] (4 projects)	Late Nesting Season: 4,158 acres[2] (20 projects)

[1] An additional 198 acres of disturbance may occur due to one project that includes pile driving.
[2] Includes an additional 198 acres of disturbance associated with one pile driving project over the life of the programmatic.

Measurable Effects from Habitat Modification to Murrelets

Direct Injury or Mortality

Direct injury or mortality to murrelets as a result of the proposed action could occur if murrelets were present during tree-felling activities and injury due to blasting near an occupied nest.

WSDOT will not fell trees in suitable murrelet nesting habitat during the nesting season. Additionally, if blasting is proposed within suitable murrelet habitat, a qualified murrelet biologist is required to determine if any suitable nest trees will be impacted and if so, these impacts must be avoided. Therefore, we do not expect direct injury or mortality to resident murrelets as a result of the proposed project.

Loss of Stands of Suitable-Habitat

As per MM-20, no activity may result in the loss of a murrelet suitable habitat stand. Therefore, there is no anticipated loss of a murrelet nesting stand as part of the proposed project.

Degradation of Stands of Suitable Habitat

The activities covered by this programmatic consultation may result in the removal of vegetation in murrelet suitable habitat. The quality and quantity of vegetation that would be eliminated depends on the scope and purpose or the individual project and can range from removing single

trees that are a safety hazard to complete clearing for a new lane. This habitat alteration could adversely affect future productivity of murrelets nesting in the action area.

Minimization measures will reduce the effects of habitat removal within suitable nesting habitat. Removal of suitable and potentially suitable nesting habitat is not permitted during the nesting season. The number of suitable and non-suitable nest trees that may be removed is limited to 30 per stand. No known nest trees may be removed. Trees that are removed are to be dropped in such a manner as to reduce damage to surrounding trees. Because the programmatic consultation is intended for maintenance, preservation, and improvement projects on existing roadways, single projects will not involve extensive amounts of murrelet suitable habitat removal. New road alignments will be limited to 0.25 mile in length (up to 1.5 acres of habitat loss per project), and major realignments will be limited to 0.5 mile (up to 3 acres of habitat loss per project). All alignments must be adjacent to the existing roadway to avoid creating new forest edges within contiguous forested habitats.

WSDOT has established sideboards that limit the amount and degree of habitat alteration that may occur in each region due to activities considered under this programmatic consultation (Table 35). Additionally, vegetation removal within or adjacent to[40] murrelet suitable habitat will be no more than 50 ft in width from the edge of the existing roadway clear zone. Since approximately 80 percent of the murrelet suitable habitat occurs in Conservation Zone 1 and 20 percent in Conservation Zone 2, the potential habitat impacts by Conservation Zone are as follows (Table 39):

[40] Adjacent is defined as within one site potential tree or 150 ft, which ever is greater.

Table 39. Potential impact to suitable murrelet nesting habitat by Conservation Zone.

Impact	Maximum Vegetation Removal per Conservation Zone 1 per Year	Maximum Vegetation Removal Conservation Zone 1 Over the Life of the Programmatic	Maximum Vegetation Removal Conservation Zone 2 per Year (including Southwest Area)	Maximum Vegetation Removal Conservation Zone 2 Over the Life of the Programmatic (including Southwest Area)	Maximum Vegetation Removal Conservation Zone 2 Over the Life of the Programmatic (Southwest West Area)
Removal of understory vegetation (includes trees less than 14 inches dbh) from murrelet nesting habitat	12 acres	60 acres	3 acres	15 acres	No additional restrictions
Removal of understory vegetation and trees from 14 inches dbh to less than 19 inches dbh within 150 ft of murrelet suitable nest trees	1.2 acres (not to exceed 0.5 acre per project or stand)	6 acres (not to exceed 0.5 acre per project or stand)	0.5 acre	1.5 acres (not to exceed 0.5 acre per project or stand)	0.5 acre
Removal of non-potential nest trees 19 inches dbh and greater from murrelet nesting habitat	120 trees (no more than 25 per project or stand over the life of the programmatic)	600 trees (no more than 25 per project or stand over the life of the programmatic)	30 trees (no more than 25 per project or stand over the life of the programmatic)	150 trees (no more than 25 per project or over the life of the programmatic)	25 trees
Removal of potential nest trees from murrelet nesting habitat	36 trees (no more than five per project or stand over the life of the programmatic)	180 trees (no more than five per project or stand over the life of the programmatic)	9 trees (no more than five per project or stand over the life of the programmatic)	45 trees (no more than five per project or stand over the life of the programmatic)	1 tree in stand with 5 or more platforms per acre

The following describes the potential effects to murrelets due to the proposed removal of vegetation within suitable nesting habitat.

Loss of Individual Potential-Nest Trees

No known occupied nest trees may be felled under this programmatic. The proposed action does allow for the loss of habitat components, such as individual large trees that may provide suitable nesting habitat. The removal of up to 225 potential nest trees would occur outside of the murrelet nesting season to insure that no adult nesting murrelets or their young are physically injured.

Murrelets appear to require specific conditions for nesting. A potential nest tree has structural elements (e.g., large limbs, mistletoe brooms, etc.) that provides for nesting. However, a potential nest tree does not mean that it is an occupied nest tree.

Ralph et al. (1995) describes suitable nest trees as typically greater than 200 years old and at least 20 inches dbh, although trees in productive ground may develop these characteristics at an earlier age (faster rate), and younger trees may also develop platforms through mistletoe infestations or in reaction to damage from wind or ice. Potential nest trees are defined as conifers with live crowns containing suitable nesting platforms. Platforms are defined as large, moss-covered branches greater than or equal to 4 inches diameter located greater than or equal to 33 ft above ground (71 FR 53840). Loss of individual large trees within stands of suitable habitat results in a degradation of the nesting habitat due to the loss of potential nesting platforms and canopy cover in the area affected. Although nest trees as small as 14 inches dbh have been used by murrelets for nesting, the smallest nest tree found in Washington and Oregon was 19 inches dbh. However, trees smaller than 19 inches dbh may contain suitable platforms. For the purposes of this programmatic, we have considered suitable nest trees to be at least 19 inches dbh. However, a specific determination of the suitability of the tree for nesting will be necessary as part of each proposed action prior to removal of trees within suitable murrelet nesting habitat.

Several authors report nest site fidelity in murrelets, which is consistent with that of other adult alcids where birds return to previously occupied, but recently destroyed nest sites for two or more years (Divoky and Horton 1995, p. 86; Nelson 1997). Murrelets are known to return to the same forest stands in successive years (Nelson and Peck 1995). According to Divoky and Horton (1995), murrelets have been recorded in the same forest stands for a minimum of 20 years in northern California, 18 years in central California, 7 years in Oregon, and 3 years in Washington. Murrelets have been documented at the same nest platform or tree in subsequent years, although not necessarily the same pair or individual (n = 7 nests) (Nelson and Peck 1995). There are more than 15 records of murrelets returning to the same tree, 6 of these to the same platform. However, individual nest cups are not reused in consecutive years (Nelson 1997).

Nest site fidelity has adaptive benefits. It can reduce potential reproductive effort by increasing the chances of breeding with the previous years' mate, eliminate or reduce the need to locate a suitable nest site, and allow the development of familiarity with the surrounding environment (Divoky and Horton 1995). Site fidelity also has important implications in how murrelets respond to habitat loss and the reestablishment of breeding areas when habitat has been altered (Divoky and Horton 1995). Because murrelets have been shown to have fidelity to the same nest

tree, we consider the felling of potential nest trees to be an adverse effect, because even if the tree is felled outside the nesting season, the murrelet returning to that tree in subsequent years would be forced to locate an alternate nest site.

Evidence suggests the fidelity murrelets have to a previously used breeding area or site should be related to the rate and magnitude of habitat destruction (Divoky and Horton 1995). The proposed action limits the removal of potential nest trees for most of the action area to no more than five per stand or project over the life of the programmatic. Additionally, no suitable habitat, including potential nest trees, may be removed in stands less than or equal to 7 acres. Since only five potential nest trees may be removed per stand larger than 7 acres, the quality of nesting habitat at the stand scale will be negligibly affected, in most cases. The exception to this is within the Murrelet Zone 2, Southwest Area (Figure 2), where only one suitable nest tree in stands with five or more platforms per acre per year may be removed (for a total of five potential nest trees over the life of the programmatic). Limited suitable nesting habitat occurs within this area; therefore, the removal of potential nest trees for murrelets within the Southwest area may affect the ability of murrelets to locate suitable nest trees should a previously used tree be removed, thus delaying their ability to breed. Therefore, for stands outside of Murrelet Zone 2, Southwest Area, we expect a negligible change in fidelity to the immediate area; and anticipate that murrelets will respond to the removal of potential nest trees by re-nesting in different trees within the affected stand, as long as alternate habitat of equal quality is available adjacent to the affected nest site. However, within the Murrelet Zone 2, Southwest Area, we anticipate that murrelets will have difficulty finding suitable nest trees if they are removed due to their limited availability in this area.

The ability for breeding murrelets to prospect for new nest sites is well documented. Prospecting involves pairs and individuals flying near and landing on tree limbs in the early spring and midsummer. Non-breeding birds and subadults may also participate in this activity during the midsummer. Birds also visit nesting areas during the winter and may select nest sites during this time (Nelson 1997). We expect the murrelets that nest within the action area to also prospect and thus have familiarity with the area around their nest site, including potential alternative nest sites. We, therefore, do not expect permanent murrelet displacement from the action area as a result of the proposed removal of up to five potential nest trees per stand or project, not to exceed 180 individual potential nest trees in Conservation Zone 1 and 45 potential nest trees in Conservation Zone 2. Additionally, although potential nest trees are limited in the Southwest Area, we anticipate that other potential nest trees are available for nesting. Thus, the removal of up to five potential nest trees from this area is not anticipated to result in the permanent displacement of individuals over the life of the programmatic.

We also consider whether relocating a nest site would delay breeding, because a significant delay could disrupt essential breeding behavior. Divoky and Horton (1995, p. 86) describe the “ease and rapidity with which displaced murrelets seek out new breeding areas.” They cite the frequency at which murrelets normally change nesting sites as evidence to this trait, and that they may be able to readily move at least short distances to new nest sites. Further, there is evidence that murrelets visit remnants of newly harvested stands before disappearing from the area (Divoky and Horton 1995, p. 86), indicating that murrelets might not immediately abandon a disturbed nest stand. The loss of five potential nest trees represents a condition far less

impacting than a harvested stand. Therefore, we do not expect murrelets to significantly delay breeding due to the removal of up to five potential nest trees per stand or project in areas outside of the Southwest Area. As stated above, due to the limited number of suitable nest trees in the Southwest Area, the removal of potential nest trees may result in delays in breeding as the murrelet prospects for another nest tree. We anticipate that this delay will result in a measurable affect to its normal breeding behavior. Therefore, the removal of a potential nest tree may adversely affect a pair of adult murrelets in the Southwest Area of Conservation Zone 2. Up to five pair of murrelets (one pair per tree removed) may be measurably affected over the life of the programmatic.

Based on the above information, we consider the loss of potential nest trees to be an adverse effect to murrelets within the action area due to the fidelity that murrelets have demonstrated for individual trees and stands. Removal of trees with suitable nest platforms would only occur after the nesting season. This minimizes the risk that individual murrelets or their eggs would be injured or killed from the felling of trees. Additionally, we do not expect the loss of up to five individual potential nest trees outside of the breeding season in the action area would result in a long-term abandonment of nesting stands. Any nesting displacement or temporary delay due to the removal of a potential nest tree would not result in a loss of reproduction within the action area as the displaced murrelets would be expected to nest in nearby suitable trees. Any nesting displacement or temporary delay would not result in a loss of reproduction within the action area as the displaced murrelets would be expected to nest in suitable trees elsewhere in the stand. The exception to this statement is within the Southwest Area of Conservation Zone 2, where due to the limited number of nest trees, removal of potential nest trees may result in displacement or temporary delay of nesting. Because of the removal of potential nest trees in an area with limited suitable nesting habitat, we conclude that the removal of potential nest trees within the Southwest Area of Conservation Zone 2 would result in a significant disruption of murrelet breeding behavior in subsequent years. We do not anticipate these actions to be significant within the remainder of the action area due to the limited number of potential nest trees removed within areas of greater habitat availability.

Indirect Effects to the Marbled Murrelet

Indirect effects are those effects that are caused by the proposed action and are later time, but still reasonably certain to occur (50 CFR 402.02). The removal of potential nest trees, non-potential nest trees 19 inches dbh and greater and understory vegetation including trees from 14 inches dbh to less than 19 inches dbh within 150 ft of murrelet suitable nest trees within suitable habitat are activities that may result in indirect effects to murrelets. Murrelets nesting in stands that remain after tree removal may experience lower nest success because of edge and fragmentation effects, which could contribute to increased predation, windthrow, and less favorable microclimatic conditions. These are considered indirect effects to murrelets and are discussed below.

<u>Nest Predation</u>

Research by Gates and Gysel (1978) was one of the first studies to demonstrate an inverse correlation between nest success (fledging success) and distance from habitat discontinuity

(habitat edge) due to mortality caused by nest predation and brood parasitism. An edge effect refers to the phenomenon in some habitat settings where predators are more effective in preying upon breeding birds nesting near habitat edges. Predators attracted by the habitat edge functions as the mechanism to lower nest success, rendering habitat nesting conditions less suitable for any species nesting along habitat edges. The preponderance of other studies on edge effects similarly demonstrate differential nest success near habitat edges and it is one of the most frequently suggested explanations for observed avian population declines in fragmented landscapes (Wilcove 1985; Paton 1994; Saracco and Collazo 1999).

Predation by corvids is a leading cause of murrelet nest failure (Ralph et al. 1995; Nelson and Hamer 1995a; Raphael et al. 2002; Martin Raphael, *in litt*. 2005). The risk of predation by avian predators appears to be highest in complex structured landscapes in proximity to edges and human activity, where many of the corvid species are in high abundance. Predation rates are influenced mainly by habitat stand size, habitat quality, nest placement (on the edge of a stand versus the interior of a stand), and proximity of the stand to human activity centers.

Nelson and Hamer (1995b) found that successful murrelet nests were significantly farther from edges (such as roads and forest openings) than unsuccessful nests, and cover directly around the nest was significantly greater at successful nests than unsuccessful nests. Murrelets experience high predation rates. Possible explanations for this include the fact that populations of murrelet predators, such as corvids (e.g., jays, ravens, and crows), are increasing in response to habitat changes and food sources provided by humans (USFWS 1997). In addition, the creation of forest edge habitat (such as from the construction of roads and timber harvest operations) may increase the vulnerability of murrelet nests to predation (USFWS 1997). However, a small number of murrelets have been recorded successfully nesting in high human-use areas, including state highways. Therefore, we assume that some murrelet nests may be adjacent to state roads.

State highways typically have high levels of human activity. Therefore, we expect that there are currently high predation rates along the edges of suitable murrelet habitat near state highways. WSDOT is proposing to limit the removal of suitable habitat to within 50 ft of the existing roadway clear zone. The loss of habitat within a small stand along an existing edge may increase the amount of predation on murrelet eggs and/or chicks due to the higher edge to area ratio that results. As stand size decreases, the edge effects increase, and the removal of habitat from these stands will result in a greater effect from any increase in edge. However, removal of suitable habitat from a stand 7 acres or smaller is not permitted under this programmatic nor is reducing the size of the stand below 7 acres allowed. Based on information for projects proposed in the 07-09 biennium, it appears that the majority of the proposed activities would not result in significant habitat removal within murrelet suitable habitat. However, the action proposes the removal of up to 0.5 acre of suitable habitat per stand (7.5 acres total) within 50 ft of an existing roadway. There is a lack of site specific information regarding the location and condition of these stands due to the programmatic nature of this consultation. Therefore, we have assumed that some projects may result in an increase in predation due to increased edge effect within the action area.

We do not anticipate that the removal of an individual tree (i.e., a potential nest trees or non-potential nest trees 19 inches dbh and greater) is likely to increase predation within a stand.

Although the removal of a single tree (i.e., due to hazard tree removal) within a stand creates a small amount of increased edge, the increase is not likely to result in a measurable increase in predation of murrelets.

We expect the proposed action to result in an increased predation risk to murrelets in some stands. Murrelets nesting adjacent to areas where suitable habitat has been removed may be exposed to an increased risk to nest predation due to human activities and reduction of cover. The actual amount of increase in predation is difficult to quantify due to the limited information regarding the presence of nesting murrelets near existing roadways and the potential increase due to removal of relatively narrow bands of vegetation (no more than 50 ft in width). Therefore, although we anticipate that there may be adverse effects to murrelets due to increased predation resulting in injury or reduced survival in areas where habitat removal decreases the distance between the nest and the habitat edge, we are unable to determine the magnitude and extent of these effects.

Windthrow Effects

Stand density, tree height, tree structure, and tree species composition are important factors in tree stability, as is support offered by adjacent trees (Harris 1989). Edge trees have longer crowns extending down their exposed side, favoring growth and stability, and are more resistant to windthrow (Oliver and Larson 1990). Trees in the lower crown classes are more susceptible to windthrow when exposed after thinning or partial cutting because they rely on surrounding trees for protection (Harris 1989; Oliver and Larson 1990).

Windthrow is often associated with timber harvest. Effects from windthrow may occur up to 30 ft to 60 ft from the edge of harvest (Stathers et al. 1994). The proposed action is unlikely to result in the extent of windthrow damage that may occur as part of a larger tree removal project, such as timber harvest. However, if wind-thrown trees have potential nesting platforms or strike and damage trees with potential nesting platforms, then indirect adverse effects to the murrelets could result. Therefore, we anticipate that windthrow may extend up to 30 ft into the stand and that damage due to falling trees could extend up to one site-potential tree (i.e., l50 ft). Therefore, total impacts could be up to 180 ft in width.

Increased windthrow as a result of tree removal could result in adverse effects to murrelets by downing or damaging suitable nest trees or downing trees adjacent to nest trees that provide cover to a nest tree, or downing trees that strike nesting murrelets. We anticipate that the likelihood of a tree actually striking a nesting murrelet is extremely unlikely to occur. Therefore, the effects are more likely to affect the suitability of the habitat for future nesting. The proposed action may remove up to 0.5 acre of understory vegetation, including trees from 14 inches dbh to less than 19 inches dbh within 150 ft of suitable murrelet nesting habitat per year per WSDOT region over the life of the programmatic, for a total of 7.5 acres. The proposal also includes the removal of up to 25 non-potential nest trees 19 inches dbh and greater per stand and the removal of up to 5 potential nest trees per stand or project within murrelet suitable habitat.

We do not anticipate that the removal of an individual tree (i.e., for hazard tree removal) will result in an increase in windthrow due to the limited openings this would create. However,

removal of multiple large trees (up to 30 trees total per stand) and/or vegetation removal within or adjacent to[41] murrelet suitable habitat up to 50 ft in width that may result in the removal of up to 0.5 acre of vegetation that includes trees from 14 inches dbh to less than 19 inches dbh per stand (not to exceed 7.5 acres total for the programmatic) may result in exposing non-wind hardened interior-stand trees to windthrow. Therefore, we anticipate that the effects to murrelet suitable habitat may be measurable due to increased windthrow.

We anticipate that some, but not all, of the areas that experience the removal of vegetation will have some loss of habitat due to windthrow. We anticipate that at most, effects from windthrow would affect murrelet habitat up to 180 ft into the stand from areas of habitat removal. Although we anticipate that there may be adverse effects to murrelets due to windthrow, we are unable to determine whether these effects will create the likelihood of injury to murrelets to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering.

Microclimate Changes

Loss of individual large trees within stands of suitable habitat adjacent to potential nest trees and the removal of up to a 50-ft wide strip of vegetation with trees from 14 inches dbh to less than 19 inches dbh within or adjacent to suitable murrelet nesting habitat may results in the degradation of nesting habitat due to the loss of canopy cover and microclimate impacts in the area affected.

New forest edges often influence the microclimate within the adjacent forest, which could affect nesting murrelets. When trees are felled, an opening in the canopy is created, which can cause changes in the microclimate in the surrounding stand. Air temperature, humidity, soil temperature, soil moisture, solar radiation, and wind speed within a stand can be altered by clearings (Chen et al. 1992). Along cut edges, the amount of windthrow and dead wood is more abundant because of exposure to strong winds and environmental stress.

Wind "significantly influences other physical (e.g., evapotranspiration) and biological (seed dispersal) processes and it drives air circulation, which controls the balance between energy (heat) and materials (e.g., vapor) between the edge and interior forest" (Chen et al. 1995). Chen et al. (1995) found that wind speed's distance of influence may range from 1,082 ft to 1,673 ft into an old-growth Douglas-fir forest. Based upon their data and other studies, the maximum distance of influence of wind blowing into the forest was probably greater than 5 or 6 tree heights. Further, microclimate changes in humidity and air temperature can affect the growth of moss (Hamer and Nelson 1995). The lack of moss can reduce the likelihood of murrelet nesting (Hamer and Nelson 1995).

We anticipate that there may be some effect to microclimate as a result of the removal up to a 50 ft width of vegetation (with trees 14 inches dbh to less than 19 inches dbh) and individual large trees (19 inches dbh and greater), within or adjacent to[42] murrelet suitable habitat measured from the edge of the existing roadway clear zone. These effects may extend up to 6 tree lengths into suitable habitat. Vegetation, including trees, to be removed would most likely be cut in a linear

[41] Adjacent is defined as within one site potential tree or 150 ft, which ever is greater.
[42] Adjacent is defined as within one site potential tree or 150 ft, which ever is greater.

manner adjacent to the roadway. While this is less impacting to a forest stand in terms of its microclimatic condition versus the removal of patches of trees in the middle of a stand or large portions of a stand (thus negatively affecting the quality of the stand as nesting habitat), this may still result in measurable effects to murrelets. The removal of individual trees may have a more localized effect.

Although the likelihood of a murrelet nest occurring in close proximity to an existing roadway is small, it is known to occur. Therefore, we anticipate that effects to microclimate due to habitat removal may occur that result in measurable effects to murrelets. Although we anticipate that there may be adverse effects to murrelets due to windthrow, we are unable to determine whether these effects will create the likelihood of injury to murrelets to such an extent as to significantly disrupt normal behavior patterns, including nesting and or sheltering.

Conclusion

Murrelets may be measurably affected due to the impacts associated with sound and visual disturbance and the removal of suitable nesting habitat. No mortality is anticipated due to the proposed action. We anticipate that murrelets may be flushed from the nest or incur a missed feeding due to sound and/or visual disturbance during the nesting season. Up to 5,264 acres of murrelet suitable habitat may be disturbed in Conservation Zone 1 and 5,226 acres in Conservation Zone 2 over the life of the programmatic. The removal of suitable habitat may result in a temporary disruption to murrelet breeding and sheltering behaviors due to the removal of potential nest trees and removal of suitable nesting habitat. These effects may include an increase in nest predation, windthrow, and microclimate. However, we do not anticipate that the effects of habitat removal will create the likelihood of injury to murrelets to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding or sheltering, except in the Southwest Area of Conservation Zone 2. Due to the limited availability of suitable nest trees within this area, the removal of up to five potential nest trees may result in displacement and temporary delayed nesting in to up to five pairs of adult murrelets (one pair per tree removed).

Effects of Interdependent and Interrelated Actions

Interdependent actions are those that have no independent utility apart from the action under consultation. Interrelated actions are those that are part of a larger action and depend upon the larger action for their justification.

Utility Relocations

WSDOT road widening or realigning projects may require utility relocation. This may include moving utility poles or uncovering buried utilities and trenching them in at new locations. Utility pole installation is typically accomplished with a large drill. Relocations may involve tree and other vegetation removal. Revegetation is possible, but would typically not include tree planting due to safety and maintenance concerns.

The proposed action may result in the removal of suitable murrelet habitat and/or disturbance of murrelets during the nesting season due to the use of large machinery that generates sound levels above ambient conditions. We anticipate that the proposed activities would occur within areas cleared as part of the WSDOT project, and no further habitat removal would be required. Additionally, except in those cases where work must occur during the murrelet nesting season as discussed previously, all work would occur outside the murrelet nesting season. Therefore, we do not anticipate that utility relocation activities will result in additional effects to murrelets or their habitat beyond those considered as part of the proposed project.

Cumulative Effects to Marbled Murrelets

Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this PBO. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. Effects to murrelets may be associated with sound and visual disturbance and habitat removal associated with activities such as county and private road improvements, and potentially land clearing for structures. However, timber harvest represents the greatest threat to murrelets within the action area.

Most private forestlands fall under the Washington Forest Practices Rules (WFPR). Under these rules, murrelet habitat is managed depending on whether or not the habitat occurs within an occupied murrelet site or in a murrelet detection area. Suitable murrelet habitat that occurs in occupied murrelet sites is protected from timber harvest. In murrelet detection areas, all suitable murrelet habitat that meets WFPR the minimum stand definitions (i.e., greater than or equal to 7 acres with greater than or equal to 2 nest platforms/acre) requires a protocol survey prior to harvest to determine murrelet occupancy. Outside murrelet detection areas, only habitat that has a high probability of murrelet occupancy (i.e., greater than or equal to 5 to 7 nest platforms/acre, depending on the location) is required to be surveyed prior to harvest. In the absence of a federally approved HCP or a State-approved special wildlife management plan, suitable murrelet habitat on non-Federal lands is only protected if protocol surveys document an occupied murrelet site. Suitable habitat outside of occupied sites that is determined to be unoccupied may be harvested. Outside murrelet detection areas, suitable habitat that has a lower probability of occupancy (i.e., less than or equal to 5 to 7 platforms/acre) is not protected on non-Federal lands and potential habitat that is located beyond 50 miles from the coast is not protected. Additionally, landowners who own less than 500 acres are exempted from these particular WFPR unless their lands contain an occupied murrelet site. However, the prohibitions against "take" in section 9 of the ESA still apply in all of these situations.

<u>Cumulative Effects to Marbled Murrelet Habitat in Conservation Zone 1</u>

The environmental baseline analysis indicates there are over 1 million acres of potential murrelet nesting habitat in Conservation Zone 1. About 68 percent (727,700 acres) is located on Federal lands, and 32 percent is located on non-Federal lands. Approximately 16 percent of the potential habitat (172,700 acres) in Conservation Zone 1 is located on private lands, while the other 16 percent is located primarily on State lands, managed under the WDNR HCP for State lands (WDNR 1997). As the WDNR has been previously consulted on under the ESA, its effects are

considered part of the baseline, and are not considered in the cumulative effects analysis. Although this habitat may be considered suitable nesting habitat for murrelets, the highest quality habitat occurs on Federal lands.

There are approximately 2.9 million acres of private lands in Conservation Zone 1, distributed across a large landscape that encompasses portions of the Olympic Peninsula, the Puget Trough lowlands, and the western Cascades. The majority of the private lands (94 percent) in Conservation Zone 1 contain second-growth forests that are not suitable murrelet nesting habitat. Potential murrelet habitat that does occur on the private lands is highly fragmented and occurs in small, isolated patches. Of the 172,700 acres of potential murrelet habitat on private lands, about 17 percent (29,200 acres) is located in murrelet detection areas, and about 8 percent (14,300 acres) is associated with the status 1 through 3 occupied site buffers. Due to the requirement for pre-harvest surveys in all stands that meet minimum suitable habitat criteria, we expect that occupied stands in murrelet detections areas are likely to be documented and protected as occupied murrelet sites.

The other 82 percent (142,000 acres) of potential murrelet habitat on the private lands in Conservation Zone 1 is not associated with detection areas or occupied sites, and is therefore at a higher risk of harvest. Only stands that have a high probability of murrelet occupancy (i.e., greater than or equal to 7 nesting platforms/acre) are protected with a pre-harvest survey requirement. We have no way of determining the number of nesting platforms per acre from the existing information, but we expect that relatively few locations on the private lands outside of detection areas will meet this criterion.

Other areas, such as the west slope of the north Cascades, have many patches of potential habitat that are not currently associated with known detection areas or occupied sites. Due to their proximity to the coast and proximity to adjacent detection areas, many of these locations may support nesting murrelets, but have not yet been surveyed to determine occupancy. Potential nest habitat that has less than 7 nesting platforms/acre could support nesting murrelets in these areas. Whether or not these areas will be surveyed prior to harvest is unknown, but there is a risk that occupied murrelet habitat outside of detection areas could be harvested.

Another area of concern is the area beyond 50 miles from the coast, since potential habitat in this area is not protected by the WFPR. Few murrelets have been documented this far from the coast, but occasional sightings have been reported. Of the 4,922 status 1 through 3 sites documented in Washington, only one site is located further than 50 miles from the coast. This particular site is located on Federal lands. Although there is substantial habitat on Federal lands beyond 50 miles from the coast, there are relatively few acres on private lands. We estimated there are 800 acres of potential habitat on private lands located 50 to 55 miles from the coast, and half of these acres are located east of the Cascade crest, so we expect that the risk of harvesting occupied habitat on private lands in these areas is low. The Service has not identified these far inland areas as important for recovery (USFWS 1997, p. 125-126). Additionally, the majority of suitable murrelet habitat that occurs beyond 50 miles from the coast is located on Federal lands and is protected by the standards and guidelines for land management under the Northwest Forest Plan, and subject to section 7 of the ESA. Actions on these lands are therefore not considered a cumulative effect.

The environmental baseline analysis for Conservation Zone 1 indicates that over 40,000 acres of potential murrelet nesting habitat was harvested between 1992 and 2002 on all ownerships, representing a decadal loss of about 3.6 percent. Timber harvest on private lands accounted for about 75 percent of the total habitat acres removed (30,000 acres). Harvest on Federal, tribal, or other HCP-covered lands accounted for the remaining 25 percent of habitat loss. Timber harvest on the private lands removed about 15 percent of the potential murrelet habitat that was present in 1992 to 1996. These data suggest that potential murrelet habitat on the private lands is currently being harvested at a rate of about 3,000 acres per year, or a rate of about 1.5 percent annually. If these rates of harvest continue into the future, up to 150,000 acres of potential murrelet habitat could be harvested on private lands over the next 50 years, essentially removing all habitat acres that are not associated with occupied murrelet sites on private lands in Conservation Zone 1.

Cumulative Effects to Marbled Murrelet Habitat in Conservation Zone 2

The environmental baseline analysis indicates that there are over 497,000 acres of potential murrelet nesting habitat in Conservation Zone 2. About 67 percent (332,400 acres) are located on Federal lands, and 33 percent (164,000 acres) is located on non-Federal lands. Approximately 14 percent of the potential habitat (69,400 acres) in Conservation Zone 2 is located on private lands, while the other 19 percent is located primarily on State lands managed under the WDNR HCP for northern spotted owls and murrelets (WDNR 1997). As stated earlier, these effects are considered part of the environmental baseline, and are not included in the cumulative effects analysis. Although this habitat may be considered suitable nesting habitat for murrelets, the highest quality habitat occurs on Federal lands.

There are over 2.5 million acres of private lands in Conservation Zone 2, distributed across a large landscape that encompasses portions of the western Olympic Peninsula, southwest Washington, the Puget Trough lowlands, and the western Cascades. The majority of the private lands (97 percent) in Conservation Zone 2 contain second-growth forests that are not suitable murrelet nesting habitat. Potential murrelet habitat that does occur on the private lands is highly fragmented and occurs in small, isolated patches. Of the 69,400 acres of potential murrelet habitat on the private lands, about 27 percent (18,650 acres) is located in murrelet detection areas, and about 16 percent (11,400 acres) is associated with the status 1 - 3 occupied site buffers. Due to the high level overlap between occupied site buffers and detection areas, we estimate that about 20,000 acres of the potential murrelet habitat is associated with murrelet detection areas or occupied sites (29 percent). Due to the requirement for pre-harvest surveys in all stands that meet minimum suitable habitat criteria, we expect that occupied stands in detections areas are likely to be documented and protected as occupied murrelet sites.

The other 71 percent (49,000 acres) of potential murrelet habitat on the private lands in Conservation Zone 2 is not associated with detection areas or occupied sites, and is therefore at a higher risk of harvest. Only stands that have a high probability of murrelet occupancy are protected with a pre-harvest survey requirement. Suitable murrelet habitat with a high probability of occupancy is defined as having greater than or equal to 5 platforms/acre in the southwest Washington murrelet special landscape (WAC 222-16-087) and greater than or equal to 7 platforms/acre elsewhere. We have no way of determining the number of nesting platforms

per acre from the existing information, but we expect that relatively few locations on the private lands outside of existing detection areas will meet these criteria.

Other areas, such as the southwest Washington murrelet special landscape, or the northwest Olympic Peninsula, have many patches of potential habitat that are not currently associated with known detection areas or occupied sites. Due to their proximity to the coast and proximity to adjacent detection areas, many of these locations may support nesting murrelets, but have not yet been surveyed to determine occupancy. Potential nest habitat that has less than five nesting platforms/acre could be supporting nesting murrelets in these areas. Whether or not these areas will be surveyed prior to harvest is unknown, but there is a risk that occupied murrelet nesting habitat outside of detection areas could be harvested.

The environmental baseline analysis for Zone 2 indicates that over 25,000 acres of potential murrelet nesting habitat was harvested between 1992 and 2002 on all ownerships, representing a decadal loss of about 4.8 percent. Timber harvest on the private lands accounted for about 87 percent of the total habitat acres removed (21,800 acres). Harvest on Federal, tribal, or other HCP-covered lands accounted for the remaining 13 percent of habitat loss. Timber harvest on the private lands removed about 24 percent of the potential murrelet habitat that was present in 1992 to1996. These data suggest that potential habitat on the private lands has been harvested at a rate of about 2,000 acres per year, or a rate of about 2.4 percent annually. If these rates of harvest continue into the future, all potential murrelet habitat on the private lands that is not associated with occupied sites could be harvested over the next 25 to 50 years.

Summary of Cumulative Effects of Private Timber Harvest to marbled Murrelets

The risk of habitat loss on private lands appears to be substantial over the long-term. The potential loss of 190,000 acres of potential murrelet habitat on private lands could result in the abandonment of some landscapes that are currently marginally suitable for murrelets, leading to a further contraction of the species distribution to Federal and State lands. Some but not all of this acreage is within the action area. We assume that the majority of murrelets in both Conservation Zones 1 and 2 are nesting in high-quality habitat patches located on Federal lands, but relatively few surveys have been conducted on Federal lands to confirm this assumption.

We have no reliable way of estimating the number of individual murrelets that could be affected by timber harvest on private lands. To do so would require an assumption of average murrelet density per acre of habitat, and we have no data to support such an assumption at the scale of the private lands. Although McShane et al. (2004) and others developed population viability models for murrelets, these models do not include habitat variables to test the effects of habitat loss on population viability. Several studies have examined the relationship between murrelet densities and available nesting habitat, but there are no clear thresholds of landscape viability from these studies. Rather, these studies have shown that murrelets are positively associated with total watershed area, positively associated with increasing amounts of late-seral forests in a watershed, and negatively associated with increasing edge and amounts of logged or unsuitable habitat (McShane et al. 2004).

Cumulative Effects of Climate Change

We expect that climate change may start to alter the ecosystem that supports murrelets during the 5 years that the PBO is in place. Effects of climate change may alter the geographic or elevation range of murrelets and the availability of nesting habitat and their forage species. Changes that may result due to climate change include an increase in forest fires due to less snow and a drier environment, changes in forest microclimate that may impact the production of moss that is used to form nest platforms, and a reduction of prey species due to ocean warming. We anticipate that although effects to murrelets and their habitat due to climate change are likely to occur, due to the short duration of this PBO (5 years) these effects may not be measurable or detectable.

Integration and Synthesis: Marbled Murrelets

The above analysis forms the foundation for our jeopardy analysis, which is intended to determine whether we would reasonably expect threatened or endangered species to experience reductions in reproduction, numbers, or distribution that would appreciably reduce the species' likelihood of surviving and recovering in the wild and/or the destruction or adverse modification of designated critical habitat. Below, we describe how the expected effects of the project will relate to the survival and recovery of the murrelet at the project, conservation zone, and listed range of the species.

The Service expects adverse effects to murrelets in the form of disturbance and habitat removal. We also expect the proposed action to result in other significant adverse indirect effects to murrelets, including increased predation, adjacent windthrow, microclimate changes, and cumulative effects. However, we do not anticipate a likelihood of injury to murrelet behavior due to these indirect effects.

The Murrelet Recovery Plan outlined a conservation strategy that includes short-term actions and long-term conservation needs for the survival and recovery of the species. Relative to the proposed action, the conservation measures against which we measure the potential for the murrelet's survival and recovery include maintaining and increasing the distribution and quality of suitable nesting habitat while minimizing disturbance and reducing predation.

In the Status of the Species and Environmental Baseline sections of this PBO, we established that murrelet abundance and distribution have been significantly reduced throughout its range. Population trends cannot be derived from current survey data, but have been estimated to be declining in all six Conservation Zones (McShane et al. 2004, pp. 6-27). The estimated population decline across all conservation zones ranges from 2.0 to 15.8 percent annually (Beissinger and Nur 1997 in USFWS 1997; McShane et al. 2004).

Conservation Zone 1

Compared to other zones, Conservation Zone 1 appears to contain one of the larger murrelet populations in the species' listed range (Huff et al. 2003). Conservation Zone 1 also has an estimated population decline that is lower than other Conservation Zones (Zones 3, 4, and 6) (Steven R. Beissinger and M. Z. Peery *in litt*. 2003).

Much of the land within Conservation Zone 1 has been replaced by urban development (USFWS 1997). Opportunities for increasing or protecting suitable additional murrelet habitat are limited, which increases the importance of the remaining habitat.

The Service expects the proposed action will result in the following adverse effects to murrelets in the form of disturbance and suitable habitat removal (Table 40). WSDOT construction and maintenance activities will result in sound and visual disturbance of to up to 2,574 acres of suitable murrelet habitat during the early nesting season and 2,178 acres during the late nesting season over the life of the programmatic. The removal of up to 180 potential nest trees makes those trees unavailable to murrelets now and into the future. The removal of 6.0 acres of understory vegetation including trees from14 inches dbh to less than 19 inches dbh within 150 ft of suitable murrelet habitat and the removal of 600 non-potential nest trees 19 inches dbh and greater may result in increased predation, windthrow, and/or changes in microclimate. Although we anticipate adverse effects may occur to murrelets due to changes in microclimate, predation, and windthrow as a result of the removal of suitable and buffer habitat, we area unable to determine whether these effects due to the proposed action will create the likelihood of injury to murrelets to such an extent as to significantly disrupt normal behavior patterns.

Table 40. Adverse effects anticipated to murrelets and their habitat in Conservation Zone 1 proposed programmatic activities.

Impact	**Per Year**	**Over Life of Programmatic (5 years)**
Visual and sound disturbance of habitat associated with nesting murrelets and their young during the nesting season resulting in flushing from the nest or a missed feeding	Early Nesting Season: Approximately 594 acres[1]	Early Nesting Season: 2,574 acres[2]
	Late Nesting Season: Approximately 396 acres[1]	Late Nesting Season: 2,178 acres[2]
Removal of potential nest trees from murrelet nesting habitat precluding their availability for nesting in the future	36 trees (no more than five per project or stand over the life of the programmatic)	180 trees (no more than five per project or stand over the life of the programmatic)
Increased predation on murrelets associated increased edge	Anticipated but unlikely to significantly disrupt normal behavior patterns	Anticipated but unlikely to significantly disrupt normal behavior patterns
Increased windthrow due to the removal of vegetation	Anticipated but unlikely to significantly disrupt normal behavior patterns	Anticipated but unlikely to significantly disrupt normal behavior patterns
Change in microclimate due to the removal of vegetation	Anticipated but unlikely to significantly disrupt normal behavior patterns	Anticipated but unlikely to significantly disrupt normal behavior patterns

[1] An additional 198 acres of disturbance may occur due to one project that includes pile driving.
[2] An additional 198 acres is included for one project that includes pile driving.

The Recovery Plan includes steps to decrease or eliminate threats to survivorship, and recognizes the importance of minimizing disturbance to attain this goal. To maintain and retain nesting murrelets within Conservation Zone 1, disturbance to adult and nestling murrelets must be minimized to avoid flushing adults off nests and exposing them and their nestlings and eggs to predation. The proposed action meets part of this conservation strategy by restricting all activities within the injury threshold distances to occur between 2 hours after sunrise to 2 hours before sunset during the nesting season.

The Recovery Plan also contains a conservation strategy for reducing nest predation. Creation of forest edge and fragmentation contributes to nest predation. The proposed action will result in a small increase in forest edge. The proposed activities will primarily occur adjacent to existing roadways where some additional edge may be created due to limited widening of the existing roadway. Because we expect some increase in forest edge, we also expect some increase in predation. However, the proposed action will require that any construction activities within 5 miles of suitable murrelet nesting habitat ensure that food waste is disposed of to prevent the attraction of corvids (MM-7), further limiting the likelihood of increasing predation. Although we anticipate some increase in predation to occur within Conservation Zone 1, we cannot determine the extent or increase in predation in an area where there is already existing forest edge, nor the number of individuals that may be affected. Nonetheless, we anticipate murrelet's within the action area may be injured, and some of these individuals will have reduced survival.

We also expect an increase in windthrow effect and microclimate changes to the adjacent forest stands because of the removal of trees. The extent and magnitude change to the stand microclimate and windthrow cannot be determined at this time, but are expected to be limited in scope due to the restrictions on habitat removal proposed within Conservation Zone 1.

Due to murrelets' high site fidelity and the fact that significant portions of the suitable habitat stands will remain intact, we expect murrelets to continue to occupy the area as a result of the proposed project despite the loss of a limited number of potential nest trees.

The only interrelated or interdependent actions anticipated are associated with the relocation of utility lines. We anticipate that these actions will occur within areas already cleared of suitable murrelet habitat as part of the proposed action and no further habitat removal would be required. Additionally, we anticipate that any sound and visual disturbance associated with these actions will occur concurrently with WSDOT action. Therefore, we do not anticipate that utility relocation actions will result in additional effects to murrelets beyond those considered as part of the proposed action.

Conservation Zone 2

Most of the forest lands in the northwestern portion of Conservation Zone 2 occur on public (State, county, city, and Federal) lands, while most forest lands in the Southwest Area are privately owned. Extensive timber harvest has occurred throughout Conservation Zone 2 in the last century, but the greatest loss of suitable nest habitat is concentrated in the Southwest Area of Conservation Zone 2 (USFWS 1997). Thus, murrelet conservation is largely dependent upon Federal lands in northern portion of Conservation Zone 2 and non-Federal lands in the Southwest

Area. Because of the greater vulnerability of murrelets in the Southwest Area of Conservation Zone 2, WSDOT is proposing to limit the loss of habitat within this area to no more than 25 non-potential nest trees, only one suitable nest tree in stands with 5 or more platforms, and 0.5 acre of understory vegetation including trees from 14 inches dbh to less than 19 inches dbh within 150 ft of suitable murrelet habitat over the life of the programmatic.

The Service expects the proposed action will result in adverse effects to murrelets in the form of disturbance and suitable habitat removal. Proposed WSDOT construction and maintenance activities will cause adverse effects from levels of sound pressure and visual disturbance to 792 acres of occupied suitable murrelet habitat during the early nesting season and 4,158 acres during the late nesting season over the life of the programmatic. The direct loss of 45 potential nest trees within nesting habitat makes those areas unavailable to murrelets now and into the future. The removal of 1.5 acres of understory vegetation, including trees from 14 inches dbh to less than 19 inches dbh within 150 ft of suitable murrelet habitat, 150 non-potential nest trees, and of 45 potential nest trees may result in modification of microclimate, increased predation, and windthrow, and loss of potential nesting habitat in the future. Although we anticipate adverse effects to murrelets due to changes in microclimate, predation, and windthrow as a result of the removal of suitable and buffer habitat, are unable to determine whether these effects due to the proposed action will create the likelihood of injury to murrelets to such an extent as to significantly disrupt normal behavior patterns. Table 41 provides a summary of these proposed impacts.

Table 41. Adverse effects anticipated to murrelets and their habitat in Conservation Zone 2 proposed programmatic activities.

Impact	Per Year	Over Life of Programmatic (5 years)
Visual and sound disturbance of habitat associated with nesting murrelets and their young during the nesting season resulting in flushing from the nest or a missed feeding	Early Nesting Season: Approximately 198 acres[1]	Early Nesting Season: 792 acres[2]
	Late Nesting Season: Approximately 792 acres[1]	Late Nesting Season: 4,158 acres[2]
Removal of potential nest trees from murrelet nesting habitat precluding their availability for nesting in the future	9 trees (no more than five per project or stand over the life of the programmatic)	45 trees (no more than five per project or stand over the life of the programmatic)[3]
Increased predation on murrelets associated increased edge	Anticipated but unlikely to significantly disrupt normal behavior patterns	Anticipated but unlikely to significantly disrupt normal behavior patterns
Increased windthrow due to the removal of vegetation	Anticipated but unlikely to significantly disrupt normal behavior patterns	Anticipated but unlikely to significantly disrupt normal behavior patterns
Change in microclimate due to the removal of vegetation	Anticipated but unlikely to significantly disrupt normal behavior patterns	Anticipated but unlikely to significantly disrupt normal behavior patterns

[1] An additional 198 acres of disturbance may occur due to one project that includes pile driving.
[2] An additional 198 acres of disturbance is included for one project that includes pile driving.
[3] Southwest Area of Conservation Zone 2 – no more than 25 trees total.

The Recovery Plan includes steps to decrease or eliminate threats to survivorship, and recognizes the importance of minimizing disturbance to attain this goal. To maintain and retain nesting murrelets within Conservation Zone 2, disturbance to adult and nestling murrelets must be minimized to avoid flushing adults off nests and exposing them to predation. The proposed action meets part of this conservation strategy by restricting all activities within the disturbance distances to occur between 2 hours after sunrise to 2 hours before sunset during the nesting season.

The Recovery Plan also contains a conservation strategy for reducing nest predation. Creation of forest edge and fragmentation contributes to nest predation. The proposed action will result in a small increase in forest edge. The proposed action will primarily occur adjacent to existing roadways where some additional edge may be created due to limited widening of the existing roadway. Because we expect some increase in forest edge, we also expect some increase in predation. However, the proposed action will require that any construction activities within 5 miles of suitable murrelet nesting habitat ensure that food waste is disposed of to prevent the attraction of corvids (MM-7), further limiting the likelihood of increasing predation. Although

we anticipate some increase in predation may occur within Conservation Zone 2, we cannot determine the extent or increase in predation in an area where there is already existing forest edge, nor the number of individuals that may be affected. Nonetheless, we anticipate murrelet's within the action area may be injured, and some of these individuals will have reduced survival.

Due to murrelets' high site fidelity and the fact that significant portions of the suitable habitat stands will remain intact, we do not expect murrelets to be extirpated from the area as a result of the proposed project due to the loss of potential nest trees. The exception is in the Southwest Area of Conservation Zone 2, where limited suitable nesting habitat remains. We anticipate that the removal of up to five potential nest trees within this area over the life of the programmatic will result in significant effects to normal behaviors, such as breeding, to five pair of adult murrelets.

We also expect an increase in windthrow effect and microclimate changes to the adjacent forest stands because of the removal of trees. The extent and magnitude change to the stand microclimate and windthrow cannot be determined at this time, but are expected to be limited in scope due to the restrictions on habitat removal proposed within Conservation Zone 2.

The only interrelated or interdependent actions anticipated are associated with the relocation of utility lines. We anticipate that these actions will occur within areas already cleared of suitable murrelet habitat as part of the proposed action and no further habitat removal would be required. Additionally, we anticipate that any sound and visual disturbance associated with these actions will occur concurrently with WSDOT action. Therefore, we do not anticipate that utility relocation actions will result in additional effects to murrelets beyond those considered as part of the proposed action.

Conclusion - Marbled Murrelets

Under section 7(a)(2) of the ESA, Federal agencies must ensure that activities are not likely to jeopardize the continued existence of any listed species. We do not anticipate that the proposed project will not reduce the reproduction, number, or distribution of murrelets within Conservation Zones 1 and 2, and therefore, is not expected to reduce appreciably the likelihood of both survival and recovery of the species in the wild. After reviewing the current status of the murrelet, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's Biological Opinion that the WSDOT Western Washington Regions programmatic consultation, as proposed, is not likely to jeopardize the continued existence of the murrelet for the following reasons.

- The proposed action will not injure or kill any murrelets. WSDOT will only remove trees within murrelet suitable habitat outside of the breeding season. Although potential nest trees may be affected due to windthrow, we anticipate that it is extremely unlikely that an active murrelet nest would be directly affected due to a falling tree.

- The amount of suitable habitat (as a surrogate) that will be exposed to injurious levels of sound and visual stimuli represents a small portion of the total suitable habitat within each conservation zone. During the early nesting season, we anticipate that a total of

3,366 acres of suitable nesting habitat will be affected over the life of the programmatic. Of this 2,574 acres will be in Conservation Zone 1 [12 projects (no more than 3 per year) of approximately 198 acres each. Excluding pile driving] and 673 acres [3 projects (no more than 1 per year) of approximately 198 acres each, excluding pile driving] will be in Conservation Zone 2. Therefore, in any one year, murrelets associate with up to approximately 2,574 acres of suitable habitat within Conservation Zone 1 and 396 acres in Conservation Zone 2 may be disturbed during the early nesting season. During the late nesting season, up to 2,178 acres of suitable nesting habitat in Conservation Zone 1 and 4,158 acres in Conservation Zone 2 may be disturbed during the late nesting season. These effects would be temporary and sublethal. Murrelets are expected to continue to use the action area. Due to the species high site fidelity and the fact that the majority of the suitable habitat stands will remain intact, we expect the murrelets to continue to use the stands in the action area after implementation of the proposed action.

- The proposed action will directly remove 180 suitable nest trees in Conservation Zone 1 and 45 suitable nest trees Conservation Zone 2. This permanent removal would reduce the number of available nest sites. However, trees with suitable platforms that could be removed by the proposed action would be close to the edge of the stand (within 50 ft) and likely are currently subject to high levels of predation. These areas typically act as population sinks with little or no successful fledging of chicks (Gates and Gysel 1978; Nelson and Hamer 1995a).

- The proposed action will directly remove 600 and 150 non-suitable nest trees 19 inches dbh and greater in Conservation Zone 1 and Conservation Zone 2, respectively. In addition, suitable habitat may be removed to within 50 ft of the existing clear zone. This permanent removal may contribute to predation, windthrow, and microclimate change. However, the area affected represents a small loss of murrelet suitable habitat

- The proposed action will also reduce suitable habitat in Conservation Zone 1 by up to 6 acres and Conservation Zone 2 by up to1.5 acres of understory vegetation including trees from 14 inches dbh to less than 19 inches dbh. These acres are distributed throughout the two Conservation Zones, with no more than 0.5 acre per project or stand. The potential loss of these acres represents a very small percent of available murrelet suitable habitat.

Effects to Marbled Murrelet Critical Habitat

The primary constituent elements of murrelet critical habitat are PCE #1 - individual trees with potential nesting platforms and PCE #2 - forested areas within 0.5 mile of individual trees with potential nesting platforms and a canopy height of at least one-half the site-potential tree height. This includes all such forests, regardless of contiguity. Areas with one or both PCEs are, by definition, considered critical habitat. For the purposes of this programmatic, we have assumed that one-half the site-potential tree height is 75 ft (see site-potential tree definition in Appendix A).

The following actions with impacts are proposed within murrelet critical habitat (Table 42).

Table 42. Potential direct impacts to murrelet critical habitat by WSDOT region.

Potential Impacts	Southwest Region (per year)	Olympic Region (per year)	Northwest Region (per year)	Total per Region for Programmatic	Total for Programmatic
Removal of understory vegetation or trees (includes trees less than 14 inches dbh) from murrelet critical habitat	5 acres	5 acres	5 acres	25 acres (not to exceed 5 acres per project or stand)	75 acres
Removal of understory vegetation and trees from 14 inches dbh to less than 19 inches dbh within 150 ft of murrelet critical habitat	0.5 acre	0.5 acre	0.5 acre	2.5 acres (not to exceed 0.5 acres per project or stand)	7.5 acres
Removal of non-potential nest trees 19 inches dbh and greater from murrelet critical habitat	50 trees (no more than 25 per project or stand over the life of the programmatic)	50 trees (no more than 25 per project or stand over the life of the programmatic)	50 trees (no more than 25 per project or stand over the life of the programmatic)	250 trees	750 trees
Removal of potential nest trees from murrelet critical habitat	15 trees (no more than five per project or stand over the life of the programmatic)	15 trees (no more than five per project or stand over the life of the programmatic)	15 trees (no more than five per project or stand over the life of the programmatic)	75 trees	225 trees

The removal of up to 5 acres of understory vegetation (including trees less than 14 inches dbh) within murrelet critical habitat per WSDOT region, per year is anticipated. Therefore, a maximum of 25 acres of such habitat per WSDOT region (not to exceed 5 acres per project or stand) can be removed for a total of 75 acres for the life of this PBO. This maximum loss will likely also be counted against the maximum loss of northern spotted owl nesting, roosting, foraging, and dispersal habitat.

The removal of up to 0.5 acre of understory vegetation including trees from 14 inches dbh to less than 19 inches dbh within 150 ft of murrelet suitable nest trees in murrelet critical habitat per WSDOT region per year is anticipated. Therefore, a maximum of 2.5 acres of such habitat per WSDOT region (not to exceed 0.5 acre per project or stand) can be removed for a total of 7.5 acres for the life of this PBO. This maximum loss will likely also be counted against the maximum loss of northern spotted owl nesting, roosting, foraging, and dispersal habitat.

The removal of up to 50 non-potential nest trees 19 inches dbh and greater (no more than 25 trees per project or stand over the life of the programmatic) in murrelet critical habitat per WSDOT region per year is anticipated. Therefore, a maximum of 250 trees of such habitat per WSDOT region can be removed, for a total of 750 trees for the life of this PBO. This maximum loss will likely also be counted against the maximum loss of northern spotted owl nesting, roosting, foraging, and dispersal habitat.

Removal of 15 potential nest trees (no more than 5 per project or stand per over the life of the programmatic) in murrelet critical habitat per region per year is allowed. Therefore, a maximum of 75 potential nest trees per WSDOT region can be removed for a total of 225 potential nest trees for the life of this PBO. This maximum loss will likely also be counted against the maximum loss of northern spotted owl nesting, roosting, foraging, and dispersal habitat.

Although lands on the Mount Rainier, North Cascades, and Olympic National Parks were not designated as critical habitat, the parks have requested that the conditions of the PBA/PBO be applied to these lands as if they were designated. We cannot base our effect determination (or adverse modification conclusion) to critical habitat based on this request as these lands have not been legally designated as critical habitat. However, all conservation measures and limits to habitat removal are assumed to apply to these national park lands based on their request.

Insignificant and Discountable Effects to Marbled Murrelet Critical Habitat

Up to 75 acres of understory vegetation (including trees less than 14 inches dbh) may be removed from areas designated as murrelet critical habitat. It is unlikely that this vegetation would be considered either PCE #1 or PCE #2. The majority of this acreage is anticipated to be existing cleared areas adjacent to roadways that will be brushed. Some acreage may also be second growth trees on active timber management lands. Some individual larger vegetation (trees less than 14 inches dbh) may be removed due to road widening or for safety reasons. However, understory vegetation that includes trees less than 14 inches dbh is not suitable as a nest tree (PCE #1) or likely to form a 75 ft forest canopy (PCE #2). Therefore, we anticipate that the removal of up to 75 acres of understory vegetation, including trees less than 14 inches dbh,

will not result in measurable effects to murrelet critical habitat. Thus, these effects are anticipated to be insignificant to the function of PCE #1 and PCE #2.

Measurable Effects to Marbled Murrelet Critical Habitat

Removal of forest vegetation would adversely affect murrelet critical habitat in the following manner:

- PCE #1: Up to 225 potential nest trees may be removed from murrelet critical habitat. These trees may be less suitable for nesting due to their proximity to roadways and increased exposure to predators due to their proximity to an edge. However, murrelets may select to nest there. Therefore, removal of these trees may result in adverse effects to murrelet critical habitat due to their permanent removal as nesting habitat.

- PCE #2: Up to 750 non-potential nest trees may be removed from critical habitat, which will reduce the suitability of the critical habitat for nesting.

- PCE #2: Up to 7.5 acres of understory vegetation from 14 inches dbh to less than 19 inches dbh within 150 ft of murrelet suitable habitat within murrelet critical habitat may be removed. The amount of this acreage that may be removed within 0.5 mile of an individual nest tree with potential nesting platforms is unknown. We have assumed for this programmatic that all 7.5 acres that may be removed could function as PCE #2, and result in the permanent loss of critical habitat function.

The loss of up to 225 potential nest trees, 750 non-potential nest trees, and 7.5 acres of understory vegetation from 14 inches dbh to less than 19 inches dbh within 150 ft of murrelet suitable habitat that serve as PCE #1 and PCE #2 within critical habitat, represents a small but permanent loss of critical habitat in each CHU it occurs. This loss prevents or delays (if trees are allowed to regenerate) future development of adjacent suitable habitat, albeit a small amount and, therefore, would result in an adverse effect to murrelet critical habitat due to the loss of these constituent elements.

The amount of vegetation removal due to the proposed action within each CHU is not known. To estimate the effects by CHU, we anticipate that the proportion of habitat removal for each CHU will be approximately equivalent to the percent of WSDOT roadway within 50 ft of that CHU (Table 43). Note that no critical habitat is likely to be affected in WA-08 as none exists within 50 ft of a state roadway.

Table 43. Direct impacts to murrelet critical habitat by CHU over the life of the programmatic.

Murrelet CHU	Murrelet Critical Habitat within Washington (acres)	Murrelet Critical Habitat within 50 ft of State Roadways in the Action Area (acres)	Murrelet Critical Habitat within 50 ft of State Roadways in Washington (percent)	Removal of understory vegetation and trees from 14 inches dbh to less than 19 inches dbh within 150 ft of murrelet suitable nest trees within CHU (acres)[1]	Removal of non-potential nest trees 19 inches dbh and greater from murrelet nesting habitat within CHU	Removal of potential nest trees from murrelet nesting habitat within CHU
WA-01	68,654	148	0.22	0.5	46	14
WA-02	64,677	94	0.15	0.3	29	9
WA-03	162,827	134	0.08	0.4	41	12
WA-05	1,434	109	7.60	0.3	34	10
WA-06	115,731	109	0.09	0.3	34	10
WA-07	192,019	925	0.48	2.9	286	86
WA-08	105,601	0	0.00	0.0	0	0
WA-09	178,696	31	0.02	0.1	10	3
WA-10	144,245	267	0.19	0.8	83	25
WA-11	172,267	610	0.35	1.9	189	57
Total	1,206,151	2427	0.20	7.5	750	225

[1] These acreages are likely to be less than stated as the calculations were run using 300 ft rather than 150 ft.

Indirect Effects to Marbled Murrelet Critical Habitat

Indirect effects are those that are caused by, or will result from, the proposed action and are later in time, but are still reasonably certain to occur (50 CFR 402.02). Indirect effects to murrelet critical habitat as a result of the proposed action may occur due to increased windthrow or microclimate change within the action area.

Windthrow Effects

Stand density, tree height, tree structure, and tree species composition are important factors in tree stability, as is support offered by adjacent trees (Harris 1989). Edge trees have longer crowns extending down their exposed side, favoring growth and stability, and are more resistant to windthrow (Oliver and Larson 1990). Trees in the lower crown classes are more susceptible to windthrow when exposed after thinning or partial cutting because they rely on surrounding trees for protection (Harris 1989; Oliver and Larson 1990).

Windthrow is often associated with forms of timber harvest. Effects from windthrow may occur up to 30 ft to 60 ft from the edge of harvest (Stathers et al. 1994). The proposed action is unlikely to result in the extent of windthrow damage that may occur as part of a larger tree removal action, such as timber harvest.

We do not anticipate that the removal of an individual tree will result in an increase in windthrow due to the limited openings this would create. However, removal of multiple large trees [up to 30 trees total per stand (a total of up to 750 non-suitable nest trees 19 inches dbh and greater and 225 potential suitable nest trees)] and/or widening the road up to 50 ft and removing up to 0.5 acres (7.5 acres total) of vegetation that includes trees from 14 inches dbh and less than 19 inches dbh within 150 ft of suitable murrelet habitat may result in exposing non-wind hardened interior-stand trees to windthrow. Therefore, we anticipate that the effects to murrelet critical habitat PCEs #1 and #2 may be measurable due to increased windthrow. However, we do not anticipate that the effects of windthrow will extend beyond 180 ft in width into murrelet critical habitat (see discussion under **Indirect Effects to Marbled Murrelet- Windthrow Effects**).

Microclimate Changes

Loss of individual large trees within stands of suitable habitat adjacent to potential nest trees and the removal of up to a 50-ft wide strip of vegetation with trees 14 inches dbh to less than 19 inches dbh within or adjacent to suitable habitat may result in the degradation of nesting habitat due to the loss of canopy cover and resulting microclimate impacts in the area affected, thus affecting PCE #2.

New forest edges often influence the microclimate within the adjacent forest, which could affect the suitability of murrelet nesting habitat. When trees are felled, an opening in the canopy is created which can cause changes in the microclimate in the surrounding stand. Air temperature, humidity, soil temperature, soil moisture, solar radiation, and wind speed within a stand can be altered by clearings (Chen et al. 1992).

Wind "significantly influences other physical (e.g., evapotranspiration) and biological (seed dispersal) processes and it drives air circulation, which controls the balance between energy (heat) and materials (e.g., vapor) between the edge and interior forest" (Chen et al. 1995). Chen et al. (1995) found that wind speed's distance of influence may range from 1,082 ft to 1,673 ft into an old-growth Douglas-fir forest. Based upon their data and other studies, the maximum distance of influence of wind blowing into the forest was probably greater than 5 or 6 tree heights. Further, microclimate changes in humidity and air temperature can affect the growth of moss (Hamer and Nelson 1995). The lack of moss can reduce the likelihood of murrelet nesting (Hamer and Nelson 1995). Therefore, the proposed action may result in changes to microclimate that results in degradation to murrelet critical habitat no more than six tree heights into murrelet critical habitat.

Effects of Interdependent and Interrelated Actions

Interdependent actions are those that have no independent utility apart from the action under consultation. Interrelated actions are those that are part of a larger action and depend upon the larger action for their justification.

Utility Relocations

WSDOT road widening or realigning projects may require utility relocation. This may include moving utility poles or uncovering buried utilities and trenching them in at new locations. Utility pole installation is typically accomplished with a large drill. Relocations may involve tree and other vegetation removal. Revegetation is possible, but would typically not include tree planting due to safety and maintenance concerns.

We anticipate that the proposed actions would occur within areas cleared as part of the WSDOT action, and no further habitat removal would be required. Therefore, we do not anticipate that utility relocation actions will result in additional effects to murrelet critical habitat beyond those considered as part of the proposed action.

Cumulative Effects to Marbled Murrelet Critical Habitat

Cumulative effects include the effects of future State, Tribal, local, or private actions that are reasonably certain to occur in the action area considered in this PBO. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to ESA section 7. Although effects to murrelet critical habitat associated with activities such as county and private road improvements, and potentially land clearing for structures, timber harvest represents the greatest threat to murrelet critical habitat within the action area.

The types and amounts of other non-Federal actions that may occur within the action area are unknown but could include non-Federal forest management and other non-Federal actions (such as recreation and development within adjacent private in-holdings) within critical habitat. Critical habitat in private ownership may or may not be occupied by murrelets. WFPR may preclude removal of these areas if they are occupied by murrelets. Therefore, the ability to remove timber is unknown. Additionally, timber harvest may occur on non-Federal forestlands that could affect PCE #2 (i.e., trees within 0.5 mile of trees with nesting platforms). However, we are unable to determine with the information provided the amount and/or likelihood of this action on non-Federal lands. Therefore, the Service is unable to conclude that future actions are reasonably certain to occur within these two critical habitat units.

Integration and Synthesis – Marbled Murrelet Critical Habitat

We expect adverse effects to murrelet critical habitat PCE #1 and PCE #2 due to the direct and indirect impacts associated with habitat removal. In the Status of the Species and Environmental Baseline, we established that the murrelet abundance and distribution have been significantly reduced throughout its range. Although the proposed action will not improved these conditions

within critical habitat, we do not anticipate that the proposed habitat removal will preclude the functions provided by the critical habitat to murrelets.

Although we anticipate structural elements (large trees) may be removed from suitable habitat stands, the stands would retain their suitability and function. In addition, the loss of these structural elements would occur within approximately 50 ft of state roadways reducing their habitat suitability due to an increase in windthrow and microclimate. Murrelet critical habitat would be adversely affected through the loss of trees with platforms suitable for murrelet nesting as well as trees that provide cover and protection of potential nest trees. It is anticipated that no trees with nesting murrelets in them would be lost. Suitable murrelet habitat would be degraded through the loss of structural elements (large trees) and the potential reduction in available stands within one-half mile of individual trees with suitable platforms, and with a canopy height of at least one-half the site potential tree height within murrelet CHUs.

However, this proposed critical habitat removal is unlikely to significantly alter the function of the CHUs to provide for the conservation of the murrelet due to the vegetation removal limits proposed within each stand anticipated for each unit (Table 42). Additional indirect effects due to windthrow and microclimate are anticipated. However, we do not anticipate that these effects will preclude the functions of the critical habitat to murrelets due to the limited habitat removal proposed.

Conclusion

The proposed project is expected to adversely affect PCEs #1 and #2. While effects to these PCEs are expected to degrade their condition, we anticipate that each of the PCEs will still be able to serve their intended conservation role for marbled murrelets.

After reviewing the current status of the murrelet critical habitat, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the biological opinion of the Service that the proposed action is not likely to result in the destruction or adverse modification of critical habitat because the effect on murrelet critical habitat PCEs is expected to be significant at the stand scale and not at the CHU level. This effect on critical habitat PCEs does not represent an appreciable diminishment in the capability of the critical habitat to satisfy essential requirements of the murrelet based on the following:

- Adverse effects to murrelet critical habitat are anticipated due to the removal of both primary constituent elements of murrelet habitat. However, the area of PCEs affected by the action is an extremely small percentage of the PCEs within the CHUs.

- The proposed action will remove 15 suitable nest trees in Conservation Zone 1 and 45 suitable nest trees Conservation Zone 2. This permanent removal would reduce the number of available nest sites. However, trees with suitable platforms that could be removed by the proposed action would be close to the edge of the stand (within 50 ft) and likely subject to elevated levels of predation. These areas typically act as population sinks with little or no successful fledging of chicks (Gates and Gysel 1978; Nelson and Hamer 1995a).

- The proposed action will also reduce suitable habitat in Conservation Zone 1 by 15 acres and Conservation Zone 2 by 5 acres. The proposed action may increase the edge to volume ratio of a stand of suitable habitat, and therefore may contribute to a change in potential windthrow and/or microclimate conditions. Although we are unable to determine the actual extent of these effects on critical habitat, we anticipate that they are limited due to the small amount of acreage affected by the proposed action and limited distance the effects extend into a stand.

- We, therefore, anticipate that the effects on designated critical habitat are relatively limited and do not appreciably diminish the capability of the critical habitat to satisfy essential requirements of the murrelet at the critical habitat unit level and moreover at the range-wide scale

Effects to Northern Spotted Owl

This section analyzes the potential effects of the proposed action on northern spotted owls through direct and indirect effects and interdependent actions. Potential direct effects include sound and visual disturbance and habitat modification within or adjacent to their suitable habitat. Indirect effects include increased predation risk, windthrow, and microclimate changes. Adverse effects of a single project could result from disturbance, habitat loss, or both.

Summary of Minimization Measures Specific to Northern Spotted Owls

The following measures are proposed in the PBA to specifically minimize impacts of the proposed action to northern spotted owls. These measures are considered part of the proposed action, and are taken into account in determining the effects of the proposed action on northern spotted owls.

MM-9	MM-10	MM-11	MM-12	MM-13	MM-15
MM-16	MM-18	MM-19	MM-21	MM-22	MM-23

Potential Effects to Northern Spotted Owls

This section analyzes the potential adverse effects of the proposed action on northern spotted owls through:

- disturbance from project-generated sound and visual stimuli
- the permanent loss of forested habitat
- reduction in prey base
- increased threat of predation/competition
- increased threat of windthrow

WSDOT is proposing the following impacts to northern spotted owls under the programmatic. WSDOT has limited their request for coverage within nesting, roosting, foraging, and dispersal northern spotted owl habitat as follows (Table 44).

Table 44. Potential adverse impacts to northern spotted owl suitable and dispersal habitat.

Potential Impacts	Southwest Region (per year)	Olympic Region (per year)	Northwest Region (per year)	Total per Region for Programmatic	Total for Programmatic
Visual and Sound Disturbance[1]	1 project	1 project	1 project	SW Region-3 NW Region-5 Olympic Region- 3	11 projects
Removal of understory vegetation and/or trees less than 14 inches dbh from northern spotted owl nesting, roosting, and foraging habitat, or dispersal habitat	5 acres	5 acres	5 acres	25 acres (not to exceed 5 acres per project or stand)	75 acres
Removal of understory vegetation or trees from 14 dbh to less than 19 inches dbh from northern spotted owl nesting, roosting, and foraging habitat, or dispersal habitat	0.5 acre	0.5 acre	0.5 acre	2.5 acres (not to exceed 0.5 acre per project or stand)	7.5 acres
Removal of non-potential nest trees 19 inches dbh and greater from northern spotted owl nesting and roosting habitat or dispersal habitat	50 trees (no more than 25 per project or stand over the life of the programmatic)	50 trees (no more than 25 per project or stand over the life of the programmatic)	50 trees (no more than 25 per project or stand over the life of the programmatic)	250 trees	750 trees
Removal of potential nest trees from northern spotted owl nesting habitat	15 trees (no more than 5 per project or stand over the life of the programmatic)	15 trees (no more than 5 per project or stand over the life of the programmatic)	15 trees (no more than 5 per project or stand over the life of the programmatic)	75 trees	225 trees

[1] Pile driving - up to one project each in the Olympic Peninsula and Western Washington northern spotted owl provinces. Blasting - up to one project each per Olympic Peninsula and Eastern Cascades Washington Cascades. Blasting during the nesting season only allowed for emergency slide removal activities.

Sound and Visual Disturbance

There is little information on northern spotted owl-specific responses to auditory and visual disruption. To analyze the potential effects on increased sound levels, the Service utilized the same data and assumptions presented for the murrelet (please see **Effects to Marbled Murrelet**: Sound and Visual Disturbance). Additional data specific to owl species are presented below.

Visual Disturbance

The analysis for estimating sight-only injury threshold - the distance at which a northern spotted owl would be flushed from its nest or cause it to miss feeding one of its young by the sight (not sight *and* sound) of human activity - is provided in the Service (2007b) and is slightly modified here. Northern spotted owls rarely flush due to presence of people who are not using loud, motorized equipment. Researchers climbing nest trees would be expected to flush adults from nests and cause missed feedings. Most roosts and virtually all nests are high enough that northern spotted owls do not flush even when someone walks directly under the roosting or nesting spotted owls (Scott Gremel, *in litt*. 2009; Dennis Rock, *in litt*. 2009; Dale Herter, *in litt*. 2009). In addition, many or most of the northern spotted owl nests in the Pacific Northwest are located in tree cavities, so pedestrians are out of view to the nesting northern spotted owls (and *vice versa*). Northern spotted owls can be flushed at approximately 6 yards to 10 yards when roosting close to the ground during, for example, hot weather (Gremel, *in litt.* 2009; Rock, *in litt.* 2009; Herter, *in litt.* 2009). Additionally, flushes by adult and juvenile Mexican spotted owls occurred within 24 meters and 12 meters, respectively, of hikers, and that a 55-meter buffer "would eliminate virtually all behavioral responses of owls to hikers" (Swarthout and Steidl 2001, p. 312). Rather than set the sight-only injury distance at 6 yards, it was anticipated that some northern spotted owls could act more like the Mexican spotted owls, so a conservative distance between 6 yards and 26 yards was set to a sight-only injury threshold at 20 yards (60 ft).

Sound Disturbance

Johnson and Reynolds (2002, p. 1) report that Mexican spotted owl behavior during military fixed-wing aircraft training, in which maximum noise levels measured at the owl site were 78, 92, and 95 dB for the three fly-bys, ranged from no response to a sudden turning of the head. Delaney et al. (1999) found that Mexican spotted owls, during both the nesting season and the non-nesting season, did not flush from the helicopter noise unless the noise was at least 92 dB.

The frequency range of the noise created by power equipment (e.g., construction equipment) appears to be a major factor in flush response of the Mexican spotted owl. Mexican spotted owls were flushed by chainsaw noise (less than 46 dB) that was considerably lower than helicopter noise levels that flushed owl (greater than 92 dB) (Delaney et al. 1999, p. 60). It appears that more of the total chainsaw noise energy was in the mid-frequency range, where estimated spotted owl hearing sensitivity is greatest. Helicopter sound energy level peaked at the lower end of the spectrum below the estimated spotted owl hearing sensitivity range. This difference partially explains the higher response rates of Mexican spotted owls to chainsaws at lower noise levels than for helicopters (Delaney et al. 1999).

The greater response of owls to chain saws versus helicopters in the study by Delaney et al. (1999) are in line with the analysis by Awbrey and Bowles (1990) that aircraft overflights were less detrimental than common ground-based activities such as hiking. However, visual detection may interact synergistically with auditory detection of humans and their activities. Delaney et al. (1990) reports that "Although chainsaws were…operated out of sight of reference spotted owls, … field crews had to set up recording equipment beneath the spotted owls for both types of manipulations." Subsequent spotted owl flushes may have been associated with the synergistic combination of ground-based human activity and chainsaw sound, rather than sound only.

Using the data mentioned above and the data presented in the preceding sections for the murrelet, the Service currently assumes that normal behavior of northern spotted owls will be disrupted when human caused noise results in sound levels that exceed 92 dB.

Habitat Removal

WSDOT proposes the removal of vegetation of various size and types – from understory vegetation (that may include grass, shrubs, or trees less than 14 inches dbh) to trees greater than 19 inches dbh. We have provided definitions of northern spotted owl suitable and dispersal habitat in (Appendix A). Because of the site specific characteristics required to determine if a stand is considered suitable, unsuitable, or dispersal habitat, we have made the following assumptions regarding the proposed habitat removal. We have assumed that all sites are, at a minimum, considered dispersal habitat. In addition, some sites may also provide roosting, foraging habitat, and/or nesting habitat, depending on site specific characteristics. Site specific surveys will need to be conducted to identify the actual type of habitat affected due to each of the proposed activities.

Insignificant and Discountable Effects to Northern Spotted Owls

Based on the above information, the Service has determined that the following types of activities will result in insignificant effects to northern spotted owls.

1. Activities that are greater than ambient sound levels and less than 92 dBA within suitable[43] habitat March 1 through July 15 (March 15 through July 30 in Mount Rainier National Park), and less than 60 ft of northern spotted owl suitable habitat.

    - Sound levels less than 92 dBA are detected by northern spotted owls, but do not result in flushing or a missed feeding of the individual (Delaney et al. 1999).

    - Visual disturbance of nesting northern spotted owls may occur if humans are within 60 ft of suitable nesting habitat. Visual disturbance may result in flushing or a missed feeding of young.

[43] Suitable habitat for northern spotted owls is defined as nesting, roosting, and foraging habitat.

- Northern spotted owls are unlikely to nest within of a 60 ft of a state highway (Johnson 1992, p. 117). Therefore, the likelihood of disturbance to northern spotted owls and their young due to visual disturbance is considered discountable.
- Therefore, implementation of these measures is likely to result in insignificant effects to northern spotted owls and their young when conducted during the early nesting season.

2. Activities (except blasting) that result in sound above 92 dBA and/or visual disturbance within northern spotted owl suitable habitat during the late nesting season (July 16 through September 30; August 1 through September 30 in Mount Rainier National Park).

    - Northern spotted owlets are no longer completely dependent upon the adults and are able to thermoregulate, fly, and forage on their own after July 15, thereby reducing their susceptibility to disturbance-related effects.

        - Therefore, effects of flushing of adults or young from a nest are not likely to significantly affect northern spotted owls during the late nesting season.

3. Blasting more than 200 ft from northern spotted owl suitable habitat during the nesting season (March 1 through September 30; March 15 through September 30 in Mount Rainier National Park).

    - Base on blasting data for WSDOT programs (Table 34), blasting that occurs greater than 200 ft from suitable habitat during the nesting season is unlikely to produce sound pressures that exceed 92 dBA within this habitat.

        - Therefore, effects to northern spotted owls are anticipated to be insignificant.

4. Removal of northern spotted owl suitable nesting habitat above 5,000 ft in elevation.

    - Northern spotted owls are not expected to nest above 5,000 ft in the Washington Cascades. Although habitat may be considered suitable above 5,000 ft, removal of this habitat is unlikely to result in a measurable effect to nesting northern spotted owl as they are unlikely to utilize for that purpose at this time[44]. *NOTE: THIS HABITAT MAY BE USED AS ROOSTING, FORAGING, AND/OR DISPERSAL HABITAT AND MUST MEET RESTRICTIONS APPROPRIATE TO THESE HABITAT TYPES*

        - Therefore, we do not anticipate that removal of northern spotted owl nesting habitat above 5,000 ft in elevation will result in significant effects to this species.

[44] Due to climate change, northern spotted owls may nest above this elevation in the future assuming suitable habiat is available.

5. Removal of up to 5 acres of understory vegetation (including trees less than 14 inches dbh) within a stand of suitable northern spotted owl habitat within the northern spotted owl nesting season (October 1 through February 28; October 1 through March 14 in Mount Rainier National Park). The following conditions would apply: sound pressures would not meet or exceed 92 dBA within, visual disturbance would not occur within 60 ft of, and trees would not be felled toward suitable northern spotted owl habitat. *VEGETATION TO BE REMOVED WOULD MEET THE DEFINITION OF DISPERSAL HABITAT*[45] *(APPENDIX A).*

    - The removal of vegetation that does not provide suitable nesting, roosting, or foraging habitat is unlikely to significantly affect nesting northern spotted owls.

    - Removal of vegetation within northern spotted owl suitable habitat is not permitted during the nesting season. This significantly reduces the likelihood of disturbance of nesting northern spotted owls to visual and sound disturbance. We anticipate that these effects will not be measurable to northern spotted owl

        - Therefore, we do not anticipate that the removal of up to 5 acres of understory vegetation (including trees up to 14 inches dbh) within a stand of suitable habitat outside the nesting season will result in significant impacts to northern spotted owl.

    - The removal of understory vegetation may affect northern spotted owl forage species. However, the amount of vegetation permitted for removal is limited to 5 acres per region per year, for a total of 75 acres (not to exceed 5 acres per project or stand) for the life of the programmatic. We do not anticipate that the removal of up to 75 acres of understory vegetation including trees less than 14 inches dbh will measurably affect northern spotted owls due to a significant reduction in the availability of forage species.

        - Therefore, we do not anticipate that the removal of up to 75 acres of understory vegetation will result in significant impacts to northern spotted owls.

    - Young forest dispersal habitat is generally abundant and well-distributed across much of western Washington. We do not anticipate that the removal of up to 75 acres of understory vegetation (no more than 5 acres per project or stand per WSDOT region per year) including trees less than 14 inches dbh will measurably affect local or regional dispersal capabilities of northern spotted owls along a highway corridor.

        - Therefore, we do not anticipate that the removal of up to 75 acres of understory vegetation will result in significant impacts to northern spotted owls.

[45] Not all young forest meets the definition of "dispersal habitat." Only those areas proposed for removal that meet this defintion are subject to the acreage removal limitations.

6. Removal of up to 0.5 acres of understory vegetation, including trees from 14 inches dbh to less than 19 inches dbh within a stand of suitable northern spotted owl habitat outside of the northern spotted owl nesting season (October 1 through February 28; October 1 through March 14 in Mount Rainier National Park). *VEGETATION TO BE REMOVED WOULD MEET THE DEFINITION OF DISPERSAL HABITAT (APPENDIX A).*

    - The removal of vegetation that does not provide suitable nesting, roosting, or foraging habitat is unlikely to measurably affect nesting northern spotted owls.

    - Removal of vegetation within northern spotted owl suitable habitat is not permitted during the nesting season. Therefore, this significantly reduces the likelihood of disturbance of nesting northern spotted owls due to visual and sound disturbance.

    - The removal of understory vegetation may affect northern spotted owl forage species. However, the amount of vegetation permitted for removal is limited to 0.5 acre per WSDOT region per year, for a total of 7.5 acres (not to exceed 0.5 acre per project or stand) over the life of the programmatic. We do not anticipate that the removal of up to 7.5 acres of understory vegetation including trees from 14 inches dbh to less than 19 inches dbh will measurably affect northern spotted owls due to a reduction in the availability of their forage species.

    - This vegetation type may be considered dispersal habitat depending on the site characteristics. Dispersal habitat is not considered suitable habitat. We do not anticipate that the removal of up to 7.5 acres (not to exceed 0.5 acre per project or stand) of understory vegetation including trees less from 14 inches dbh to less than 19 inches dbh will measurably affect local or regional dispersal capabilities of northern spotted owls.

        - Therefore, we do not anticipate that the removal of up to 7.5 acres (not to exceed 0.5 acre per project or stand) of dispersal habitat outside of the nesting season will result in significant impacts to northern spotted owls.

Measurable Effects to Northern Spotted Owl from Sound and Visual Disturbance

WSDOT's proposed action could adversely affect northern spotted owls from exposure to increased sound levels and visual stimuli during the northern spotted owl nesting season. The proposed action may result in a postponed or missed feeding of a chick or the flushing of an adult from the nest due to sound or visual disturbance. These responses are anticipated to result in measurable effects to individuals.

The Service completed an analysis of the potential for injury associated with sight- and sound-caused disturbance to northern spotted owls in the terrestrial environment (USFWS 2007b, Appendix G). In that analysis, we concluded that that the behaviors indicating potential injury include flushing from the nest, aborted feeding attempts, and postponed feedings. These behaviors and their potential consequences are described below.

Scientific data related to injury threshold distances associated with sound and visual disturbance are limited, and we continue to collect pertinent data related to the issue. Consequently, the injury threshold distances used in this PBO may be adjusted in the future, when warranted.

Flushing exposes the adult and the nest to any predator in the vicinity. Premature departure (flushing) of a juvenile northern spotted owl can increase the risk of predation and/or physically harm the young.

Northern spotted owls have co-evolved with their old-growth forest habitats and thus are behaviorally and physiologically adapted to these forests (USFWS 2007c, Appendix G; USFWS 2007d, Appendix G). Northern spotted owls are secretive, and their passive defense behaviors and physical characteristics tend to decrease the visibility of a nesting or roosting owl. Adult northern spotted owls maintain a constant diurnal presence at nest sites during the breeding season. Females rarely leave the nest during the incubation and brooding periods for longer than 10 to 20 minutes, especially during the hottest portion of the day. Flushing responses during the incubation and brooding periods can expose the embryos and chicks to unfavorable elements (e.g., heat) and to predators.

Northern spotted owls utilize cavity and platform nests and roosts during the day when they are relatively inactive. Northern spotted owls are highly heat intolerant and appear to actively seek roost sites with favorable microclimate conditions. California spotted owls displayed behavioral responses to heat stress (increased breathing rate, ptiloerection, gaping, and wing drooping) at relatively moderate temperatures of 30°C to 34 °C (86 °F to 93 °F).

Flushing in response to human activities may deplete northern spotted owl "activity budgets"

Northern spotted owls have extremely low metabolic rates and metabolic intake needs, which are demonstrated by their minimal diurnal activities, their sit-and-wait foraging behavior, and their apparently modest energy requirements. For example, California spotted owls, on average, can feed young and meet their own energy needs by consuming one northern flying squirrel (*Glaucomys sabrinus*) every 1.8 days or one woodrat (*Neotoma fusciptes*) every 3.7 days (USFWS 2007c, Appendix G; USFWS 2007d, Appendix G). Juveniles display inactivity and roosting behaviors similar to those of adults.

The low diurnal activity level of northern spotted owls is demonstrated by the remarkably low metabolic rates for the California spotted owl. Members of the order Strigiformes are known to have lower metabolic rates and metabolizable energy intake than other birds, yet the California spotted owl, even among a group known for low metabolic rates, has a metabolic rate that is 18 percent lower and metabolizable energy intake that is 44 percent lower than predicted for an owl the size and weight of the California spotted owl (Carey 1985). Also, field metabolic rates of five adults provisioning dependent young averaged only 34 percent of that predicted for comparably sized non-passerine birds.

Additionally, the activity budgets of female northern spotted owls may be more directly affected by human disturbance than that of males. Since female northern spotted owls attend nests almost exclusively, egg and nestling survival depend largely on their behavior (Weathers et al. 2001).

Extent of Exposure to Northern Spotted Owls due to Disturbance

The early breeding season for northern spotted owls spans from March 1 to July 15 (March 15 through July 30 within Mount Rainier National Park), and the late breeding season spans from July 16 to September 30 (August 1 through September 30 within Mount Rainier National Park). Northern spotted owls are more susceptible to noise disturbance during the early nesting season when adults are producing and incubating eggs and the young are still unable to fly (Weathers et al. 2001). During the late nesting season, we do not anticipate that fledgling northern spotted owls would be adversely affected by disturbance, because they are able to thermoregulate without the aid of their parents and can fly away from a disturbance.

Some activities may occur during the northern spotted owl early nesting season due to adverse weather conditions or their emergency nature. Increased sound and visual disturbance may result in an adult flushing from the nest. However, we expect that adult northern spotted owls can flush from the nest without crushing their eggs or hurting their young. Adults are expected to return to the nest when the disturbance has subsided. Flushing from the nest infrequently and for a short duration is unlikely to result in a failed nest during incubation. We do not anticipate the proposed actions to result in a failed nest or injury to young.

Northern spotted owls would be vulnerable to visual disturbance and sound levels generated from heavy equipment operated during this time period. Additionally, blasting may occur during the breeding season within northern spotted owl suitable habitat at least once each in the Olympic Peninsula and Eastern Washington Cascades Provinces over the life of the programmatic. Blasting during the nesting season would only be allowed if needed as part of emergency slide removal projects.

All proposed activities that exceed 92 dBA sound pressure in suitable northern spotted owl habitat [except those that must occur during the early nesting season due to location (high elevation that limits the construction season due to adverse weather conditions and snow), low temperatures and/or coastal fog (for paving) or emergency nature] will be conducted outside of the early nesting season for northern spotted owl. High elevation construction activities may be conducted during the early nesting season for northern spotted owl due to the limited construction season at those locations. However, WSDOT assumes that approximately a half to three quarters of the higher elevation projects can avoid disturbance related injuries to listed species. Paving actions may also need to occur during the early nesting season due to minimum temperatures needed for this work. Additionally, paving cannot occur unless roads are dry. This further limits the work window within coastal areas where fog creates wet pavement. Emergency actions covered in this PBO may occur at any time, including the nesting season, due to the urgency of implementing these activities to protect human life and property. These types of activities will expose breeding northern spotted owl to sound and/or visual disturbance through blasting, pile driving, jackhammers, guardrail post drivers, rock drills, chainsaws, batch plants, and heavy equipment operation during the northern spotted owl breeding season. Unlike normal traffic, the proposed action will result in heavy machinery advancing slowly along the road corridor, with many starts and stops. In addition, there will be a number of workers outside their vehicles causing increased visual disturbance. WSDOT has requested one project per

WSDOT region per year (not to exceed a total of 11 projects over 5 years[46]) be permitted to disturb nesting northern spotted owls over the life of the programmatic for activities associated with emergencies or that cannot be delayed until outside of the nesting season due to adverse weather conditions. These 11 projects are likely to include several types of sound generating equipment, some that may not exceed the 92 dBA sound pressure during the entire duration of the work, while others may include blasting and pile driving in addition to construction equipment that exceeds 92 dBA. No more than one blast each is anticipated during the early nesting season in the Olympic Peninsula and Eastern Cascade Provinces over the life of the programmatic. We anticipated that visual disturbance will occur as part of each of the proposed 11 projects.

No information was provided regarding the previous use of pile driving during the northern spotted owl nesting season within suitable habitat. We have estimated that effects due to pile driving may occur twice over the life of the programmatic. We have assumed that pile driving may occur once each in the Washington Lowlands and Western Washington Cascades Provinces. Pile driving may occur as part of a project that also includes other construction related sound and visual disturbance activities.

Because of the programmatic nature of this consultation, the FHWA and WSDOT were not able to identify the specific timing and locations of the activities, or the level of disturbance that may be caused by the work. To determine the extent of exposure of sound and visual disturbance that may result from the proposed 11 projects, we assumed that most projects would result in disturbance of up to 200 ft from a project within northern spotted owl suitable habitat during the nesting season. All activities, except those that included impact pile driving, would attenuate to below 92 dBA within 200 ft of the sound creating event. Impact pile driving was anticipated to attenuate to less than 92 dBA at 400 ft. Because some of the potential projects may use less disturbing equipment, the extent of the impacts is considered to be conservative (over-estimated). Therefore, the actual number of acres affected, and presumably the number of individual northern spotted owls that may be disturbed, is likely to be lower than predicted.

Based on information previously provided by WSDOT (Swarthout and Steidl 2003), 73 projects occurred within a total linear distance of 346 miles of potentially suitable northern spotted owl habitat over approximately 2 years (2005 to 2007). Potential suitable habitat was defined by WSDOT as all areas in National Park, National Forest, northern spotted owl critical habitat, northern spotted owl territories, and WDNR special emphasis areas. The linear distance of the average project was calculated to be approximately 4.7 miles.

Using the largest disturbance threshold distance (excluding pile driving) expected for the types of equipment used for the projects considered in this consultation (200 ft), the anticipated number of projects (11) that may occur during the northern spotted owl nesting season within or adjacent to suitable habitat, and the average length of projects (4.7 miles), we have calculated that an average project could cause visual and/or sound disturbance to northern spotted owls

[46] Based on GIS mapping information (described later in this section) the Service determined that there was a probability that 11 northern spotted owl pairs may be affected due to the proposed action. We have limited the adverse effects of the programmatic such that each northern spotted owl is only adveresly affected once over the life of the programmatic. Thus, WSDOT is limited to 11 projects.

associated with 228 acres of suitable northern spotted owl habitat. Therefore, for the 11 proposed projects, up to 3,420 acres of suitable northern spotted owl habitat would be subject to sound and/or visual disturbance above the disturbance thresholds. In addition to this, we have assumed that impact pile driving may occur twice within northern spotted owl suitable habitat over the life of the programmatic. Based on Appendix I we have estimated that sound pressure from pile driving will attenuate to less than 92 dBA by at least 400 ft. This would result in an additional 912 acres of disturbance to northern spotted owls during the nesting season. As some of the acreage associated with pile driving will overlap the area affected by other sound and visual disturbance activities (assuming a distance of 200 ft of overlap in all directions), we have estimated that an additional 456 acres would be impacted due to pile driving from two pile driving projects over the life of the programmatic, for a total acreage of 3,874 acres. This additional disturbance would occur within the Western Washington Cascades and Washington Lowlands northern spotted owl provinces. This acreage is likely an overestimate as stated above. Additionally, some projects will likely use quieter equipment with narrower disturbance threshold distances over the life of this consultation, further reducing the effects of the proposed action.

Northern spotted owl survey data are not current: therefore, the Service assumes that the action area could be occupied by northern spotted owls during implementation of the proposed action. We anticipate that noise levels and visual stimuli may disrupt normal feeding, breeding, and sheltering behaviors of nesting northern spotted owls associated with to 3,874 acres during the early breeding season over the life of the programmatic.

The Service conducted a mapping exercise using GIS information to estimate the number of northern spotted owl pairs that may be affected due to the disturbance proposed for this project. The Service used historic northern spotted owl core areas (0.7 mile radius circle), potential suitable habitat, and proximity to state highways data as part of the assessment. Although northern spotted owl data are not current, it is the best available information at this time for estimating the presence of northern spotted owl territories. A full description of the methodology used is available in our records for this action.

Based on this analysis, 11 historic northern spotted owl core areas were within proximity to a state highway, representing areas of high probability that northern spotted owls may be present and affected by the proposed action if work occurred during the nesting season. These effects by province are as follows:

- Olympic Peninsula Province - 4 northern spotted owl pairs and their young
- Eastern Washington Cascades Province - 2 northern spotted owl pairs and their young
- Western Washington Cascades Province - 5 northern spotted owl pairs and their young

Therefore, we assume that up to 11 northern spotted owl pairs and their young may be adversely affected due to visual and/or sound disturbance during the early nesting season that will disrupt their normal feeding, breeding, and sheltering behaviors.

Measurable Effects to Northern Spotted Owls from Habitat Modification

The proposed action would result in the removal of suitable and dispersal habitat within the action area. Table 45 includes the estimated acreage of suitable habitat that occurs within 50 ft of state highways (based on GIS analysis), and thus subject to potential habitat removal due to the proposed action.

Table 45. Total acres of nesting, roosting, and foraging northern spotted owl habitat affected due to sound disturbance associated with the proposed action.

Northern Spotted Owl Province	**Northern Spotted Owl Suitable Habitat in the action area (acres)**	**Northern Spotted Owl Suitable Habitat within 50 ft of the highway (acres)**	**Percent of Northern Spotted Owl Suitable Habitat within 50 ft of the highway**
Olympic Peninsula	46,909	1,341	0.2
Western Washington Lowlands	59,485	2,045	0.5
Western Washington Cascades	113,587	3,462	0.2
Eastern Washington Cascades	13,110	394	0.0
Totals:	**233,091**	**7,242**	**0.2%**

WSDOT has established sideboards that limit the amount and degree of habitat alteration that can occur in each WSDOT region due to activities considered under this programmatic consultation (Table 46). Additionally, vegetation removal within or adjacent to[47] northern spotted owl habitat will be no more than 50 ft in width from the edge of the existing roadway clear zone.

[47] Adjacent is defined as within one site potential tree or 150 ft, which ever is greater.

Table 46. Potential impact to northern spotted owl suitable and dispersal habitat by WSDOT region.

Potential Impacts	Southwest Region (per year)	Olympic Region (per year)	Northwest Region (per year)	Total per Region for Programmatic	Total for Programmatic
Removal of understory vegetation or trees less than 14 inches dbh from northern spotted owl nesting, roosting, and foraging habitat, and/or dispersal	5 acres	5 acres	5 acres	25 acres[1] (not to exceed 5 acres per stand)	75 acres (not exceed 5 acres per stand)
Removal of understory vegetation or trees from 14 inches dbh to less than 19 inches dbh from northern spotted owl nesting, roosting, and foraging, and/or dispersal habitat	0.5 acre	0.5 acre	0.5 acre	2.5 acres[1] (not to exceed 0.5 acre per stand)	7.5 acres (not to exceed 0.5 acre per stand)
Removal of non-potential nest trees 19 inches dbh and greater than from northern spotted owl nesting, roosting, and foraging, and/or dispersal habitat	50 trees (no more than 25 trees per project or stand over the life of the programmatic)	50 trees (no more than 25 trees per project or stand over the life of the programmatic)	50 trees (no more than 25 trees per project or stand over the life of the programmatic)	250 trees	750 trees
Removal of potential nest trees from northern spotted owl nesting, roosting, and foraging habitat	15 trees (no more than five trees per project or stand over the life of the programmatic)	15 trees (no more than five trees per project or stand over the life of the programmatic)	15 trees (no more than five trees per project or stand over the life of the programmatic)	75 trees	225 trees

[1] The total acreage of understory vegetation within dispersal habitat cannot exceed 5 acres per stand.

Many of the activities covered by this programmatic consultation could result in the modification or elimination of components of northern spotted owl habitat such as potential nest trees, large trees that shelter nest trees, or understory vegetation that supports prey species. Some of the proposed activities, such as new interchanges, lane widenings, and stormwater treatment, would cause permanent habitat loss. These projects also have the potential for the greatest quantity of habitat loss. Other activities, such as bridge scour repair, culvert replacement or extension, placement of instream structures such as riprap, barbs, and groins, and debris removal may require tree and understory removal to provide access and staging areas. The impacts associated with these latter activities are expected to result in a smaller footprint, can avoid the removal of individual high value trees, and in most cases the sites will be re-vegetated following completion of the activities.

Direct Injury or Mortality

Direct injury or mortality to northern spotted owls as a result of the proposed action could occur if northern spotted owls were present during tree-felling activities and injury due to blasting near an occupied nest.

WSDOT will not fell trees in suitable northern spotted owls nesting habitat during the nesting season (March 1 through September 30; March 15 through September 30 in Mount Rainier National Park). Additionally, if blasting is proposed within suitable northern spotted owl habitat, a qualified northern spotted owl biologist is required to determine if any suitable nest trees will be impacted, and if so, these impacts must be avoided. Therefore, we do not expect direct injury or mortality to northern spotted owls as a result of the proposed action.

Loss of Individual Potential Nest Trees

No known occupied nest trees may be felled. However the proposed action may result in the loss of habitat components such as individual large trees or snags. Of concern is the loss of potential nest trees or large trees adjacent to potential nest trees. A potential nest tree does not mean that it is actually being used for nesting; just that it has the structural elements that provide for nesting. In the PBO, a potential nest tree is defined as a tree 19 inches dbh or greater that is located within suitable habitat. Determination of whether trees to be removed are currently suitable nest trees shall be done on a site-specific and tree-specific basis by qualified WSDOT project biologists using the definitions provided in Appendix A.

As stated above, the projects and activities covered by this programmatic consultation will be adjacent to existing roads and highways. As a result, the likelihood that any of these potential nest trees would actually be an occupied nest tree is low. Johnson (1992, p. 117; USFWS 2002) found that northern spotted owl nest sites were predominantly located more than 328 ft from forest edges (such as roads and developed sites). The proposed action may result in the removal of vegetation up to 50 ft beyond the existing clear zone. Therefore, the likelihood that an occupied northern spotted owl nest trees would be removed is reduced but not eliminated.

The removal of up to 225 potential nest trees due to the proposed action would result in a significant effect to northern spotted owls as they would be precluded from the use of these nest trees in the future.

Loss of Stands of Suitable and/or Dispersal Habitat

As per MM-23, no activity may result in the downgrading of a northern spotted owl suitable or dispersal habitat stand. Therefore, there is no anticipated loss of a stands of northern spotted owl suitable habitat as part of the proposed action.

Degradation of Stands of Suitable Habitat

The activities covered by this programmatic consultation may result in the removal of vegetation in northern spotted owl suitable habitat. The quality and quantity of vegetation that would be eliminated depends on the scope and purpose or the individual project, and can range from removing single trees that are a safety hazard to complete clearing for a new lane. This habitat alteration could adversely affect future productivity of northern spotted owls nesting, roosting, and foraging in the action area.

A maximum of 225 potential nest trees and 750 non-potential nest trees 19 inches dbh and larger may be removed during the term of this programmatic consultation. In addition, up to 75 acres of understory vegetation, including trees up to 14 inches dbh[48] and 7.5 acres of understory vegetation, including trees from 14 inches dbh to less than 19 inches dbh may be removed from nesting, roosting, and foraging habitat.

The removal of habitat within home-range circles is expected to have negative effects on northern spotted owls. Removal of overstory trees could have localized effects on the number of trees available for nesting, roosting, and foraging northern spotted owls. Bart (1995) reported a linear reduction in northern spotted owl productivity and survivorship as the amount of suitable habitat within a northern spotted owl home-range circle declined. In northwestern California, Franklin et al. (1992, p. 117) found that survivorship of adult northern spotted owls was greater where greater amounts of older forest were present around the activity center, but also found increased reproductive success where the amount of edge between older and younger forest was relatively high. Other research has demonstrated that northern spotted owl abundance and productivity significantly decrease when the amount of suitable habitat within 0.7 mile of an activity center falls below 500 acres (Bart 1995), which is 50 percent of the acres within a 0.7-mile radius circle.

We have assumed for this programmatic that all habitat proposed for removal (75 acres of understory vegetation including trees less than 14 inches dbh and 7.5 acres of understory vegetation including trees 14 inches dbh to less than 19 inches dbh) may be suitable habitat (roosting and foraging habitat). This assumption may be an overestimate but cannot be verified at the scale of this consultation. Loss of individual large trees and the proposed removal of up to

[48] Note that all acreage removed that meets this these sizes (including that defined as dispersal habitat) counts towards the limit of 75 acres.

5 acres of roosting and foraging habitat within a stand of suitable habitat are considered habitat modifications that may negatively affect northern spotted owls' ability to forage and find shelter.

Minimization measures will reduce but not eliminate the effects of habitat removal within suitable habitat. Removal of suitable and potentially suitable nesting habitat is not permitted during the nesting season. The number of suitable and non-suitable nest trees that may be removed is limited to 30 per stand. No known nest trees may be removed. Trees that are removed are to be dropped in such a manner as to reduce damage to surrounding trees. Because the programmatic consultation is intended for maintenance, preservation, and improvement projects on existing roadways, individual projects will not involve extensive amounts of northern spotted owl suitable habitat removal. New road alignments will be limited to 0.25 mile in length (up to 1.5 acres of habitat loss per project) and major realignments will be limited to 0.5 mile (up to 3 acres of habitat loss per project). All alignments must be adjacent to the existing roadway to avoid creating new forest edges within contiguous forested habitats. Additionally, the habitat, following removal, must maintain its current function (i.e., it cannot be downgraded). Therefore, although northern spotted owls are likely to be adversely impacted by the proposed habitat removal, the effects are not anticipated to create a likelihood of injury to such an extent as to significantly disrupt normal behavior patterns such as feeding and sheltering.

Prey Species Effects

The proposed action may result in the loss of northern flying squirrel and other northern spotted owl prey species habitat. The removal of large trees, snags, and downed wood can affect prey composition and prey availability by altering characteristics of the habitat upon which prey species depend. Because the amount of snags and down material present on the forest floor correlates positively with densities of some northern spotted owl prey species, removing these materials may contribute to declines in northern spotted owl prey, at least on a localized, short-term basis (Franklin et al. 2000). Road construction and maintenance activities may negatively affect prey species due to the removal of hazard trees or snags.

The PBA includes conservation measure MM-24 to minimize impacts to prey species by retaining LWD on the adjacent forest unless owner permission is not granted. In those circumstances, LWD shall be removed and used for future environmental restoration efforts where possible. This measure does not assure that downed wood would be retained in all circumstances, though it would minimize impacts to prey species and northern spotted owls where it is implemented.

Although we anticipate that the proposed action may affect the prey base of northern spotted owls, we do not anticipate that these effects will be measurable. The loss of potential prey habitat is limited to the removal of up to 975 individual trees as well as 82.5 acres of suitable foraging habitat. However, no more than 30 trees per stand 19 inches dbh and greater may be removed. Additionally, the removal up to 82.5 acres of potential prey habitat would not exceed 3 acres per project (based on a maximum limit of 0.5 mile of new road alignment and no more than 50 ft of widening into suitable habitat). Furthermore, the function of suitable habitat cannot be downgraded under the programmatic; thus, the stand must continue to function as foraging habitat upon completion of the proposed action. Therefore, we anticipate that although foraging habitat components may be affected, the effects will be insignificant to northern spotted owl.

Predation/Competition Risk

Great horned owls, a predator of northern spotted owls (Thomas et al. 1990), are known to be closely associated with fragmented forest habitats (Williams et al. 1992; Bevis et al. 1997). As mature forests are harvested, great horned owls may colonize the fragmented forest, with the result that northern spotted owls may become more susceptible to predation from great horned owls (Forsman et al. 1984). We do not anticipate an increase in fragmentation as the result of the proposed action. Removal of suitable habitat will only occur along the existing edges of roadways. Therefore, we anticipate a negligible increase in the current threat of great horned owl predation on northern spotted owls.

It is unknown how this action may influence barred owl-northern spotted owl interactions. However, given the relatively minor effects to habitat associated with the proposed action, barred owl-northern spotted owl relations are not expected to change, and the effects to northern spotted owls are not anticipated to be measurable.

Windthrow Effects

Stand density, stand height, stand structure, and species composition are important factors in tree stability (Johnson 1992). Edge trees have longer crowns extending down their exposed side and are more resistant to windthrow (Johnson 1992). Trees are more susceptible to windthrow when exposed after an opening is created because they rely on surrounding trees for protection (Harris 1989).

Windthrow is often associated with timber harvest. Effects from windthrow may occur up to 30 ft to 60 ft from the edge of harvest (Oliver and Larson 1990). The proposed action is unlikely to result in the extent of windthrow damage that may occur as part of a larger tree removal project, such as timber harvest. However, if wind-thrown trees have potential nesting site, or strike and damage trees with a potential nest site, then indirect adverse effects to northern spotted owls could result. Therefore, we anticipate that windthrow may extend up to 30 ft into the stand and that damage due to falling trees could extend up to one site-potential tree (i.e., l50 ft). Therefore, total impacts could be up to 180 ft in width.

Increased windthrow as a result of tree removal could result in adverse effects to northern spotted owls by downing or damaging suitable nest trees or downing trees adjacent to nest trees that provide cover to a nest tree, or downing trees that strike nesting northern spotted owls. We anticipate that the likelihood of a tree striking a northern spotted owl is extremely unlikely to occur. Therefore, the effects are more likely to affect the suitability of the habitat for future nesting, roosting, and foraging.

The proposed action may to remove up to 5 acres of understory vegetation including trees less than 14 inches dbh and 0.5 acre of understory vegetation, including trees from 14 inches dbh to less than 19 inches dbh within suitable northern spotted owl suitable habitat per year per WSDOT region over the life of the programmatic, for a total of 5.5 acres per year. Habitat removal would be no more than 50 ft in width. The proposal also includes the removal of up to 25 non-potential nest trees 19 inches dbh and greater per stand and the removal of up to 5

potential nest trees per stand within northern spotted owl suitable habitat, for a total removal of up to 30 trees per stand 19 inches dbh and greater. Removal of suitable and unsuitable nest trees may occur as part of the overall removal of vegetation up to 50 ft in width or may occur as an individual activity.

We do not anticipate that the removal of an individual tree (i.e., for hazard tree removal) will result in an increase in windthrow due to the limited openings this would create. However, removal of multiple large trees (up to 30 trees total per stand) and/or understory vegetation removal within or adjacent to[49] northern spotted owl suitable habitat up to 50 ft in width from the edge of the existing roadway clear zone may result in exposing non-wind hardened interior-stand trees to windthrow. Therefore, we anticipate that the effects to northern spotted owl suitable habitat may be measurable due to increased windthrow and the associated loss of nesting, roosting, and foraging habitat.

We anticipate that some but not all of the areas that results in the removal of vegetation will result in some loss of habitat due to windthrow. Although we anticipate that there may be adverse effects to northern spotted owls due to windthrow, we are unable to determine whether these effects will create the likelihood of injury to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering.

Summary of Effects of the Proposed Action on Northern Spotted Owls

The Service anticipates that the proposed construction and maintenance activities will directly affect northern spotted owls through exposure to elevated sound levels and increased visual stimuli and habitat alteration. Disturbance during the early nesting season could cause adult northern spotted owls to flush from the nest. Disturbance may also affect the metabolic rate and energy budgets of adult northern spotted owls tending to nests. All northern spotted owls nesting within sound pressures greater than 92 dB would be significantly disturbed especially between March 1 and July 15 (March 15 through July 30 within Mount Rainier National Park). Disturbance effects should be temporary and will revert to background levels when the activity is completed. Habitat alteration could result from the removal of nest trees, potential nest trees, and understory vegetation that comprises suitable habitat for northern spotted owls and their prey species. Additional negative effects to suitable habitat may occur as a result of windthrow.

Cumulative Effects on Northern Spotted Owls

Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this PBO. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. Continuing harvest activities on private lands can be expected to impact northern spotted owl habitat on all provinces within the action area through the reduction, fragmentation, and/or degradation of northern spotted owl habitat. Northern spotted owl nests in remaining fragmented habitats on private lands may potentially be

[49] Adjacent is defined as within one site potential tree or 150 ft, which ever is greater.

subject to increasing predation from or competition with other species. The ability of the landscape to provide connectivity will decline.

The WDFW has listed the northern spotted owl as endangered in the State of Washington. This listing requires other state agencies to address impacts to northern spotted owls during project planning. The Washington State Forest Practices Board has adopted a Spotted Owl Rule for all non-Federal lands in Washington. Non-Federal lands must meet the Washington State Forest Practice Rules for northern spotted owls (WAC 222-16-085), at a minimum. The State's Spotted Owl Rule delineates spotted owl special emphasis areas (SOSEAs), which provide protection of 1,000-acre cores around northern spotted owl activity centers and maintains 40 percent suitable northern spotted owl habitat within the median annual home range radii. Under the State rule, outside of designated SOSEAs, only seasonal protection for northern spotted owls exists on non-Federal lands.

State Forest Practice Rules are effective at protecting northern spotted owls in occupied sites within SOSEAs. However, there has been an emphasis on surveying sites and decertifying those which are not occupied after three years of survey protocol (required time and process for decertifying active sites). It has been shown that northern spotted owl sites that are not occupied for three years can be reoccupied by other northern spotted owls, emphasizing the importance of the site centers to northern spotted owls.

Conversion of privately-held timberlands to residential use adjacent to northern spotted owl critical habitat is a resource concern in Washington State. The Service issued a Biological Opinion recently for the Washington State Forest Practices Rules governing timber harvest. The biological opinion states that several assumptions can be made about population growth in western Washington: a) that growth of residential development is likely to be high around the peripheries of the existing human population centers, and b) that development areas in western Washington are expected to expand east toward the Cascade foothills (Harris 1989; Oliver and Larson 1990).

The immigration of telecommuters and retirees will result in growth outside of transportation corridors and urban centers. New technologies have created the opportunity for residential development of rural areas, followed by the development of support services (Stathers et al. 1994). The Puget Sound Action team estimates that Skagit County, for example, will experience a 50 percent growth rate by 2025 (USFWS 2006a). This conversion of forestland to residential use is also occurring on land in Skamania and Pierce Counties, Washington. These lands were historically managed for timber production. Development restrictions and critical area ordinances may reduce or minimize the potential for some of the negative impacts associated with development. This could reduce the potential loss of suitable and dispersal northern spotted owl habitat on these lands. However, visual and sound disturbance and fragmentation of habitat may still continue.

Increased development or recreation not associated with Federal lands may also have the potential for thinning and occasional tree removal and may destroy or downgrade nesting, roosting, and foraging habitat, and may affect dispersal habitat and connectivity.

Integration and Synthesis: Northern Spotted Owl

After reviewing the current status of the northern spotted owl, the environmental baseline, the effects of the proposed action on northern spotted owls, and the cumulative effects, it is the Service's Biological Opinion that implementation of the proposed action discussed herein is not likely to jeopardize the continued existence of the northern spotted owl. The Service reached this conclusion based on following factors.

The management of private forest lands under the Forest Practices Act should provide dispersal habitat conditions per the SOSEA goals. Lands managed under the 1997 WDNR HCP will also provide habitat for dispersing northern spotted owls. In addition, stream corridors managed under the 2006 Forest Practices HCP may also eventually provide some narrow corridors of northern spotted owl habitat. Over longer time frames, mature forest along these riparian corridors may work synergistically with SOSEA conservation approaches for dispersing northern spotted owls.

Barred and great horned owls will likely continue to predate and compete for resources with northern spotted owls, and the outcome may be to the detriment of northern spotted owls. The proposed action, however, is not expected to influence or magnify the effect to northern spotted owls from these competing species over what is already occurring. Because of this, the proposed action is not expected to give a competitive advantage to the barred and great horned owls.

We are not expecting total removal of all the habitat elements that comprise northern spotted owl habitat. Because of the conservation commitments of the Late-Successional Reserve for national forest lands, the SOSEA for private landowners, and the obligations of the WDNR HCP for State trust lands, the action area has a landscape conservation strategy for northern spotted owls. The minimization and mitigation measures associated with these different conservation approaches are expected to provide long-term benefits for northern spotted owls.

Possible adverse effects to northern spotted owls due to disturbance may occur. The disturbance of nesting adults and juvenile northern spotted owls during the early nesting season may result in effects to normal feeding, breeding, and sheltering behaviors. Up to 11 northern spotted owl pairs and their young may be disturbed during the early nesting season. These effects will be temporary, but are expected to measurably affect individual adult and juvenile northern spotted owls.

If northern spotted owls use the action area now or in the future, they are likely to be adversely affected by the removal of suitable nesting, roosting, and foraging habitat due to the loss of 750 non-potential nest trees and 225 potential nest trees. However the potential for direct injury or disturbance of northern spotted owls has been minimized by incorporating seasonal restrictions that preclude vegetation removal within suitable habitat during the nesting season. In addition, we do not anticipate that northern spotted owls would be displaced from their home ranges as a result of the proposed project.

The losses or degradation of suitable northern spotted owl habitat as a result of the proposed action will be minor relative to the amounts present in each of the provinces individually and as a

whole. The proposed action may result in a total loss of 75 acres and 7.5 acres due to removal of understory vegetation, including trees less than 14 inches dbh and understory vegetation, including trees 14 inches dbh to less than 19 inches dbh, respectively. Depending on site-specific determinations, this habitat may be considered non-habitat, dispersal habitat, or nesting, roosting, and/or foraging habitat for northern spotted owls. Based on Table 47, up to 7,242 acres of suitable habitat is within 50 ft of the state highways and subject to some removal and/or degradation due to the proposed action. However, all of this acreage is unlikely to be suitable habitat, due to the scale of GIS mapping used for this analysis. However, if we assume it is all suitable habitat, it represents up to 0.5 percent of suitable habitat in the Western Washington Lowlands province and approximately 0.2 percent within all four provinces within the action area. The proposed action may impact a smaller portion of this acreage (up to 90 acres). This loss of suitable habitat represents a minor decrease in suitable habitat within the Olympic Peninsula, Western Washington Cascades, Eastern Washington Cascades, and Western Washington Lowlands provinces and consequently rangewide. Its loss is not likely to result in an appreciable reduction of northern spotted owl numbers, reproduction, or distribution.

Table 47. Suitable northern spotted owl habitat.

Province	**Total Northern Spotted Owl Suitable Habitat in Washington (acres)**	**Northern Spotted Owl Suitable Habitat in the action area (acres)**	**Northern Spotted Owl Suitable Habitat in Province in the action area (percent)**	**Northern Spotted Owl Suitable Habitat within 50 ft[50] of the state roadway (acres)**	**Northern Spotted Owl Suitable Habitat within 50 ft of the state roadway (percent)**
Olympic Peninsula	717,000	46,909	6.5	1,341	0.2
Western Washington Lowlands	378,600	59,485	15.3	2,045	0.5
Western Washington Cascades	1,616,300	113,587	7.0	3,462	0.2
Eastern Washington Cascades	972,500	13,110	1.3	394	<0.1
Totals:	**3,684,400**	**233,091**	**6.3**	**7,242**	**0.2**

[50] Acreage based on GIS mapping. Due to the scale of the analysis and resolution of the data, potential mapping error was assumed to be approximately 150 ft from each side of the mapped roadway; therefore, mapping was based on a 200 ft buffer (150 ft + 50 ft). Also, at this scale, width of road (e.g., 20 ft vs 40 ft) cannot be detected.

We anticipate negligible changes from the proposed action in 1) the amount of habitat for prey species; 2) predation by great horned owls; and 3) competition with barred owls. Although we anticipate that there may be adverse effects to northern spotted owls due to windthrow, we are unable to determine whether these effects will create the likelihood of injury to such an extent as to significantly disrupt normal behavior.

Conclusion - Northern Spotted Owl

After reviewing the current status of northern spotted owl, the environmental baseline for the action area , the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the WSDOT Western Washington Regions programmatic consultation, as proposed, is not likely to jeopardize the continued existence of the northern spotted owl. Consequently, the Service has determined that the adverse effects to northern spotted owls that would result from the WSDOT Western Washington Regions programmatic consultation would not contribute to an appreciable reduction in the likelihood of survival and recovery of the northern spotted owl in the wild by reducing northern spotted owl numbers, reproduction, or distribution.

Potential Effects to Northern Spotted Owl Critical Habitat

The primary constituent elements of northern spotted owl critical habitat are nesting, roosting, foraging, and dispersal habitat (USFWS 2006a). The final rule (USFWS 2006b) states that "alterations [that appreciably modify or affect critical habitat] include… actions that would reduce the canopy closure, reduce the average dbh of a stand, appreciably modify the multi-layered stand structure, reduce the suitability of the landscape to provide for safe movement, or reduce the abundance or availability of prey species." Dispersal habitat consists of stands with adequate tree size and canopy closure to provide protection from avian predators and at least minimal foraging opportunities (57 FR 1796-1838). Actions can alter PCEs if they remove or degrade forest habitat, or prevent or delay future attainment of suitable habitat.

WSDOT proposes the removal of vegetation of various size and types – from understory vegetation (that may include grass, shrubs, or trees less than 14 inches dbh) to trees greater than 19 inches dbh. We have provided definitions of how northern spotted owl suitable and dispersal habitat are defined (Appendix A). Because of the site specific characteristics required to determine if a stand is considered suitable, unsuitable, or dispersal habitat, we have made the following assumptions regarding the proposed habitat removal. We have assumed that all sites are, at a minimum, considered dispersal habitat (PCE #2). In addition, they may be a component of suitable (nesting, roosting, and foraging) habitat, depending on site specific characteristics (PCE #1). Site specific surveys will need to be conducted to identify the actual type of habitat affected due to each of the proposed activities and which primary constituent element, if any, is being affected.

The proposed action area encompasses portions of five northern spotted owl CHUs (Olympic Peninsula, Northwest Washington Cascades, Okanogan, Southwest Washington, Southeast Washington Cascades) (Table 15). It is unknown at this time the extent a specific CHU may be

affected due to the proposed action. Therefore, we anticipate that the proposed action may affect each of these CHUs.

WSDOT proposes the following impacts to northern spotted owl critical habitat (Table 48).

Table 48. Potential impact to northern spotted owl critical habitat by WSDOT region.

Potential Impacts	**Southwest Region (per year)**	**Olympic Region (per year)**	**Northwest Region (per year)**	**Total per Region for Programmatic**	**Total for Programmatic**
Removal of understory vegetation or trees less than 14 inches dbh from northern spotted owl critical habitat	5 acres	5 acres	5 acres	25 acres (no more than 5 acres per stand or project)	75 acres
Removal of understory vegetation or trees from 14 inches dbh to less than 19 inches dbh from northern spotted owl critical habitat	0.5 acre	0.5 acre	0.5 acre	2.5 acres (no more than 0.5 acre per stand or project)	7.5 acres
Removal of non-potential nest trees 19 inches dbh and greater from northern spotted owl critical habitat	50 trees (no more than 25 per project or stand over the life of the programmatic)	50 trees (no more than 25 per project or stand over the life of the programmatic)	50 trees (no more than 25 per project or stand over the life of the programmatic)	250 trees	750 trees
Removal of potential nest trees from northern spotted owl critical habitat	15 trees (no more than five per project or stand over the life of the programmatic)	15 trees (no more than five per project or stand over the life of the programmatic)	15 trees (no more than five per project or stand over the life of the programmatic)	75 trees	225 trees

Effects to Northern Spotted Owl Critical Habitat

PCE #1 - Effects to Nesting, Roosting, Foraging Habitat

Habitat removal

The proposed action is likely to adversely affect northern spotted owl critical habitat by removing or degrading nesting, roosting, and foraging habitat. Up to 225 potential nest trees, 750 non-potential nest trees 19 inches dbh and greater, 75 acres understory vegetation (including trees less than 14 inches dbh), and 7.5 acres of understory vegetation (including trees 14 inches dbh to less than 19 inches dbh) over the life of the programmatic within the action area. No more than 5 acres of northern spotted owl critical habitat that meets the definition of suitable habitat (the equivalent of PCE 1) may be removed per stand over the life of the programmatic. No more than 30 trees (5 suitable nest trees and 25 non-suitable nest trees) may be removed per stand over the life of the programmatic. The proposed action would occur adjacent to existing roadways and would extend no more than 50 ft beyond existing clear zones. The proposed removal of this vegetation would adversely affect critical habitat due to the loss of primary constituent elements that currently may provide nesting, roosting, and foraging habitat for northern spotted owls. While suitable habitat may be removed or degraded by the proposed action, it is expected that the critical habitat would continue to function, though to a lesser degree, as nesting, roosting, and foraging habitat due to the limited habitat removal and proposed conservation measures. Therefore, we anticipate that the proposed action would have measurable effects on critical habitat.

Windthrow

Increased windthrow as a result of tree removal could result in adverse effects to northern spotted owls by downing or damaging suitable trees within critical habitat. We do not anticipate that the removal of an individual tree (i.e., for hazard tree removal) will result in an increase in windthrow due to the limited openings this would create. However, removal of multiple large trees (up to 30 trees total per stand) and/or understory vegetation removal within or adjacent to[51] northern spotted owl critical habitat up to 50 ft in width from the edge of the existing roadway clear zone may result in exposing non-wind hardened interior-stand trees to windthrow. Therefore, we anticipate that the effects to northern spotted owl suitable habitat may be measurable due to increased windthrow and loss of nesting, roosting, and foraging habitat.

We anticipate that some but not all of the areas that result in the removal of vegetation will result in some loss of habitat due to windthrow. This loss of vegetation would be an additive to that removed as part of the proposed action. Although we expect that effects to northern spotted owl critical habitat PCE #1 may be measurable due to increased windthrow, we do not anticipate that the effects of windthrow will extend beyond 180 ft in width into northern spotted owl critical habitat (see discussion under **Indirect Effects to Marbled Murrelet- Windthrow Effects**).

[51] Adjacent is defined as within one site potential tree or 150 ft, which ever is greater.

PCE #2: Effects to Northern Spotted Owl Dispersal and Habitat Connectivity

Habitat removal

The proposed action could reduce overstory canopy cover of the critical habitat units due to the removal of trees associated with activities including but not limited to maintenance activities, road widening, and hazard tree removal. The proposed action will occur adjacent to existing state roadways, but will not extend more than 50 ft beyond existing clear zones.

Although large areas of non-forested habitat (e.g., Willamette Valley) appear to act as barriers to dispersal, northern spotted owls regularly disperse through highly fragmented landscapes that are typical in western Washington and western Oregon (U.S. Fish and Wildlife Service 1992). Northern spotted owls are known to cross highway corridors such as Interstate 5 in Oregon and Interstate 90 in Washington (U.S. Fish and Wildlife Service 1992, p. 1824). Although it is clear from this study that northern spotted owls disperse across fragmented forest landscapes, we do not know if survival rates of dispersing northern spotted owls are influenced by the amount of forest fragmentation or the amount of suitable habitat encountered along the dispersal path. Lamberson (in Forsman et al. 2002) suggested that survival of dispersing northern spotted owls may be lower in fragmented forests or in areas with little old forest. However, Miller (in Forsman et al. 2002) found no correlation between forest fragmentation and survival or dispersal distance of northern spotted owls. Young forest dispersal habitat is generally abundant and well-distributed across much of western Washington. Considering the information presented above, the loss of up to 5 acres of dispersal habitat per project along a highway corridor is not expected to measurably affect the northern spotted owl dispersal behavior or success in dispersing.

Additionally, although the proposed action may degrade dispersal habitat, MM-23 precludes this habitat from being downgraded to unsuitable conditions. Therefore, the stands are assumed to maintain a canopy cover of at least 40 percent as a result of the proposed action. A canopy cover of at least 40 percent is necessary to be considered functioning dispersal habitat for northern spotted owls. Therefore, we anticipate that the proposed action will not measurably affect the function of northern spotted owl critical habitat to provide dispersal and habitat connectivity for northern spotted owls. A site specific analysis will be necessary to confirm this assumption and ensure that the stands retain their suitability for dispersal and connectivity.

Windthrow

Increased windthrow as a result of tree removal may result in adverse effects to PCE #2 by downing or damaging trees within suitable and dispersal habitat. The effects of windthrow may result in reducing the canopy cover below 40 percent in areas that have had vegetation removed as a result of the proposed action. We do not anticipate that the removal of an individual tree (i.e., for hazard tree removal) will result in an increase in windthrow due to the limited openings this would create. However, removal of multiple large trees (up to 30 trees total per stand) and/or understory vegetation removal within or adjacent to[52] northern spotted owl critical habitat

[52] Adjacent is defined as within one site potential tree or 150 ft, which ever is greater.

up to 50 ft in width from the edge of the existing roadway clear zone may result in exposing non-wind hardened interior-stand trees to windthrow.

We anticipate that some, but not all, of the areas with vegetation removal will result in some loss of critical habitat due to windthrow (see discussion under **Indirect Effects to Marbled Murrelet- Windthrow Effects**). However, MM-23 precludes this habitat from being downgraded to unsuitable conditions. Therefore expect that effects to northern spotted owl critical habitat PCE #2 will not be measurable due to increased windthrow. A site specific analysis will be necessary to confirm this assumption and ensure that the stands retain their suitability for dispersal and connectivity.

Summary of Project Effects to Northern Spotted Owl Critical Habitat

The proposed project may remove a total of 82.5 acres of forested stands that provide northern spotted owl nesting, roosting, and foraging or dispersal habitat. Up to 750 non-potential nest trees 19 inches dbh and greater and 225 potential nest trees may be removed within northern spotted owl critical habitat. In addition, we have assumed an impact of up to 180 ft in width due to windthrow within the stands with vegetation removal.

New road alignments will be limited to 0.25 mile in length (up to 1.5 acres of habitat loss per project), and major realignments will be limited to 0.5 mile (up to 3 acres of habitat loss per project). All alignments must be adjacent to the existing roadway to avoid creating new forest edges within contiguous forested habitats. These activities represent the greatest effects anticipated due to a proposed action. This may limit but not reduce the effects to northern spotted owl critical habitat associated with the proposed programmatic.

In summary, adverse effects to northern spotted owl critical habitat would result from 1) removing nesting and potential nest trees from suitable habitat (PCE #1) and 2) windthrow up to 180 ft in width associated with removing suitable and dispersal habitat within 50 ft of the existing clear zone that may affect suitable habitat (PCE 1).

Cumulative Effects to Northern Spotted Owl Critical Habitat

Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this PBO. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. All designated northern spotted owl critical habitat occurs on Federal lands. Therefore, cumulative effects to northern spotted owl critical habitat within the action area may only result from actions in the action area that are adjacent to these Federal lands. This includes recreation and land development activities. Timber harvest related to land conversion, land development, and road building may have the potential for tree removal, and may destroy or downgrade northern spotted owl suitable habitat, and dispersal habitat and connectivity adjacent to northern spotted owl critical habitat.

Conversion of privately-held timberlands to residential use adjacent to northern spotted owl critical habitat is a resource concern in Washington State. The Service issued a Biological

Opinion recently for the Washington State Forest Practices Rules governing timber harvest. The Biological Opinion states that several assumptions can be made about population growth in western Washington: a) that growth of residential development is likely to be high around the peripheries of the existing population centers and b) that development areas in western Washington are expected to expand east toward the Cascade foothills (Lamberson et al. 1992).

The immigration of telecommuters and retirees to these areas will result in growth outside of transportation corridors and urban centers. New technologies have created the opportunity for residential development of rural areas, followed by the development of support services (Miller 1989). The Puget Sound Action team estimates that Skagit County, for example, will experience a 50 percent growth rate by 2025 (USFWS 2006a). This conversion of forestland to residential use is also occurring on land in Skamania and Pierce Counties, Washington. These lands were historically managed for timber production. Development restrictions and critical area ordinances may reduce or minimize the potential for some of the negative impacts associated with development.

Increased development or recreation not associated with Federal lands may also have the potential for thinning and occasional tree removal and may destroy or downgrade nesting, roosting, and foraging habitat, and may affect dispersal habitat and connectivity. These actions may effect adjacent critical habitat by isolating the unit and diminish its effectiveness to provide connectivity between CHUs.

Cumulative Effects of Climate Change

We expect that climate change may start to alter the ecosystem that supports northern spotted owl critical habitat during the 5 years that the PBO is in place. Effects of climate change may alter the availability of northern spotted owl suitable and dispersal habitat and their forage species. Changes that may result due to climate change include an increase in forest fires due to less snow and a drier environment and changes in forest microclimate that may impact the food for prey. We anticipate that although effects to northern spotted owl critical habitat due to climate change are likely to occur, due to the short duration of this PBO (5 years) these effects may not be measurable or detectable.

Integration and Synthesis - Northern Spotted Owl Critical Habitat

After reviewing the current status of the critical habitat, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Services' Biological Opinion that the action, as proposed, is not likely to result in the destruction or adverse modification of northern spotted owl critical habitat. This conclusion is based on the rationale that although the proposed project would result in adverse effects to critical habitat within the action area, these effects would not appreciably affect the function of the Olympic Peninsula, Northwest Washington Cascades, Okanogan, Southwest Washington Cascades, and Southeast Washington Cascades CHUs, and they would continue to maintain a stable, self-sustaining, and interconnected population of northern spotted owls within the West Cascades, East Cascades, and Olympic Peninsula Provinces, and across the species' range due to the action's limited affects on the landscape.

Only a small percentage of the total designated critical habitat within the five CHUs would potentially be impacted by the proposed action (less than 0.05 percent) occurs within 50 ft of a state highway and could be affected by the proposed project (Table 15). This represents approximately 685 acres of the northern spotted owl critical habitat. Of this, up to 82.5 acres of critical habitat may be removed or less than 0.05 percent of the critical habitat within these five CHUs (range is from approximately 0 to 0.064 percent). The majority of the critical habitat that may be affected within the action area due to the proposed action occurs within the Northwest Washington Cascades, which is also the second largest CHU in the action area (393,500 acres) that would be affected. If we assumed that the entire 82.5 acres of northern spotted owl critical habitat would be removed from the smallest CHU (the Okanogan, approximately 115,600 acres), this would represent approximately 0.07 percent of this CHU. However, the removal of this entire acreage in one province is not likely to occur nor is it permitted under the programmatic, due to the distribution of acreage across the three WSDOT Regions.

The proposed action will result in the removal of up to 225 potential and 750 non-potential nest trees within critical habitat. However, these potential nest trees would be in close proximity to existing roadways, and are therefore, less likely to be utilized for nesting by northern spotted owls, reducing the potential effects to PCE 1. Additionally, no known nesting trees will be removed. Furthermore, the proposed action cannot result in the downgrading of habitat; therefore, critical habitat at the site scale would continue to function as nesting, roosting, and foraging habitat (PCE 1). Therefore, although there may be significant affects to PCE 1 at the site scale, effects at the CHU scale are not anticipated.

Northern spotted owls use both suitable habitat and dispersal habitat for movements across the landscape. Conservation strategies for the northern spotted owl recommend maintaining at least 50 percent of the landscape with forest capable of supporting northern spotted owl dispersal (USFWS 2006a). A landscape analysis has not been performed to determine the conditions or amount of connectivity habitat (nesting, roosting, and foraging and dispersal) within the action area. However, we do not anticipate the proposed level of habitat removal will significantly affect the ability of northern spotted owls to disperse across the landscape. The removal of vegetation would occur adjacent to existing roadways and would not extend more than 50 ft into suitable habitat. The proposed action would result in a loss of some dispersal and nesting, roosting, and/or foraging habitat at the stand scale. Northern spotted owls do not necessarily avoid crossing small openings such as road corridors when dispersing. Given the relatively small impact associated with these road segments, the removal of vegetation, including that affected due to windthrow, the proposed action is not expected to appreciably influence northern spotted owl dispersal patterns at the site scale (PCE 2). Therefore, we do not anticipate this level of habitat loss to have a significant effect on connectivity or use of the habitat at the CHU scale.

Therefore, although the removal of 82.5 acres of northern spotted owl critical habitat, loss of up to 180 ft width of suitable habitat due to windthrow, and removal of up to 225 potential and 750 non-potential nest trees may represent an adverse impact to northern spotted owl critical habitat at the site scale, it is not considered significant at the critical habitat unit scale. Therefore, it would not be considered significant at the province scale.

Conclusion - Northern Spotted Owl Critical Habitat

After reviewing the current status of the northern spotted owl critical habitat, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Biological Opinion of the Service that the WSDOT Western Washington Regions programmatic consultation, as proposed, is not likely to result in the destruction or adverse modification of critical habitat because the effect on northern spotted owl critical habitat PCEs is only expected at the stand scale and not at the critical habitat unit level. This effect on critical habitat PCEs does not represent an appreciable diminishment in the capability of the critical habitat to satisfy essential requirements of the northern spotted owl (nesting, roosting, foraging, dispersal, and connectivity) as they are not anticipated to have an appreciable effect to connectivity, nesting, roosting, or foraging within the action area or the CHU.

INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. *Harm* is defined by the Service as an act which actually kills or injures wildlife. Such act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavior patterns, including breeding, feeding, or sheltering (50 CFR 17.3). *Harass* is defined by the Service as an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering (50 CFR 17.3). Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by the FHWA/Corps/National Park Service/U.S. Forest Service so that they become binding conditions of any grant or permit issued to WSDOT, as appropriate, for the exemption in section 7(o)(2) to apply. The FHWA/Corps/National Park Service/U.S. Forest Service have a continuing duty to regulate the activity covered by this incidental take statement. If the FHWA/Corps/National Park Service/U.S. Forest Service 1) fails to assume and implement the terms and conditions or 2) fails to require WSDOT to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, WSDOT must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 CFR 402.14(i)(3)].

AMOUNT OR EXTENT OF TAKE

We anticipate the following amount or extend of incidental take to result from the proposed actions over the life of the programmatic. The Service will not refer the incidental take of any migratory bird for prosecution under the Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. 703-712), if such take is in compliance with the terms and conditions (including amount and/or number) specified herein.

Bull Trout - Amount or Extent of Take

The incidental take of individual bull trout is likely to result from the proposed action and will result in the harassment and harm of bull trout within the Coastal-Puget Sound management unit. The Service has estimated the number of bull trout that may be harassed, harmed, killed, or captured due to the proposed project. The capture and handling of bull trout for salvage purposes will result in direct take (kill, capture, injury). However, the direct take resulting from salvage operations will minimize the incidental take of individual bull trout from stream diversion/dewatering activities.

Additionally, the Service anticipates incidental take of some bull trout will be difficult to detect for the following reasons**:**

1. finding a dead or impaired specimen is unlikely
2. delayed mortality
3. the relationship between habitat conditions and distribution and abundance of individuals is imprecise such that the number of specific individuals affected cannot be practicably obtained
4. the species occurs in habitat (e.g., undercut banks, log jams) that makes detection difficult.

However, the take of bull trout can be anticipated using concurrent and post-project habitat conditions as a surrogate indicator of take.

We have summarized the anticipated take in Tables 49 and 50. The Service anticipates that these estimates represent a reasonable approximation of the amount and extent of incidental take using best available science.

Table 49. The capture, handling activities, and estimated incidental take to bull trout in the Coastal-Puget Sound Interim Recovery Unit as a result of the proposed action.

ACTIVITY	**Extent of Incidental Take (number of bull trout)**			**Extent of Incidental Take (number of bull trout) (5 Year total)**	
Capture and Handling of Bull Trout	**Per Project**	**Annual**	**5-Year Total**	**Harass**	**Harm**
Block nets	1 juvenile	10 juveniles	50 juveniles	47 juveniles due to handling	3 juveniles (kill)
Minnow traps, seines and dip nets	1 juvenile, adult, or subadult	84 juveniles, fry, subadults, adults	420 juveniles, subadults, adults	420 juveniles, subadults, adults due to handling	0
Electroshocking	1	36 juveniles, subadults, adults	171 juveniles, subadults, adults	128 juveniles, subadults, adults due to handling	43 juveniles, subadults, adults (kill or physical injury)
Stream Dewatering	1	1 juveniles, subadults, adults	9 juveniles, subadults, adults	8 adult/subadult due to handling	1 juvenile (kill)
Total Individuals	**4**	**130**	**650**	**603**	**47**

Table 50. The construction activities and estimated incidental take to bull trout in the Coastal-Puget Sound Interim Recovery Unit as a result of the proposed action.

Construction Activities	**Extent of Incidental Take (ft/miles/acres of bull trout habitat)**			**Extent of Incidental Take (ft/miles/acres of bull trout habitat) (5-Year Total)**	
	Per Project	**Annual**	**5-Year Total**	**Harass**	**Harm**
Sediment and Turbidity	600 ft	600 ft juveniles/fry/eggs 28,800 ft adults/subadults	3,000 ft juveniles/fry/eggs 285,000 ft adults/subadults	285,000 ft (54 miles) adults/subadults due to reduced feeding efficiency and avoidance of habitat	3,000 ft (0.6 miles) juveniles/fry/eggs (physical injury or kill) due to reduced growth rate, delayed hatching, and/or mortality
Stormwater Contaminants[1]	300 ft	unknown	1.7 miles associated with adults/subadults	1.7 miles associated with adults/subadults due to avoidance of habitat or temporary olfactory inhibition	0
Bank hardening	100 ft (non-culverts) 33.6 ft (culverts)	2,808 ft associated with adults/subadults and juveniles	14,040 ft (2.6 miles) associated with adults/subadults and juveniles	14,040 ft (2.6 miles) associated with adults/subadults and juveniles due to loss of habitat	0
Stream bed hardening	750 ft^2	36,000 ft^2 (0.83 acre)	180,000 ft^2 (4.1 acres)	180,000 ft^2 (4.1 acres) due to loss of foraging opportunities	0

Construction Activities	Extent of Incidental Take (ft/miles/acres of bull trout habitat)			Extent of Incidental Take (ft/miles/acres of bull trout habitat) (5-Year Total)	
	Per Project	**Annual**	**5-Year Total**	**Harass**	**Harm**
Riparian vegetation removal	0.63 acre	3.28 acres associated with adults/subadults and juveniles	16.4 acres associated with adults/subadults and juveniles	16.4 acres associated with adults/subadults and juveniles due to loss of habitat and foraging opportunities	0
Pile driving activities	0.16 mile (total for injury of adults/subadults)	1.6 miles associated with adults/subadults	8 miles associated with adults/subadults		8 miles associated with adults/subadults (physical injury, including barotrauma)
	2 miles (total for disturbance for adults/subadults)	20 miles associated with adults/subadults	100 miles associated with adults/subadults	100 miles associated with adults/subadults due to avoidance of suitable habitat, disruption of foraging and migration,	
Total Area/Miles				158.3 miles 20.5 acres	8.6 miles

[1] We anticipate that the stormwater contaminants (copper, zinc, and mixtures) will occur within the same discharge, therefore only we have assigned take once per discharge location.

Take due to Capture and Handling of Bull Trout

Harm

- Up to three bull trout juveniles may be killed due to the use block nets over the life of the programmatic. No more than one bull trout juvenile may be killed per project.
- Up to 43 juveniles, subadults, or adults (or a combination of these life stages) may be killed or physically injured due to electroshocking over the life of the programmatic. No more than two bull trout individuals per project may be killed or injured.
- Up to one bull trout juvenile may be harmed through stranding, resulting in mortality over the life of the programmatic

Harassment

- Up to 47 bull trout juveniles may be harassed due to the use of block nets over the life of the programmatic. No more than seven bull trout juveniles may be harassed per project.
- Up to 420 juveniles, subadults, or adults (or combination of these life stages) may be harassed due to the use of minnow traps, seines, and dip nets. No more than two bull trout individuals may be harassed per project.
- Up to 128 juveniles, fry, subadults, or adults (or combination of these life stages) may be harassed due to electroshocking. No more than two bull trout may be harassed per project.
- Up to eight adult or subadult (or combination of these life stages) may be harassed due to stream dewatering. No more than one bull trout may be harassed per project.

Take due to Construction Related Activities

Harm

- All bull trout juveniles, fry, and eggs associated with up to 3,000 ft of spawning and rearing habitat would be killed or injured due to sediment and turbidity associated with in-water construction activities. No more than 600 ft of spawning and rearing habitat may be affected per project and no more than 1 project may occur per local population over the life of the programmatic. The effects would occur within 1 year of project completion and be short-term in duration.
- All adult and subadult bull trout associated with 8 miles of foraging, migration, and overwintering habitat would be injured due to pile driving. No more than 0.16 mile of foraging, migration, and overwintering bull trout habitat may exceed sound pressure injury threshold values per project. We anticipate up to 10 hours of sound pressures that exceed threshold levels for injury will occur per project. No more than 100 piles may be installed that exceed the sound threshold value (180 dBA_{peak}) within a 5th-field watershed if it would result in adverse impacts to bull trout.

Harassment

- All adult and subadults bull trout associated with up to 285,000 ft (54 miles) of foraging, migration, and overwintering habitat would be harassed due to sediment and turbidity associated with in-water construction activities. No more than 600 ft of foraging, migration, and overwintering habitat may be affected per project and no more than 5 projects per 5th-field watershed may occur per year over the life of the programmatic. The effects would occur within 1 year of project completion and be short-term in duration.
- All adult and subadult bull trout associated with 100 miles of foraging, migration, and overwintering habitat would be harassed due to pile driving. No more than 2 miles of bull trout foraging, migration, and overwintering habitat may exceed sound disturbance threshold values per project. We anticipate up to 10 hours of sound pressures that exceed threshold levels for behavioral modification will occur per project. No more than 100 piles may be installed that exceed the sound disturbance threshold value (150 dbA_{rms}) within a 5th-field watershed if it would result in adverse impacts to bull trout.
- All adult and subadult bull trout associated with 1.7 miles of foraging, migration, and overwintering habitat would be harassed due to stormwater contaminants (including dissolved zinc, dissolved copper, and chemical mixtures). No more than 300 ft of foraging, migration, and overwintering habitat may be affected per project and no more than 1 project per FMO may occur per year over the life of the programmatic. The frequency of the effects is anticipated to occur several times a year after periods of dry weather, followed by heavy storms, though the actual frequency is unknown. The duration of the effects is in perpetuity.
- All adult, subadult, and juvenile bull trout associated with 14,040 ft (2.6 miles) of rearing, foraging, migration, and overwintering habitat would be harassed due to bank hardening. No more than 100 ft (non-culverts) and 33.6 ft (culverts) of rearing, foraging, migration, and overwintering habitat may be affected per project or stream reach over the life of the programmatic. The effects would be in perpetuity.
- All adult, subadult, and juvenile bull trout associated with 180,000 ft^2 (4.1 acres) of rearing, foraging, migration, and overwintering habitat would be harassed due to stream bed hardening. No more than 750 ft^2 of rearing, foraging, migration, and overwintering habitat would be affected per project or stream reach over the life of the programmatic. The effects would be in perpetuity.
- All adult, subadult, and juvenile bull trout associated with 16.4 acres of rearing, foraging, migration, and overwintering habitat would be harassed due to riparian vegetation removal. No more than 0.63 acre may be removed per project or stream reach over the life of the programmatic. These effects would be long-term and may be in perpetuity depending on the site.

Bull Trout Effect of the Take

In the accompanying Biological Opinion, Service determined that this level of anticipated take is not likely to result in jeopardy to the bull trout or adverse modification of its designated critical habitat.

Marbled Murrelet - Amount or Extent of Take

The Service anticipates incidental take of actual numbers of murrelets will be difficult to detect**.** There is currently no reliable way to estimate the average density of murrelets per acre of habitat at this time. Therefore, effects to murrelets are based on acres of suitable habitat affected due to increased sound and activity disturbance and habitat impacts.

Furthermore, the Service does not know where all the projects will take place or whether the suitable habitat is occupied or not. Therefore, we cannot estimate the number of murrelets that will be harassed by the proposed action at this time.

Because of the low quality of the existing survey data and the lack of site specific information regarding proposed projects, we are using suitable habitat exposed to injurious levels of sound and visual stimuli, and habitat removal as a surrogate for the actual number of murrelets harassed due to the proposed action.

A single project could result in visual or noise disturbance in nesting habitat or the elimination or degradation of nesting habitat. The following type and quantity of take is anticipated due to the proposed action.

Harassment

<u>Take due to Sound and/or Visual Disturbance</u>

Harassment would be in the form of sound and visual stimuli from construction activities within the injury distances of suitable murrelet habitat during the breeding season (April 1 through September 15) from 2 hours after sunrise to 2 hours before sunset. Harassment would also be in the form of removal of potentially suitable nesting habitat outside the nesting season.

Up to 15 projects may occur during the early nesting season (April 1 to August 5) and 30 projects during the late nesting season (August 6 to September 15). The distribution of these activities by Conservation Zone is as follows.

Conservation Zone 1

Early nesting season (April 1 to August 5)

We expect harassment of all murrelets exposed to injurious levels of sound and visual stimuli within of 2,574 acres of suitable habitat over the life of the programmatic. Up to 12 projects total may occur in the early nesting season. No more than three projects may

occur during the early nesting period per year. No more than 198 acres of suitable habitat may be disturbed per year per project, unless the project includes pile driving. Then up to 396 acres may be disturbed. One pile driving and one blasting activity may occur over the life of the programmatic during the early nesting season.

Late nesting season (August 6 to September 15)

We expect harassment to all murrelets exposed to injurious levels of sound and visual stimuli within of 2,178 acres of suitable habitat over the life of the programmatic. Up to 10 projects may occur in the late nesting season. No more than two projects may occur during the late nesting period per year. No more than 198 acres of suitable habitat may be disturbed per year per project, unless a project includes pile driving. Then up to 396 acres may be disturbed. One pile driving activity may occur over the life of the programmatic during the late nesting season.

Conservation Zone 2

Early nesting season (April 1 to August 5)

We expect harassment to all murrelets exposed to injurious levels of sound and visual stimuli within of 792 acres of suitable habitat over the life of the programmatic. Up to 3 projects may occur in the early nesting season. No more than one project may occur during the early nesting period per year. No more than 198 acres of suitable habitat may be disturbed per year per project. One pile driving and one blasting activity may occur over the life of the programmatic during the early nesting season.

Late nesting season (August 6 to September 15)

We expect harassment to all murrelets exposed to injurious levels of sound and visual stimuli within of 4,158 acres of suitable habitat over the life of the programmatic. Up to 20 projects may occur in the late nesting season. No more than two projects may occur during the late nesting period per year. No more than 198 acres of suitable habitat may be disturbed per year per project, unless the project includes pile driving. Then up to 396 acres may be disturbed. One pile driving activity may occur over the life of the programmatic during the late nesting season.

<u>Take due to Habitat Removal</u>

We anticipate the following take associated with harassment of murrelets associated with the removal of suitable nesting habitat. Habitat removal will create the likelihood of injury to murrelets to such an extent as to significantly disrupt normal behavior patterns to breeding due to a delay in finding a suitable nest tree.

Conservation Zone 2 (Southwest Area only)

- Removal of up to one potential nest tree in a stand with five or more platforms per acre from murrelet nesting habitat per year over the life of the programmatic. The proposed action would result in harassment to up to 5 pair of adult murrelets (one pair per tree removed). The effects are permanent.

Marbled Murrelet - Effect of the Take

In the accompanying PBO, Service determined that this level of anticipated take is not likely to result in jeopardy to the murrelet or adverse modification of its designated critical habitat.

Northern Spotted Owl - Amount or Extent of Take

The Service anticipates incidental take of northern spotted owls to result in the form of harm and/or harassment due to a maximum of fifteen actions in the three regions over the five year term of this programmatic consultation. A single project could result in visual or noise disturbance in nesting habitat or the elimination or degradation of nesting habitat. The following type and quantity of take is anticipated due to the proposed action.

Harassment

Take due to Sound and/or Visual Disturbance

An increase in sound levels and visual stimuli will disrupt normal breeding, feeding, and roosting behaviors and result in take of northern spotted owls in the form of harassment. The Service anticipates that disturbance from any vehicle, pedestrian, or construction activity above ambient conditions within suitable nesting habitat between March 1 and July 15 (March 15 through July 30 within Mt Rainier National Park[53]), will result in harassment of northern spotted owls. The Service anticipates that up to 11 adult northern spotted owl pairs and their young would be taken due to the proposed action. The incidental take is expected to be in the form of harass**.** The harassment could occur during both daylight and night hours. No more than one project resulting in harassment may occur in the WSDOT Southwest, Northwest, and Olympic Regions per year. The following number of projects may occur per WSDOT Region over the life of the programmatic (5 years): Southwest Region - 3; Northwest Region - 5; and Olympic Region - 3. This effect of visual and sound disturbance would be temporary, and would end when each project is completed.

Northern Spotted Owl - Effect of the Take

In the accompanying BO, the Service determined that this level of anticipated take is not likely to result in jeopardy to the northern spotted owl or adverse modification of its designated critical habitat.

[53] Adverse affects are not permitted within Mt. Rainier National Park under this programmatic.

REASONABLE AND PRUDENT MEASURES

The Service believes the following reasonable and prudent measures (RPMs) are necessary and appropriate to minimize take of bull trout, murrelets, and northern spotted owls: Therefore, the RPMs are as follows:

Bull Trout

RPM-B1: Reduce effects to sensitive bull trout lifestages.

RPM-B2: Minimize effects associated with bank hardening.

RPM-B3: Monitor and minimize effects due to headcutting and incision.

RPM-B4: Monitor and report the effects of the implementation of the proposed activities on bull trout.

Marbled Murrelets

RPM-M1: Monitor and report the effects of the implementation of the proposed activities on murrelets.

Northern Spotted Owl

RPM-N1: Monitor and report the effects of the implementation of the proposed activities on northern spotted owls.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the ESA, the FHWA, U.S. Forest Service, and Corps must comply with the following terms and conditions, which implement the RPMs described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

Bull Trout

The following terms and condition is required for to implement RPM-B1:

1. WSDOT will plan construction activities as early in the in-water work window as feasible to ensure block nets and turbidity are not present at the onset of bull trout spawning (which varies by stream). WSDOT shall coordinate with the Service at the Pre-Biological Assessment meeting to determine the most appropriate in-water work window and any conflicts with effects to other listed species, such as murrelets or northern spotted owls.

2. Block nets located within a bull trout local population will be checked every 4 hours, 24 hours a day. If any fish are impinged or killed on the nets they will be checked hourly.

3. During fish removal activities, bull trout shall not be kept in the same holding container with aquatic species that may prey on or injure bull trout.

The following terms and conditions are required for to implement RPM-B2.

1. If invert protecting riprap (riprap placed over the top and sides of a culvert) has been placed as part of a culvert, native soil materials will be placed over the top of the riprap and re-vegetated with native woody vegetation, unless such plantings would present a safety hazard or preclude maintenance inspections. WSDOT will provide justification to the Service if this term and condition cannot be implemented due to these constraints.

The following terms and conditions are required for to implement RPM-B3.

1. Prior to project implementation, the risk of channel incision and headcutting following culvert removal or replacement will be evaluated using the *Dichotomous Key to Evaluate the Potential for Stream Incision at Sites Being Considered for Culvert Replacement or Removal Projects* (Appendix J). If the project is determined to be a high risk project, it will not be covered by this programmatic consultation.

2. In the event that the constructed project 1) does not meet the duration, velocity, flow, depth, and elevation drop standards to allow passage of fish species or 2) results in unacceptable incision and headcuts, the permittee is required to implement corrective actions necessary to provide fish passage of the fish species and correct or stop the incision and headcutting process. FHWA/WSDOT will confer with the Service prior to implementation of corrective actions.

The following terms and conditions are required for to implement RPM-B4.

1. Prior to and after the completion of sediment generating project within a potential or known spawning and rearing area in a bull trout local population, streambed embeddedness within the effected reach will be determined using a standard survey method[54] and reported as part of the post-project monitoring report. Streambed embeddedness will also be monitored and reported to the Service 1 year after the completion of the project to determine if the streambed downstream of the action has returned to pre-project conditions. If conditions have not been restored, the WSDOT will provide information to the Service describing why and what actions may be necessary to correct this condition if it has resulted due to the project.

[54] The Service may provide a list of standard survey methods for embeddedness monitoring.

2. WSDOT shall prepare an annual report summarizing the completed activities and their impacts to bull trout [50 CFR § 402.14(i)(3)]. The report shall be submitted to the Service no later than February 28 of each year. The report shall list and describe the following:

    a. The total incidental take reported in previous years.
    b. The location, acreage of impact, number of individuals handled and/or impinged, and type of each project implemented during that calendar year. The estimated size of fish handled/impinged shall also be provided – living fish will not be measured as this would result in additional stress to the fish.
    c. Photograph of each bull trout (live) taken as a result of the proposed action. Date photo taken and location of bull trout "taken" will be provided with the photograph.
    d. Timing and duration of each take associated with each project/activity.
    e. Acres of new impervious surface (identified as either pollution generating or non-pollution generating) that have resulted in adverse effects.
    f. Acres and type of vegetation removed.
    g. Number, size, and species of trees removed that resulted in take.

3. All incidental mortalities of bull trout shall be kept whole and put on ice or frozen. Frozen mortalities shall be wrapped directly in aluminum foil to preserve the specimen for future contaminant analysis. Reports of incidental injury or killing must include the date, time, precise location of the take, and pertinent information regarding cause of death or injury. The Service is to be notified at 360-753-9440 within three working days of incidental mortality and provided with the specimen, unless other disposition of the specimen for scientific purposes has been approved by the Service.

4. Water quality and sound pressure monitoring reports shall be provided to the Service within 90 days following completion of the action.

Marbled Murrelet

1. WSDOT shall prepare an annual report summarizing the completed activities and their impacts to murrelets [50 CFR § 402.14(i)(3)]. The report shall be submitted to the Service no later than February 28 of each year. The report shall list and describe the following:

    a. The total incidental take reported in previous years;
    b. The location, acreage of suitable nesting habitat impacted, and type of each project implemented during that calendar year;
    c. Timing and duration of each take associated with each action.
    d. Number, size, and species of trees removed that resulted in take.

Northern Spotted Owl

1. WSDOT shall prepare an annual report summarizing the completed activities and their impacts to northern spotted owls [50 CFR § 402.14(i)(3)]. The report shall be submitted to the Service no later than February 28 of each year. The report shall list and describe the following:

    a. The total incidental take reported in previous years;

    b. The location, acreage of nesting, roosting, foraging, and/or dispersal habitat impacted (by type), and type of each project implemented during that calendar year;

    c. Timing and duration of each take associated with each action.

    d. Number, size, and species of trees removed that resulted in take.

The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The Federal agency must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

The Service is to be notified within three working days upon locating a dead, injured, or sick endangered or threatened species specimen not authorized to be taken by this PBO. Initial notification must be made to the nearest U.S. Fish and Wildlife Service Law Enforcement Office. Notification must include the date, time, precise location of the injured animal or carcass, and any other pertinent information. Care should be taken in handling sick or injured specimens to preserve biological materials in the best possible state for later analysis of cause of death, if that occurs. In conjunction with the care of sick or injured endangered or threatened species or preservation of biological materials from a dead animal, the finder has the responsibility to ensure that evidence associated with the specimen is not unnecessarily disturbed. Contact the U.S. Fish and Wildlife Service Law Enforcement Office at (425) 883-8122, or the Service's Washington Fish and Wildlife Office at (360) 753-9440.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

Bull Trout

Habitat Restoration and Enhancement

Habitat restoration measures for bull trout habitat should be constructed and functioning prior to impacts occurring.

Enhance aquatic environments by removing unused piles, especially creosote piles, and other unneeded anthropogenic materials and dispose the material in permitted disposal facilities that are in compliance with the ESA.

Remove un-needed impervious surfaces to improve infiltration.

Plant riparian vegetation, especially trees where and when possible to enhance the aquatic environment for bull trout and their forage species.

Incorporate large woody debris into projects to provide increased habitat complexity for bull trout and their forage species.

Prevention and/or Reduction of Stormwater Pollutants

Treat galvanized metals exposed to rain or water that may reach fish bearing streams with a non-toxic paint or other coating to reduce and/or prevent the leaching of zinc into stormwater. Other options to using galvanized metals should be considered, when and where feasible.

Marbled Murrelets and Northern Spotted Owls

Habitat Restoration and/or Preservation

Restore and/or preserve s suitable murrelet and northern spotted owl habitat to further minimize the effects of actions that remove suitable habitat. We recommend that WSDOT and FHWA work with the Service to identify sites and/or parcels of lands that would be beneficial to restore and/or preserve for these species.

Northern Spotted Owls

Disturbance

Remove dispersal habitat outside of the northern spotted owl nesting season to reduce the potential of temporarily disturbing foraging and nesting northern spotted owls within adjacent suitable habitat.

REINITIATION NOTICE

This concludes formal consultation on the actions outlined in the Programmatic Biological Assessment (WSDOT 2005) and subsequent documents. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: 1) the amount or extent of incidental take is exceeded; 2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; 3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or 4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

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APPENDIX A

Appendix A. Definitions

These definitions provide additional detail on terms, techniques, and materials discussed in the programmatic.

Adfluvial bull trout - Bull trout migrate from tributary streams to a lake or reservoir to mature. Adfluvial bull trout return to a tributary to spawn.

A-Jacks - cured concrete pieces resembling "jacks" that are assembled into a continuous, interlocking, yet flexible matrix. A-Jacks are an alternative to riprap. A-Jacks are typically secured together with steel cable.

Anadromous - a fish that is born in fresh water, migrates to the ocean to grow and live as an adult, and then returns to freshwater to spawn (reproduce). Anadromous bull trout are on of the three migratory bull trout life history forms, the others being adfluvial and fluvial forms.

Barbs, J-Hook Vanes, and Groins. Barbs are structures comprised of large angular rocks projecting into the stream at varying upstream angles. J-hook vanes are rock and/or logs, projecting into the stream at 20 to 30 degrees and have a J-like hook at the end. Groins are rocks and/or logs projecting into the stream perpendicular to the flow. All three redirect flow away from the stream bank and encourage sediment deposition. Groins are built to the height of the top of the bank or 100 year flood level. Permeable groins are piles, fencing, or concrete or timber cribs. Groin length into the channel does not exceed 15 percent of the bank-full width for impermeable structures or 25 percent for permeable structures, except where structures are used to realign the channel. Barb heights do not exceed the height of the stream bank and do not exceed 1.5 feet above the normal low flow elevation at the tip. Barb lengths do not exceed 30 percent of the bank-full width, except where structures are used to realign the channel.

The spacing of these methods varies with channel geometry and their length. To prevent end-cutting or flanking by flood flows, they are keyed into the stream bank. All may need periodic cleaning, and flood events could damage them.

Bio-engineering - approaches including willow staking, brush layers, brush mattresses, etc can be used on slopes that are less than 1:1 on surfaces with adequate sunlight, moisture, and wind protection to support vegetation. Bank grading is typically required prior to establishing bio-engineered.

Biotechnical Techniques. Biotechnical techniques use woody plantings to arrest and prevent slope failures and erosion. WSDOT often uses biotechnical techniques in combined with the structural techniques. Biotechnical techniques reduce the surface erosion potential of slopes and stream banks and develop a root matrix to increase subsurface soil strength. Vegetation increases surface roughness on the banks, reducing local flow velocities, transport capacities, and shear stress adjacent to the bank, resulting in sediment deposition. Vegetation also reduces surface runoff through increased water retention, and decreases both runoff and erosive effects of heavy rainfall. Planted areas may be vulnerable to erosion until the vegetation establishes. Maintenance such as replanting may be necessary.

Bull Trout Core Area - The combination of core habitat (i.e., habitat that could supply all elements for the long-term security of bull trout) and a core population (a group of one or more local bull trout populations that exist within core habitat) constitutes the basic unit on which to gauge recovery. Core areas require both habitat and bull trout to function, and the number (replication) and characteristics of local populations inhabitation a core area provide a relative indication of the core area's likelihood to persist. In most cases, core areas are presumed to reflect the metapopulation structure of bull tout.

Bull Trout Core Habitat - Habitat that encompasses spawning and rearing habitat (resident populations), with the addition of foraging, migration, and overwintering habitat if the population includes migratory fish. Core habitat is defined a habitat that contains, or if restored would contain, all of the essential physical elements to provide for the security of and allow for the full expression of life history forms of one or more local populations of bull trout. Core habitat may include currently unoccupied habitat if that habitat contains essential elements for bull trout to persist or is deemed critical to recovery.

Bull Trout Core Population - A group of one or more bull trout local populations that exist within core habitat.

Bull Trout Foraging, Migration, and Overwintering Habitat - relatively large streams and mainstem rivers, lakes or reservoirs, estuaries and nearshore environments, where adult and subadult migratory bull trout forage.

Bull Trout Local Population - A group of bull trout that spawn within a particular stream or portion of a stream system. Multiple local populations may exist within a core area. A local population is considered to be the smallest group of fish that is known to represent an interacting reproductive unit. For most waters where specific information is lacking, a local population may be represented by a single headwater tributary or complex of headwater tributaries. Gene flow may occur between local populations (e.g., those within a core population), but is assumed to be infrequent compared with that among individuals within a local population.

Class IV General Forest Practices: forest practices that are conducted on 1) lands platted after January 1, 1960, 2) lands that have or are being converted to another use or 3) forest practices which would otherwise be Class III but which are taking place on lands that are not to be reforested because of likelihood of future conversion to urban development. Class I and Class II forest practices located within the Urban Growth Area are, by definition, Class IV-General (see RCW 76.09.050).

Clear zone – a safety feature for cars leaving a roadway. The combined width of Zones 1 and 2 (see figure)

Concrete mattresses -closed cell and open cell. Closed cell mattresses are flat, continuous blocks of cured concrete. Open cell mattresses have voids in which stream gravel is placed. The concrete blocks are linked together with steel or synthetic cable

Cross Vanes. Cross vanes are large angular rocks and/or logs that deflect flow away from the stream bank and towards the center of the channel. Similar to drop structures, cross vanes are typically used as an alternative to riprap and can result in slower flows and pool and riffle formation. They require extensive in-stream work. Cross vanes may need periodic debris removal.

Daily peak activity for marbled murrelets – two hours before official sunrise to two hours after official sunrise and two hours before official sunset to two hours after official sunset.

Debris Flow – A rapidly moving fluid mass of rock fragments, soil, water, and organic material with more than half of the particles being larger than sand size. Generally, debris flows occur on steep slopes or in gullies, and can travel long distances. Debris flows typically result from unusually high rainfall or rain on snow events.

Drop Structures. Drop structures are used in degrading streams riprap and/or logs to spill and direct flow away from eroding banks, dissipate and redistribute energy, relocate the depositional zone, and provide grade stabilization. Drop structures can be a navigational hazard and are generally used in smaller stream systems without navigation requirements. Drop structures typically require equipment operation in the channel. Drop structures can collect spawning gravels, create pool habitat, promote gravel bar/riffle formation, and trap suspended sediments. These structures are keyed into the bank and are oriented perpendicular to the flow or as an upstream-oriented "V." They have no more than a 12-inch vertical drop to ensure fish passage. Drop structures are designed and implemented as recommended in the ISPG or WSDOT Hydraulics Manual. Drop structures require frequent maintenance.

Engineered Log Jam (ELJ) - ELJs are LWD placed singly or in a series to add channel complexity. In addition to improving in-stream fish habitat, ELJs can stabilize stream banks and promote riparian vegetation establishment. Due to their large size and complex nature, ELJs are not used in emergency situations, nor are they installed above scour-critical bridges.

Fishways -Culverts that have been modified with weirs or baffles to pass fish.

Fluvial bull trout - Bull trout that migrate from tributary streams to larger rivers to mature (one of three migratory bull trout life history forms). Fluvial bull trout migrate to tributarie to spawn.

Landslide – The vertical and horizontal displacement of a soil mass, under the influence of gravity, within a slope or embankment. Generally, landslides can be divided into two categories based on failure geometry: circular and sliding block failures. The rate of movement of landslides can vary from very slow moving to very rapid.

Marbled murrelet detection area - an area of land associated with a visual or audible detection of a marbled murrelet, made by a qualified surveyor that is documented and recorded in the WDFW database. The marbled murrelet detection area shall be comprised of the section of land in which the marbled murrelet detection was made and the eight sections of land immediately adjacent to that section.

Marbled murrelet nesting season- April 1 to September 15.

(1) **Early murrelet nesting season means** April 1 to August 5.

(2) **Late murrelet nesting season means** August 6 to September 15.

Marbled murrelet occupied site -:

1. A contiguous area of suitable marbled murrelet habitat where at least one of the following marbled murrelet behaviors or conditions occur:

    a. A nest is located; or

    b. Downy chicks or eggs or egg shells are found; or

    c. Marbled murrelets are detected flying below, through, into or out of the forest canopy; or

    d. Birds calling from a stationary position within the area; or

    e. Birds circling above a timber stand within one tree height of the top of the canopy; or,

2. A contiguous forested area which does not meet the definition of suitable marbled murrelet habitat, in which any of the behaviors or conditions listed above, has been documented by the WDFW and which is distinguishable from the adjacent forest based on vegetative characteristics important to nesting marbled murrelets.

3. For sites defined in (1) above, the outer perimeter of the occupied site shall be presumed to be the closer, measured from the point where the observed behaviors or conditions listed in (1) above occurred, of the following:

    a. 1.5 miles from the point where the observed behaviors or conditions listed in (1) above occurred; or

    b. The beginning of any gap greater than 300 feet wide lacking one or more of the vegetative characteristics listed under “suitable marbled murrelet habitat”; or

    c. The beginning of any narrow area of “suitable marbled murrelet habitat” less than 300 feet in width and more that 300 feet in length.

4. For sites defined under (2) above, the outer perimeter of the occupied site shall be presumed to be the closer, measured from the point where the observed behaviors or conditions listed in (1) above occurred, of the following:

    a. 1.5 miles from the point where the observed behaviors or conditions listed in (1) above occurred; or

    b. The beginning of any gap greater than 300 feet wide lacking one or more of the distinguishing vegetative characteristics important to murrelets; or

c. The beginning of any narrow area of "suitable marbled murrelet habitat" less than 300 feet in width and more that 300 feet in length.

In determining the existence, location, and status of occupied marbled murrelet sites, the WSDOT shall consult with the WDFW and use only those sites documented in substantial compliance with guidelines or protocols and quality-control methods established by and available from the WDFW.

Marbled murrelet potential nest tree - Potential nest trees are defined as conifers with live crowns containing suitable nesting platforms. Platforms are defined as large, moss-covered branches ≥ 4 inches diameter located ≥ 33 ft above ground (71 FR 53840).

Marbled murrelet suitable nesting habitat – marbled murrelet suitable habitat occurs within 55 miles of marine waters and is defined as having the following components.

Platform: Platforms are defined as limbs greater or equal to 4 inches diameter (10 centimeters (cm)) and greater or equal to 33 ft (10 m) above ground (71 FR 53840). Younger forests with dwarf mistletoe or other deformations or structures can also provide nesting platforms (Evans Mack et al. 2003). Tree diameter and height have been positively correlated with platform size and the abundance of platforms, but the relationship may change depending on the variety of tree species and forest types marbled murrelets use for nesting (Huff et al. 2006). Overall, nest trees in Washington, Oregon, and northern California have been greater than 19 inches (48 cm) in diameter-at-breast-height and greater than 98 ft (30 m) tall (Hamer and Nelson 1995).

Other important attributes of the platform are vertical and horizontal cover and substrate. Known nest sites have platforms that are generally protected by branches above (vertical cover) or to the side (horizontal cover) (Huff et al. 2006).

Number of Platforms per Acre: The stand should have at least two platforms per acre. The platforms may be clumped in one area or dispersed throughout the stand, but the average number of platforms/acre should be at least two.

This is a very basic description of suitable habitat which may be changed on a case by case basis dependant upon site specific information.

Non-potential nest tree - a tree that may contain the suitable elements (e.g., structure, size) for providing nesting habitat, but due to its location or other factors, it is unlikely to be used for nesting purposes.

Northern spotted owl nesting season (except within Mt. Rainier National Park) - March 1 to September 30.

(1) **Early spotted owl nesting season means** March 1 to July 15.
(2) **Late spotted owl nesting season means** July 15 to September 30.

Northern spotted owl nesting season (within Mt. Rainier National Park) - March 15 to September 30.

(1) **Early spotted owl nesting season means** March 15 to July 30.
(2) **Late spotted owl nesting season means** August 1 to September 30.

Northern spotted owl dispersal habitat - habitat stands that provide the characteristics needed by northern spotted owls for dispersal. Such habitat provides protection from the weather and predation, roosting opportunities, and clear space below the forest canopy for flying. Timber stands that provide for northern spotted owl dispersal have the following characteristics:

a) **For western Washington,** timber stands 5 acres in size or larger with:

   i. 70 percent or more canopy cover; and

   ii. 70 percent or more of the stand in conifer species greater than 6 inches diameter at breast height; and

   iii. A minimum of 130 trees per acre with a diameter at breast height of at least 10 inches or a basal area of 100 square feet of 10 inch diameter at breast height or larger trees; and

   iv. A total tree density of 300 trees per acre or less; and

   v. A minimum of 20 feet between the top of the understory vegetation and the bottom of the live canopy, with the lower boles relatively clear of dead limbs.

b) **For eastern Washington,** timber stands 5 acres in size or larger with:

   i. 50 percent or more canopy closure; and

   ii. A minimum of 50 conifer trees per acre, with a diameter at breast height of 6 inches or more in even-aged stands or 4 inches or more in uneven-aged stands, and an average tree height of 65 feet or more; and

   iii. Total tree density of 200 trees per acre or less; and

   iv. A minimum of 20 feet between the top of the understory vegetation and the bottom of the live canopy, with the lower boles relatively clear of dead limbs; or

   v. Conifer stands with a quadratic mean diameter of 9 inches or more and a relative density of 33 or more or a canopy closure of 55 percent or more.

c) Suitable northern spotted owl habitat provides all of the required characteristics needed by northern spotted owls for dispersal

Northern spotted owl nest tree: A large tree or snag, located within a stand of suitable habitat, with any of the following features: a broken top, a cavity, mistletoe brooms, or a raptor nest. Northern spotted owls will nest in cavities in snags, but the snag or live tree must be located in a stand of suitable habitat. No minimum stand size for northern spotted owl habitat has been

defined, but 5 acres may be considered a reasonable minimum. A nest patch has been defined as 70 acres of the best suitable habitat surrounding a known nest tree.

Northern spotted owl suitable habitat - forest stands that meet the description of old forest habitat, sub-mature habitat or young forest marginal habitat found in (a) and (b) of this subsection. Old forest habitat is the highest quality, followed in descending order by sub-mature habitat and young forest marginal habitat.

a. **Old forest habitat** means habitat that provides for all the characteristics needed by northern spotted owls for nesting, roosting, foraging, and dispersal, described as stands with:

    i. A canopy closure of 60 percent or more and a layered, multispecies canopy where 50 percent or more of the canopy closure is provided by large overstory trees (typically, there should be at least 75 trees greater than 20 inches diameter at breast height per acre, or at least 35 trees 30 inches diameter at breast height or larger per acre); and

    ii. Three or more snags or trees 20 inches diameter at breast height or larger and 16 feet or more in height per acre with various deformities such as large cavities, broken tops, dwarf mistletoe infections, and other indications of decadence; and

    iii. More than two fallen trees 20 inches diameter at breast height or greater per acre and other woody debris on the ground.

b. **Sub-mature habitat and young forest marginal habitat.** Sub-mature habitat provides all of the characteristics needed by northern spotted owls for roosting, foraging, and dispersal. Young forest marginal habitat provides some of the characteristics needed by northern spotted owls for roosting, foraging, and dispersal. Sub-mature habitat and young forest marginal habitat stands can be characterized based on the forest community, canopy closure, tree density and height, vertical diversity, snags and cavity trees, dead and down wood, and shrubs or mistletoe infection. They are described in Tables 1 and 2.

Table 1. Western Washington Northern Spotted Owl Sub-Mature and Young Forest Marginal Habitat Characteristics from the Washington Forest Practices Rules (WAC 222-16-085).

Characteristic	**Habitat Type**	
	Sub-Mature	**Young Forest Marginal**
Forest Community	conifer-dominated or conifer hardwood (greater than or equal to 30% conifer)	conifer-dominated or conifer hardwood (greater than or equal to 30% conifer)
Canopy Closure	greater than or equal to 70% canopy closure	greater than or equal to 70% canopy closure
Tree Density and Height Vertical Diversity	115-280 trees/acre (greater than or equal to 4 inches dbh) with dominants/codominants greater than or equal to 85 feet high OR dominant/codominants greater than or equal to 85 feet high with 2 or more layers and 25 - 50% intermediate trees	115-280 trees/acre (greater than or equal to 4 inches dbh) with dominants/codominants greater than or equal to 85 feet high OR dominant/codominants greater than or equal to 85 feet high with 2 or more layers and 25 - 50% intermediate trees
Snags/Cavity Trees	Greater than or equal to 3/acre (greater than or equal to 20 inches dbh and 16 feet in height)	greater than or equal to 2/acre (greater than or equal to 20 inches dbh and 16 feet in height) OR greater than or equal to 10% of the ground covered with 4 inch diameter or larger wood, with 25-60% shrub cover
Dead, Down Wood	N/A	
Shrubs	N/A	
The values indicated for canopy closure and tree density may be replaced with a quadratic mean diameter of greater than 13 inches and a basal area of greater than 100.		

Table 2. Eastern Washington Northern Spotted Owl Sub-Mature and Young Forest Marginal Habitat Characteristics from the Washington Forest Practices Rules (WAC 222-16-085).

<table>
<tr><th rowspan="2">Characteristic</th><th colspan="3">Habitat Type</th></tr>
<tr><th>Sub-Mature</th><th>Young Forest Marginal (closed canopy)</th><th>Young Forest Marginal (closed canopy)</th></tr>
<tr><td>Forest Community</td><td>greater than or equal to 40% fir</td><td>greater than or equal to 40% fir</td><td>greater than or equal to 40% fir</td></tr>
<tr><td>Tree Density and Height</td><td rowspan="4">110-260 trees/acre (greater than or equal to 4 inches dbh) with dominants/codominants greater than or equal to 90 feet high OR dominants/codominants greater than or equal to 90 feet high with 2 or more layers and 25-50% intermediate trees</td><td>100-300 trees/acre (greater than or equal to 4 inches dbh)</td><td>100-300 trees/acre (greater than or equal to 4 inches dbh)</td></tr>
<tr><td rowspan="3">Vertical Diversity</td><td>dominants/codominants equal to or greater than 70 feet high</td><td>dominants/codominants equal to or greater than 70 feet high</td></tr>
<tr><td>2 or more layers</td><td>2 or more layers</td></tr>
<tr><td>25-50% intermediate trees</td><td>25-50% intermediate trees</td></tr>
<tr><td>Canopy Closure</td><td>greater than or equal to 70% canopy closure greater</td><td>greater than or equal to 70% canopy closure greater</td><td>greater than or equal to 50% canopy closure</td></tr>
<tr><td>Snags/Cavity Trees</td><td rowspan="2">greater than or equal to 3/acre (greater than or equal to 20 inches dbh 16 feet in height) OR high or moderate infection</td><td>N/A</td><td>2/acre or more (greater than or equal to 20 inches dbh 16 feet in height)</td></tr>
<tr><td>Mistletoe</td><td>N/A</td><td>high or moderate infection</td></tr>
<tr><td>Dead, Down Wood</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
<tr><td colspan="4">The values indicated for canopy closure and tree density may be replaced with the following:
a) For sub-mature a quadratic mean diameter of greater than 13 inches and a relative density of greater than 44;
b) For young forest marginal a quadratic mean diameter of greater than 13 inches and a relative density of greater than 28.</td></tr>
</table>

Potential nest tree - a tree that contains the suitable elements (e.g., structure, size) for providing nesting habitat and may be used for nesting purposes. (Also see **non-potential nest tree** definition).

Porous Weirs. Porous weirs are large rocks that spill and direct flow and provide soft grade control. Primarily used in smaller streams, they realign flow and add channel diversity and bed roughness. Porous weirs create and maintain pools, sort sediment at the pool tailout and along the thalweg, and can deepen the thalweg. Equipment operation within the channel may be required for construction. Porous weirs are designed to withstand the 100-year peak flow and are arranged either in an upstream-oriented "V", "U", or "W" formation. Porous weirs should be completely submerged at bank-full depth. These structures are keyed into the bank to prevent erosion and end-cutting and are designed and implemented as recommended in ISPG.

Production blasting – blasting used to generate construction material.

Restrainers - Longitudinal restrainers prevent abutting spans from being pulled apart during an earthquake. Transverse restrainers pin abutting spans together and prevent them from being sheared apart during an earthquake.

Riprap Armoring. Riprap armoring is typically angular rock placed on the stream bank. WSDOT does not typically use riprap for banks steeper than 2:1 (horizontal: vertical). Bank grading may be required prior to placing riprap. A layer of gravel or fabric is placed beneath the large rock to prevent underlying soils from washing through. WSDOT will key in riprap at the toe of the slope. During emergency repairs, WSDOT may place riprap using an excavator. If conditions are unsafe for an excavator, they may end dump riprap.

Rockfall – The fall of newly detached segments of bedrock of any size from a cliff or steep slope. Movements are very rapid to extremely rapid, and may not be preceded by minor movements.

Settlement – The vertical displacement of a soil mass not associated with a horizontal movement within a slope or embankment. Generally, movement is slow. Piping occurs when erosion of the subsurface soil, associated with groundwater flow, causes failure of the soil.

Site potential tree height - The average maximum height for trees given the local growing conditions and is based on species-specific site index tables. We have assumed for determining the height of one-site potential tree, that the species is a Douglas fir (it is the tallest species in Washington State), and within a class 1 site (the best site condition) trees that are in the 14 to 19 inch size class are approximately 50 years old . Trees of this characteristic would have a potential tree height of approximately 146 feet (rounded to 150 feet for this programmatic). In contrast, a tree growing on a class 5 site (the worst site condition), would have a potential tree height of 60 feet. For the purposes of this programmatic, one-half a site potential tree height is defined as 75 feet.

Slope Erosion – The wearing away of a soil mass by the actions of running water. On slopes, this process can result in the overland flow of water in an unconcentrated sheetwash, or the development of rills. Along streams or rivers, the process can entail the near vertical undercutting of adjacent stream/river banks.

Slope flattening - the placement and removal of fill material on existing cut slopes to make them more traversable and to improve site distance

Stand (tree stand) - an aggregation of trees occupying a specific area and sufficiently uniform in composition, age, arrangement, and condition as to be distinguishable from the forest in adjoining areas. (USFWS 1992).

Status 1-4 marbled murrelet detection -

1 - nest site

2 - downy young or eggshell fragments (this may not indicate the accurate location of a nest)

3 - subcanopy behavior & circling above canopy (not sure just what height above canopy WDFW is currently using, used to be below 1.25 canopy height, but I think they raised the height. For detections under the NWFP, circling above the stand below 2 canopies is considered an occupied behavior).

4 - above canopy behavior (this also includes heard only detections, unless the heard only adequately documents a circling behavior).

In general, Status 1-3 are considered occupied and Status 4 is presence. However, see the caveats attached to Status 2 and 3.

Stream Reach: A meander cycle. This is approximately 10 channel widths. A stream reach includes only one stream type (such as that used in the Rosgen Classification).

Threshold Discharge Area (TDA): An on-site area draining to a single natural discharge location or multiple natural discharge locations that combine within 0.25 mile downstream (as determined by the shortest flow path).

Turning Rocks: Turning rocks are large rocks that spill and direct flow, confine the low flow channel, and dissipate energy. Two-thirds of each rock is buried in the substrate. Turning rocks are generally used in small streams and can provide feeding, resting, and shelter areas for fish. Turning rocks can also help maintain higher base flows and prevent the settling of sediments. Equipment operation within the channel may be required for construction. Turning rocks are designed to withstand the 100-year peak flow, and the maximum channel restriction is 20 percent. Boulder heights are less than one-half bank-full depth.

"W" Weirs. "W" weirs are riprap or logs that redirect flow away from banks, provide grade control on larger rivers, and redirect the debris line through bridge openings to avoid debris accumulation on piers. These weirs can be used to protect multiple bridge piers. "W" weirs are typically used as an alternative to riprap and can result in slower flows, increased sediment transport capacity, and pool and riffle formation. "W" weirs require extensive in-stream work. "W" weirs are keyed into the stream bank. "W" weirs need periodic debris removal.

Literature Cited

(reviewed in Burger 2002 and McShane et al. .2004.

Evans Mack et al. 2003

U.S. Fish and Wildlife Service. 1992. Draft final recovery plan for the northern spotted owl. U.S. Fish and Wildlife Service. 2 Volumes. Portland, Oregon. Page 658

APPENDIX B

Appendix B. NPDES General Permit WA-0039039.

Issuance Date: March 3, 2004
Effective Date: April 3, 2004
Expiration Date: April 3, 2009

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM
WASTE DISCHARGE PERMIT No. WA-0039039

State of Washington
DEPARTMENT OF ECOLOGY
Olympia, Washington 98504-7600

In compliance with the provisions of
The State of Washington Water Pollution Control Law
Chapter 90.48 Revised Code of Washington
and
The Federal Water Pollution Control Act
(The Clean Water Act)
Title 33 United States Code, Section 1251 et seq.

Washington State Department of Transportation
310 Maple Park Ave SE
PO Box 47331
Olympia, WA 98501

Facility Location: NA	Receiving Water: Statewide Fresh and Marine Waters
Water Body I.D. No.: NA	Discharge Location: NA
Industry Type: Washing and Pressure Washing of Bridges and Ferry Terminals	

is authorized to discharge in accordance with the special and general conditions which follow.

Melodie Selby, P.E.
Program Development Section Manager
Washington State Department of Ecology

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SUMMARY OF PERMIT REPORT SUBMITTALS

Permit Section	Submittal	Frequency	First Submittal Date
S3.B	Annual Project Completion Report	Annually	Winter 2004/2005
S3.B	Annual Proposed Project List	Annually	Spring 2004
S3.E	Noncompliance Notification	As necessary	
G1.	Notice of Change in Authorization	As necessary	
G4.	Permit Application for Substantive Changes to the Discharge	As necessary	

G5.	Engineering Report for Construction or Modification Activities	As necessary	
G7.	Application for Permit Renewal	1/permit cycle	March 1, 2008
G8	Notice of Permit Transfer	As necessary	
G21	Reporting Anticipated Non-compliance	As necessary	
G22.	Reporting Other Information	As necessary	

SPECIAL CONDITIONS

All discharges and activities authorized by this permit shall be consistent with the terms and conditions of this permit.

In the event that the permittee cannot adhere to the conditions of this permit on a specific site or project due to human health or safety reasons, the permittee may apply for a separate permit for that project from the appropriate regional office of the Department of Ecology.

The discharge of pollutants more frequently than, or at a level in excess of, that identified and authorized by this permit shall constitute a violation of the terms and conditions of this permit.

S1. DISCHARGE LIMITATIONS

Beginning on the effective date of this permit and lasting through the expiration date, the Permittee is authorized to discharge high pressure wash water or low pressure wash water from bridges, ferry terminals and ferry transfer spans in Washington State subject to the following limitations:

A. Bridge Maintenance Cleaning and Washing (This section applicable to operations described in the fact sheet and is not applicable to operations such as street sweepers which are covered by the Water Quality Implementing Agreement).

1. Work shall only occur during the following times:

   West of the Cascade Mountain Crest: November 1 to May 31.
   East of the Cascade Mountain Crest: December 1 to June 30.

2. Measures shall be used to prevent damage to the vegetation in the riparian (streamside or shoreline) area located within 200 feet perpendicular to the water

and adjacent to the structure. Within the riparian area existing parking lots and open managed fields and lots may be used for staging work.

3. No work or equipment use shall occur below the ordinary high water line (OHWL).

4. The bridge shall first be cleaned using dry methods and equipment (scraping, sweeping, vacuuming) that will prevent debris and substances from entering state waters. Residual grease is to be removed by hand methods and degreaser on absorbent material, provided none of this material shall enter state waters. Examples of debris and substances include, but are not restricted to:
    a. bird nests and fecal material
    b. dirt, moss, sediments, and rust
    c. old paint chips and residue
    d. petroleum products
    e. cement chips
    f. construction materials
    g. chemicals or any other toxic or deleterious substances

5. During bridge cleaning and low pressure washing, if debris, substances, or wash water could enter state waters through deck drains, the drains shall be temporarily blocked to route water to the landward end(s) of the structure and onto vegetative areas, where practicable.

6. Debris and substances resulting from bridge maintenance cleaning shall be collected, contained, and deposited above the limits of flood water or extreme high tide in a site that has the appropriate regulatory approval. No debris, marine growth, or substances shall be placed in road drainages, wetlands, riparian (streamside or shoreline) areas, or on adjacent land where they may be eroded into state waters.

7. Washing shall be done with clean water. No detergents or other cleaning agents shall be used.

8. Washing shall occur with the minimum water pressure necessary to accomplish the work to prevent existing paint from being removed and entering state waters.

9. After dry cleaning methods have been completed, debris accumulations remaining in the drains may be flushed with clean water.

10. No petroleum products, hydraulic fluids, chemicals, or any other polluting substances shall be allowed to enter state waters.

B. Ferry Terminal/Transfer Span Maintenance Cleaning and Washing and Marine Growth Removal

1. Measures shall be used to prevent damage to the vegetation in the riparian (streamside or shoreline) area located within 200 feet perpendicular to the water and adjacent to the structure. Within the riparian area existing parking lots and open managed fields and lots may be used for staging work.

2. No work or equipment use shall occur below the ordinary high water line (OHWL) except the use of a temporary floating work platform for marine growth removal.

3. No disturbance to the shoreline shall occur when placing or removing a temporary floating work platform.

4. Ferry terminals and spans shall first be cleaned using dry methods and equipment (scraping, sweeping, vacuuming) that will prevent debris and substances from entering state waters. Residual grease may be removed by hand methods and degreaser on absorbent material, provided none of this material shall enter state waters. Examples of debris and substances include, but are not restricted to:
   a. bird nests and associated fecal material
   b. dirt, moss, sediments, and rust
   c. old paint chips and residue
   d. petroleum products
   e. cement chips
   f. construction materials
   g. chemicals or any other toxic or deleterious substances

5. If debris, substances, and/or wash water could enter state waters through drains, the drains shall be temporarily blocked to route water to the landward end of the ferry terminal and onto vegetative areas, where practicable.

6. Marine growth removal from creosote or any other treated wood shall be restricted to the use of methods and tools that will minimize removal of the creosote or treated wood fibers.

7. Debris and substances resulting from this cleaning project shall be contained and deposited above the limits of extreme high tide in a site that has the appropriate regulatory approval. No debris, marine growth, and substances shall be placed in road drainages, wetlands, riparian (shoreline) areas, or on adjacent land where they may be eroded into state waters.

8. Washing shall be done with clean water. No detergents or other cleaning agents shall be used.

9. Washing shall occur with the minimum water pressure in order to prevent paint from being removed and entering state waters.

10. After dry cleaning methods have been completed, debris accumulations remaining in the drains may be flushed with clean water.

11. No petroleum products, hydraulic fluids, chemicals, or any other polluting substances shall be allowed to enter state waters.

C. Bridge Preparatory Washing (Pre-painting)

1. For bridges over lakes and wetlands or over rivers listed on the 303(d) list for copper, zinc or lead - No discharge to surface waters.

   For rivers with flows of 55 cfs or less in Eastern Washington or 89 cfs or less in Western Washington at the time of washing – No discharge to surface waters.

   These wastewaters may be directed to ground discharge at a location near the bridge if the soils are suitable for infiltration. These wastewaters must be filtered with #100 sieve fabric prior to discharge to ground. This authorization is contingent upon timely completion of ground water evaluation as given in condition S6.

2. For bridges over rivers with flows of 56 cfs to 325 cfs at the time of washing (Eastern Washington) or 90 cfs to 532 cfs (Western Washington) – The permittee will explain in their Annual Proposed Project List (see Monitoring and Reporting) the mitigation measures for meeting water quality standards and must include plans for using less than six pressure washers operating simultaneously. Wash water and debris resulting from pressure washing, including but not restricted to dirt and old paint chips, shall be filtered through a filter tarp of a minimum of # 100 sieve before discharge to surface waters. This authorization is contingent upon timely completion of a effluent specific translator study as given in S6.

3. For bridges over rivers with flows of 326 cfs to 4260 cfs (Eastern Washington) or 533 cfs to 7930 (Western Washington) at the time of washing – The permittee will explain in their Annual Proposed Project List the mitigation measures to meet water quality standards. Wash water and debris resulting from pressure washing, including but not restricted to dirt and old paint chips, shall be filtered through a filter tarp of a minimum of # 100 sieve before discharge to surface waters. A maximum of six pressure washers may be used. This authorization is contingent upon timely completion of a effluent specific translator study as given in S6.

4. For bridges over rivers with flows of 4261 or greater (Eastern Washington) or 7931 or greater cfs (Western Washington) at the time of washing - Wash water

and debris resulting from pressure washing, including but not restricted to dirt and old paint chips, shall be filtered through a filter tarp of a minimum of #100 sieve before discharge to surface waters. A maximum of six pressure washers may be used.

5. For bridges over marine waters - The permittee will explain in their Annual Proposed Project List the mitigation measures for meeting water quality standards. Wash water and debris resulting from pressure washing, including but not restricted to dirt and old paint chips, shall be filtered through a filter tarp of a minimum of # 100 sieve before discharge to surface waters.

6. Measures shall be used to prevent damage to the vegetation in the riparian (streamside or shoreline) area located within 200 feet perpendicular to the water and adjacent to the structure. Within the riparian area existing parking lots and open managed fields and lots may be used for staging work..

7. No work or equipment use shall occur below the ordinary high water line (OHWL) except the use of a temporary floating work platform.

8. No disturbance to the stream banks or shoreline shall occur when placing or removing a temporary floating work platform.

9. Bridges shall first be cleaned using dry methods and equipment (scraping, sweeping, vacuuming) that will prevent debris and substances from entering state waters. Residual grease may be removed by hand methods and degreaser on absorbent material, provided none of this material shall enter state waters. Examples of debris and substances include, but are not restricted to:
    a. bird nests and fecal material
    b. dirt, moss, sediments, and rust
    c. old paint chips and residue
    d. blasting medium
    e. petroleum products
    f. cement chips
    g. construction materials
    h. chemicals or any other toxic or deleterious substances

10. If debris, substances, or wash water could enter state waters through deck drains, the drains shall be temporarily blocked to route water to the landward end(s) of the structure and onto vegetative areas where practicable.

11. Work that would result in debris and substances entering state waters, including but not restricted to dirt, abrasive blasting medium, old paint chips, and new paint, shall include a containment structure capable of collecting all such debris and substances.

12. Debris and substances collected in the containment or filter structure shall be removed from the structure;
    a. daily,
    b. whenever accumulations may place the structure at risk,
    c. and whenever its moved or removed.

13. Work shall not occur when weather conditions would place the containment or filter structure at risk, or result in loss of contained material or the loss of filtering function.

14. Any containment or filter structure shall be routinely inspected and repaired as necessary to ensure its function.

15. Debris and substances from this project shall be collected, contained and then deposited above the limits of flood water or extreme high tide in a site that has the appropriate regulatory approval. No debris and substances shall be placed in road drainages, wetlands, riparian (streamside and shoreline) areas, or on adjacent land where they may be eroded into state waters.

16. Pressure washing and washing shall be done with clean water. No detergents or other cleaning agents shall be used.

17. After dry cleaning methods have been completed, debris accumulations remaining in the drains may be flushed with clean water.

18. No cleaning of any painting or other equipment or mixing or storing of paint and other polluting materials and substances shall be done over the water or in an area where a spill would result in these materials and substances entering state waters.

19. For brush and/or roller paint application methods, painters shall work from pails containing a maximum of two (2) gallons of paint to minimize the impact of accidental spillage.

20. No cleaning solvents or chemicals utilized for tool or equipment cleaning may be discharged to the ground or water. Cleaning of painting and maintenance equipment shall not be done in state waters nor shall resultant cleaning runoff be allowed to enter state waters. No paint cans, lids, brushes, or other debris shall be allowed to enter state waters.

21. All liquid products shall be stored and mixed on impervious surfaces in secure and contained location to eliminate the potential for spills into state waters.

22. Drip pans or other protective devise shall be required for all paint mixing and solvent transfer operations.

23. Drip tarps shall be suspended below paint platforms to prevent spilled paint, buckets, brushes, etc., from being lost to state waters.

24. Paint and solvent spills shall be treated as oil spills and shall be prevented from reaching storm drains and subsequent discharge into the water. Any such spill shall be reported to the appropriate Ecology Regional Office immediately.

25. The project Engineer or Inspector shall be on site or on call, and be readily accessible to the site at all times while cleaning and painting activities are occurring that may affect the quality of surface water of the state.

26. No petroleum products, hydraulic fluids, chemicals, or any other polluting substances shall be allowed to enter state waters.

27. Pressure washing of concrete structures shall be held to the minimum necessary to maintain structural integrity.

D. Ferry Transfer Span Preparatory Washing

1. Washing shall only be done in weeks of maximum tidal exchange (spring tide) and at time of maximum daily tidal flows.

2. Wash water and debris resulting from pressure washing, including but not restricted to dirt and old paint chips, shall be filtered through a filter tarp of a minimum of # 100 sieve before discharge to surface waters.

3. The number of pressure washers at any time shall be four or less.

4. Measures shall be used to prevent damage to the vegetation in the riparian (streamside or shoreline) area located within 200 feet perpendicular to the water and adjacent to the structure. Within the riparian area existing parking lots and open managed fields and lots may be used for staging work.

5. No work or equipment use shall occur below the ordinary high water line (OHWL) except the use of a temporary floating work platform for marine growth removal.

6. No petroleum products, hydraulic fluids, chemicals, or any other polluting substances shall be allowed to enter state waters.

7. No disturbance to the shoreline shall occur when placing or removing a temporary floating work platform.

8. Ferry terminals shall first be cleaned using dry methods and equipment (scraping, sweeping, vacuuming) that will prevent debris and substances from entering state waters, except residual grease may be removed by hand methods

and degreaser on absorbent material, provided none of this material shall enter state waters. Examples of debris and substances include, but are not restricted to:

a. bird nests and associated fecal material
b. dirt, moss, sediments, and rust
c. old paint chips and residue
d. petroleum products
e. cement chips
f. construction materials
g. chemicals or any other toxic or deleterious substances

9. If cleaned debris, substances, and/or wash water could enter state waters through deck drains, the drains shall be temporarily blocked to route water to the landward end of the ferry terminal and onto vegetative areas where practicable.

10. Work that would result in debris and substances entering state waters, including but not restricted to dirt, abrasive blasting medium, old paint chips, and new paint, shall include a containment structure capable of collecting all such debris and substances.

13. Debris and substances collected in the containment or filter structure shall be removed from the structure;
    a. daily,
    b. whenever accumulations may place the structure at risk,
    c. and whenever its moved or removed.

14. Work shall not occur when weather conditions would place the containment or filter structure at risk, result in loss of contained material or loss of filtering function.

15. Any containment or filter structure shall be routinely inspected and repaired as necessary to ensure its function.

16. Marine growth removal from creosote or any other treated wood shall be restricted to the use of hand tools and methods that will minimize removal of the creosote or treated wood fibers.

17. Debris, marine growth, and substances from this project shall be collected and then contained and deposited above the limits of extreme high tide in a site that has the appropriate regulatory approval. No debris, marine growth, and substances shall be placed in road drainages, wetlands, riparian (shoreline) areas, or on adjacent land where they may be eroded into state waters.

18. Washing shall be done with clean water. No detergents or other cleaning agents shall be used.

19. After dry cleaning methods have been completed, debris accumulations remaining in the drains may be flushed with clean water.

20. No cleaning of any painting or other equipment or mixing or storing of paint and other polluting materials and substances shall be done over the water or in an area where a spill would result in these materials and substances entering state waters.

21. For brush and/or roller paint application methods, painters shall work from pails containing a maximum of two (2) gallons of paint to minimize the impact of accidental spillage.

22. No cleaning solvents or chemicals utilized for tool or equipment cleaning may be discharged to the ground or water. Cleaning of painting and maintenance equipment shall not be done in sate waters nor shall resultant cleaning runoff be allowed to enter state waters. No paint cans, lids, brushes, or other debris shall be allowed to enter state waters

23. All liquid products shall be stored and mixed on impervious surfaces in secure and contained location to eliminate the potential for spills into state waters.

24. Drip pans or other protective device shall be required for all paint mixing and solvent transfer operations.

25. Drip Tarps shall be suspended below paint platforms to prevent spilled paint, buckets, brushes, etc., from being lost to state waters.

26. Paint and solvent spills shall be treated as oil spills and shall be prevented from reaching storm drains and subsequent discharge into the water. Any such spill shall be reported to the appropriate Ecology Regional Office immediately.

27. The project Engineer or Inspector shall be on site or on call, and be readily accessible to the site at all times while cleaning and painting activities are occurring that may affect the quality of surface water of the state.

E. <u>Mixing Zone Descriptions for C. and D. above</u>

An acute mixing zone is authorized for Bridge Preparatory Washing over rivers. The maximum allowance for the mixing zone is defined as follows:

Acute – 2.5% of the river flow at the time of washing

The dilution factor from this mixing zone varies with the number of pressure washers and the river flow at the time of washing.

An acute mixing zone is authorized for Ferry Transfer Span Preparatory Washing over marine waters. The maximum boundaries of the mixing zone is as follows:

Acute – Twenty feet around the point of discharge.

The dilution factor resulting from this mixing zone varies with the number of pressure washers and receiving water current velocity.

S2. MONITORING REQUIREMENTS

A. Wash Water and Pressure Wash Water Monitoring:

The permittee shall monitor wash and pressure wash water as follows:

1. Bridge and Ferry Transfer Span Maintenance Washing

   The permittee shall monitor one representative project (bridge or ferry transfer span) per year. The permittee shall collect a composite sample of effluent and analyze for total hardness, dissolved and total recoverable copper, dissolved and total recoverable lead, and dissolved and total recoverable zinc.

2. Bridge and Ferry Transfer Span Preparatory Washing

   The permittee shall sample one representative project (bridge or ferry transfer span) per year. The permittee shall collect a composite sample of effluent after passing through the filter tarp. The sample shall be analyzed for dissolved and total recoverable copper, dissolved and total recoverable lead, dissolved and total recoverable zinc, total hardness, and acute toxicity to Ceriodaphnia dubia, Daphnia pulex, or Daphnia magna (48 hour static test, method: EPA/600/4-90/027F) and to Fathead minnow, Pimephales promelas (96 hour static-renewal test, method: EPA/600/4-90/027F). The permittee shall also collect samples of the receiving water "upstream" of the project bridge or transfer span and analyze the water for dissolved and total recoverable copper, dissolved and total recoverable lead, dissolved and total recoverable zinc, and total hardness.

B. Sampling and Analytical Procedures

Samples and measurements collected to meet the requirements of this permit shall be representative of the volume and nature of the monitored parameters, including representative sampling of any unusual discharge or discharge condition, including bypasses, upsets, and maintenance-related conditions affecting effluent quality.

Sampling and analytical methods used to meet the monitoring requirements specified in this permit shall conform to the latest revision of the Guidelines Establishing Test Procedures for the Analysis of Pollutants contained in 40 CFR

Part 136 or to the latest revision of Standard Methods for the Examination of Water and Wastewater (APHA), unless otherwise specified in this permit or approved in writing by the Department of Ecology (Department).

C. Laboratory Accreditation

All monitoring data required by the Department shall be prepared by a laboratory registered or accredited under the provisions of, Accreditation of Environmental Laboratories, Chapter 173-50 WAC.

S3. NOTIFICATION, REPORTING, AND RECORDKEEPING REQUIREMENTS

The Permittee shall notify, monitor and report in accordance with the following conditions. Notification, as required under S3 A.1 PROJECT NOTIFICATION (below), applies to all activities covered under this permit except ferry transfer span maintenance cleaning and washing. The falsification of information submitted to the Department shall constitute a violation of the terms and conditions of this permit.

A. Notification

1. PROJECT NOTIFICATION: The Ecology Regional Office Water Quality Program shall be notified (letter or fax) at least three (3) working days prior to start of work. Notification shall include:

    a. Agency name, contact person, and telephone number
    b. Type of activity
    c. Water body name
    d. Bridge location, including road number, milepost
    e. Latitude and longitude (S1.C and S1.D only)
    f. Starting date and estimated ending date for work

2. NOTIFICATION OF FISH KILL, PERMIT VIOLATION, WATER QUALITY PROBLEM: If at any time, as a result of project activities, fish are observed in distress, a fish kill occurs, a water quality problem occurs, or a permit violation occurs the Permittee shall:

    a. Immediately take action to stop, contain, and clean up unauthorized discharges or otherwise stop the noncompliance, correct the problem and, if applicable, repeat sampling and analysis of any discharge immediately and submit the results to the Department within thirty (30) days after becoming aware of the violation.

    b. Immediately notify the Department of Ecology of the failure to comply.

    c. Submit a detailed written report to the Department of Ecology within thirty (30) days (five [5] days for upsets and bypasses), unless requested earlier by the Department. The report shall contain a description of the

noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and the steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

Compliance with these requirements does not relieve the Permittee from responsibility to maintain continuous compliance with the terms and conditions of this permit or the resulting liability for failure to comply.

B. Reporting

The first monitoring period begins on the effective date of the permit.

Annual Proposed Project List Report – Each year the permittee shall submit a list of bridges and ferry transfer spans expected to be pressure washed and painted that year. The report shall be submitted at least 90 days prior to the start of activity. The report shall list the expected projects for that year and the river flows (for bridges) expected at time of preparatory washing. The report shall specify the expected monitoring, mitigation measures (condition S1.C), and any special studies which are planned for that year. For discharges to ground, the permittee shall specify the approximate location and the soil suitability for infiltration. The report shall be submitted to Department of Ecology, SEA Program, PO Box 47600, Olympia, WA 98504-7600.

Annual Project Completion Report: The permittee shall submit to the Department of Ecology, SEA Program, PO Box 47600, Olympia, WA 98504-7600, a calendar year annual report of Bridge Cleaning and Washing work by January 31 of the following year. An annual report is also required if no work was conducted. The annual report shall include:

1. General: Reporting agency, contact person, address, telephone number, date of report, time period.
2. Summary: Total number of individual projects by region and statewide.
3. Problem(s) encountered: Provision violation, notification, corrective action, impacts to fish life and water quality from problem. If the Environmental Compliance Assurance Procedure (ECAP) was used, what activity triggered the procedure. [these may be highlighted and specified in this section or included in the full list of projects completed below]

4. Recommendations for improvement to BMPs and mitigation [optional]

5. List of individual projects completed: By region including water body name, bridge name, road number and milepost, latitude and longitude, and date of work.

6. Water Quality Data: All data and analysis required under S2. and S6. of this permit.

All laboratory reports providing data for organic and metal parameters shall include the following information: sampling date, sample location, date of analysis, parameter name, CAS number, analytical method/ number, method detection limit (MDL), laboratory practical quantitation limit (PQL), reporting units, and concentration detected.

C. Records Retention

The Permittee shall retain records of all monitoring information for a minimum of three (3) years. Such information shall include all calibration and maintenance records and all original recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit. This period of retention shall be extended during the course of any unresolved litigation regarding the discharge of pollutants by the Permittee or when requested by the Director.

D. Recording of Results

For each measurement or sample taken, the Permittee shall record the following information: (1) the date, exact place, method, and time of sampling or measurement; (2) the individual or laboratory who performed the sampling or measurement; (3) the dates the analyses were performed; (4) the individual who performed the analyses; (5) the analytical techniques or methods used; and (6) the results of all analyses.

E. Additional Monitoring by the Permittee

If the Permittee monitors any pollutant more frequently than required by this permit using test procedures specified by Condition S2. of this permit, then the results of this monitoring shall be included in the calculation and reporting of the data submitted in the Permittee's Annual Project Completion Report.

F. Maintaining a Copy of This Permit

A copy of this permit or a document containing relevant conditions must be kept at the project site (bridge and ferry transfer span preparatory washing only) and be made available upon request to Ecology inspectors.

S4. OPERATION AND MAINTENANCE

The Permittee shall, at all times, properly operate and maintain all facilities or systems of treatment and control (and related appurtenances) which are installed to achieve compliance with the terms and conditions of this permit. Proper operation

and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems, which are installed by a Permittee only when the operation is necessary to achieve compliance with the conditions of this permit.

The Permittee is required to take all reasonable steps to minimize or prevent any discharge or sludge use or disposal in violation of this permit that has a reasonable likelihood of adversely affecting human health or the environment.

S5. SOLID WASTE DISPOSAL

A. Solid Waste Handling

The Permittee shall handle and dispose of all solid waste material in such a manner as to prevent its entry into state ground or surface water.

B. Leachate

The Permittee shall not allow leachate from its solid waste material to enter state waters without providing all known, available and reasonable methods of treatment, nor allow such leachate to cause violations of the State Surface Water Quality Standards, Chapter 173-201A WAC, or the State Ground Water Quality Standards, Chapter 173-200 WAC. The Permittee shall apply for a permit or permit modification as may be required for such discharges to state ground or surface waters.

S6. COMPLIANCE SCHEDULE

A. Waste-Specific Translator

The permittee is allowed to discharge filtered waste water resulting from pressure washing to rivers with flows between 55 cfs and 4200 cfs (7900 cfs in Western Washington) only if the permittee is in compliance with the following condition to develop a waste-specific translator or a comparable assessment that further defines the effluent characteristics or mixing zone effects:

By Spring of 2005 the permittee shall submit to Ecology for review and approval, a study plan to develop a waste-specific translator or comparable assessment. The plan shall identify the University contractor, contain the quality assurance plan for the chemical analysis, and the time schedule for completing the study within the period of this permit. The objective of the study is to determine the dynamics of conversion of total recoverable metal in the effluent to dissolved metal in the receiving water.

B. Ground Discharge Study

An evaluation of the impacts of discharge to ground is required. The evaluation report is due one year after three pressure wash projects using #100 filter tarp have been completed and evaluated. The report shall use the effluent analysis required elsewhere in this permit and evaluate the potential of this discharge for violation of ground water standards (Chapter 173-200).

C. Water Effect Ratio

The permittee may develop a water effect ratio to demonstrate the mitigating effects of the receiving water on the dissolved metal fraction of the wastewater. The development of a water effect ratio may be a combination of in-stream studies and literature reviews. If the permittee elects to perform a study of the water effect ratio, the permittee shall submit a study plan for review and approval to the Department of Ecology. The study plan must adhere to guidance given in publications EPA -823-B-94-001 and Ecology 92-109.

D. Mixing Zone Study

A mixing zone study may be performed to determine effective dilution of pressure washing wastewater in marine waters. If the permittee elects to perform a mixing zone study, the permittee shall submit a study plan for review and approval to the Department of Ecology. The study plan must adhere to guidance given in Ecology publication 92-109.

S7. HAZARDOUS SPILL PREVENTION AND CONTROL

A. No petroleum products, wet cement, lime, concrete, chemicals - including emulsifiers, dispersants or cleaning solvents used for tool or equipment cleaning, or other toxic or deleterious materials shall be used in or immediately adjacent to waters of the state, or be discharged into waters of the state.

B. Equipment that enters the state's waters shall be maintained to prevent any visible sheen from petroleum products from appearing on the water. Containment measures for the sheen will be deployed if a visible sheen is observed. If a sheen is observed, work shall cease and all leaking or dirty equipment shall be removed from the water and the source of the sheen shall be fixed prior to reentering the water.

C. All oil, fuel or chemical storage tanks or containers will be stored in a method which provides appropriate containment in the event of a spill thereby reducing impacts to surface water or groundwater of the state.

D. Fuel hoses, oil drums, oil or fuel transfer valves and fittings, etc., shall be checked regularly for drips or leaks, and shall be maintained and stored properly

to prevent spills into state waters. Proper security shall be maintained to prevent vandalism.

E. Concentrated waste or spilled chemicals shall be transported off site for disposal at a facility approved by Ecology or the appropriate County Health Department. These materials shall not be discharged to any sewer without approval of the local sewer authority.

GENERAL CONDITIONS

G1. SIGNATORY REQUIREMENTS

All applications, reports, or information submitted to the Department shall be signed and certified.

A. All permit applications shall be signed by either a responsible corporate officer of at least the level of vice president of a corporation, a general partner of a partnership, or the proprietor of a sole proprietorship.

B. All reports required by this permit and other information requested by the Department shall be signed by a person described above or by a duly authorized representative of that person. A person is a duly authorized representative only if:

    1. The authorization is made in writing by a person described above and submitted to the Department.

    2. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility, such as the position of plant manager, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.)

C. Changes to authorization. If an authorization under paragraph B.2 above is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of paragraph B.2 above must be submitted to the Department prior to or together with any reports, information, or applications to be signed by an authorized representative.

    1. Certification. Any person signing a document under this section shall make the following certification:

I certify under penalty of law, that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

G2. RIGHT OF INSPECTION AND ENTRY

The Permittee shall allow an authorized representative of the Department, upon the presentation of credentials and such other documents as may be required by law:

A. To enter upon the premises where a discharge is located or where any records must be kept under the terms and conditions of this permit.

B. To have access to and copy - at reasonable times and at reasonable cost - any records required to be kept under the terms and conditions of this permit.

C. To inspect - at reasonable times - any facilities, equipment (including monitoring and control equipment), practices, methods, or operations regulated or required under this permit.

D. To sample or monitor - at reasonable times - any substances or parameters at any location for purposes of assuring permit compliance or as otherwise authorized by the Clean Water Act.

G3. PERMIT ACTIONS

This permit may be modified, revoked and reissued, or terminated either at the request of any interested person (including the permittee) or upon the Department's initiative. However, the permit may only be modified, revoked and reissued, or terminated for the reasons specified in 40 CFR 122.62, 122.64 or WAC 173-220-150 according to the procedures of 40 CFR 124.5.

A. The following are causes for terminating this permit during its term, or for denying a permit renewal application:
    1. Violation of any permit term or condition.
    2. Obtaining a permit by misrepresentation or failure to disclose all relevant facts.
    3. A material change in quantity or type of waste disposal.
    4. A determination that the permitted activity endangers human health or the environment or contributes to water quality standards violations and

can only be regulated to acceptable levels by permit modification or termination [40 CFR part 122.64(3)].

5. A change in any condition that requires either a temporary or permanent reduction or elimination of any discharge or sludge use or disposal practice controlled by the permit [40 CFR part 122.64(4)].
6. Nonpayment of fees assessed pursuant to RCW 90.48.465.
7. Failure or refusal of the permittee to allow entry as required in RCW 90.48.090.

B. The following are causes for modification but not revocation and reissuance except when the permittee requests or agrees:

1. A material change in the condition of the waters of the state.
2. New information not available at the time of permit issuance that would have justified the application of different permit conditions.
3. Material and substantial alterations or additions to the permitted facility or activities which occurred after this permit issuance.
4. Promulgation of new or amended standards or regulations having a direct bearing upon permit conditions, or requiring permit revision.
5. The Permittee has requested a modification based on other rationale meeting the criteria of 40 CFR part 122.62.
6. The Department has determined that good cause exists for modification of a compliance schedule, and the modification will not violate statutory deadlines.
7. Incorporation of an approved local pretreatment program into a municipality's permit.

The following are causes for modification or alternatively revocation and reissuance:

1. Cause exists for termination for reasons listed in A1 through A7, of this section, and the Department determines that modification or revocation and reissuance is appropriate.
2. The Department has received notification of a proposed transfer of the permit. A permit may also be modified to reflect a transfer after the effective date of an automatic transfer (General Condition G8) but will not be revoked and reissued after the effective date of the transfer except upon the request of the new permittee.

G4. REPORTING PLANNED CHANGES

The Permittee shall, as soon as possible, but no later than sixty (60) days prior to the proposed changes, give notice to the Department of planned physical alterations or additions to the permitted facility, production increases, or process modification which will result in: 1) the permitted facility being determined to be a new source pursuant to 40 CFR 122.29(b); 2) a significant change in the nature or an increase in

quantity of pollutants discharged; or 3) a significant change in the Permittee's sludge use or disposal practices. Following such notice, and the submittal of a new application or supplement to the existing application, along with required engineering plans and reports, this permit may be modified, or revoked and reissued pursuant to 40 CFR 122.62(a) to specify and limit any pollutants not previously limited. Until such modification is effective, any new or increased discharge in excess of permit limits or not specifically authorized by this permit constitutes a violation.

G5. PLAN REVIEW REQUIRED

Prior to constructing or modifying any wastewater control facilities, an engineering report and detailed plans and specifications shall be submitted to the Department for approval in accordance with Chapter 173-240 WAC. Engineering reports, plans, and specifications shall be submitted at least one hundred eighty (180) days prior to the planned start of construction unless a shorter time is approved by Ecology. Facilities shall be constructed and operated in accordance with the approved plans.

G6. COMPLIANCE WITH OTHER LAWS AND STATUTES

Nothing in this permit shall be construed as excusing the Permittee from compliance with any applicable federal, state, or local statutes, ordinances, or regulations.

G7. DUTY TO REAPPLY

The Permittee shall apply for permit renewal at least 180 days prior to the specified expiration date of this permit.

G8. TRANSFER OF THIS PERMIT

In the event of any change in control or ownership of facilities from which the authorized discharge emanate, the Permittee shall notify the succeeding owner or controller of the existence of this permit by letter, a copy of which shall be forwarded to the Department.

A. Transfers by Modification

Except as provided in paragraph B below, this permit may be transferred by the Permittee to a new owner or operator only if this permit has been modified or revoked and reissued under 40 CFR 122.62(b)(2), or a minor modification made under 40 CFR 122.63(d), to identify the new Permittee and incorporate such other requirements as may be necessary under the Clean Water Act.

B. Automatic Transfers

This permit may be automatically transferred to a new Permittee if:

1. The Permittee notifies the Department at least 30 days in advance of the proposed transfer date.
2. The notice includes a written agreement between the existing and new Permittee's containing a specific date transfer of permit responsibility, coverage, and liability between them.
3. The Department does not notify the existing Permittee and the proposed new Permittee of its intent to modify or revoke and reissue this permit. A modification under the subparagraph may also be minor modification under 40 CFR 122.63. If this notice is not received, the transfer is effective on the date specified in the written agreement.

G9. REDUCED PRODUCTION FOR COMPLIANCE

The Permittee, in order to maintain compliance with its permit, shall control production and/or all discharges upon reduction, loss, failure, or bypass of the treatment facility until the facility is restored or an alternative method of treatment is provided. This requirement applies in the situation where, among other things, the primary source of power of the treatment facility is reduced, lost, or fails.

G10. REMOVED SUBSTANCES

Collected screenings, grit, solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters shall not be resuspended or reintroduced to the final effluent stream for discharge to state waters.

G11. DUTY TO PROVIDE INFORMATION

The Permittee shall submit to the Department, within a reasonable time, all information which the Department may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit or to determine compliance with this permit. The Permittee shall also submit to the Department upon request, copies of records required to be kept by this permit.

G12. OTHER REQUIREMENTS OF 40 CFR

All other requirements of 40 CFR 122.41 and 122.42 are incorporated in this permit by reference.

G13. ADDITIONAL MONITORING

The Department may establish specific monitoring requirements in addition to those contained in this permit by administrative order or permit modification.

G14. PAYMENT OF FEES

The Permittee shall submit payment of fees associated with this permit as assessed by the Department.

G15. PENALTIES FOR VIOLATING PERMIT CONDITIONS

Any person who is found guilty of willfully violating the terms and conditions of this permit shall be deemed guilty of a crime, and upon conviction thereof shall be punished by a fine of up to ten thousand dollars ($10,000) and costs of prosecution, or by imprisonment in the discretion of the court. Each day upon which a willful violation occurs may be deemed a separate and additional violation.

Any person who violates the terms and conditions of a waste discharge permit shall incur, in addition to any other penalty as provided by law, a civil penalty in the amount of up to ten thousand dollars ($10,000) for every such violation. Each and every such violation shall be a separate and distinct offense, and in case of a continuing violation, every day's continuance shall be deemed to be a separate and distinct violation.

G16. UPSET

Definition – “Upset” means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limitations because of factors beyond the reasonable control of the Permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

An upset constitutes an affirmative defense to an action brought for noncompliance with such technology-based permit effluent limitations if the requirements of the following paragraph are met.

A Permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs or other relevant evidence that: 1) an upset occurred and that the Permittee can identify the cause(s) of the upset; 2) the permitted facility was being properly operated at the time of the upset; 3) the Permittee submitted notice of the upset as required in condition S3 and 4) the Permittee complied with any remedial measures required under S4 of this permit.

In any enforcement proceeding the Permittee seeking to establish the occurrence of an upset has the burden of proof.

G17. PROPERTY RIGHTS

This permit does not convey any property rights of any sort, or any exclusive privilege.

G18. DUTY TO COMPLY

The Permittee shall comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Clean Water Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or denial of a permit renewal application.

G19. TOXIC POLLUTANTS

The Permittee shall comply with effluent standards or prohibitions established under Section 307(a) of the Clean Water Act for toxic pollutants within the time provided in the regulations that establish those standards or prohibitions, even if this permit has not yet been modified to incorporate the requirement.

G20. PENALTIES FOR TAMPERING

The Clean Water Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained under this permit shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than two years per violation, or by both. If a conviction of a person is for a violation committed after a first conviction of such person under this Condition, punishment shall be a fine of not more than $20,000 per day of violation, or by imprisonment of not more than four (4) years, or by both.

G21. REPORTING ANTICIPATED NON-COMPLIANCE

The Permittee shall give advance notice to the Department by submission of a new application or supplement thereto at least one hundred and eighty (180) days prior to commencement of such discharges, of any facility expansions, production increases, or other planned changes, such as process modifications, in the permitted facility or activity which may result in noncompliance with permit limits or conditions. Any maintenance of facilities, which might necessitate unavoidable interruption of operation and degradation of effluent quality, shall be scheduled during non-critical water quality periods and carried out in a manner approved by the Department.

G22. REPORTING OTHER INFORMATION

Where the Permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or in any report to the Department, it shall promptly submit such facts or information.

G23. COMPLIANCE SCHEDULES

Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this permit shall be submitted no later than fourteen (14) days following each schedule date.

APPENDIX C

GHPA – Marine Sediment Test Bore
HPA – Fresh Water Sediment Boring / Geotechnical Survey
HPA – General Permits Map 2006
HPA – Beaver Dam Removal
HPA – Channelized Stream Maintenance
HPA - Culvert Maintenance
HPA – Debris Removal Relocation
HPA – Maintenance Exist Fishway
HPA – State Bridge and Ferry Terminal Maintenance
NPDES – Waste Discharge 0039039
Paint Prep Bridge Guidance
Bridge Maintenance Washing and Cleaning
Unified Bridge Ferry Maintenance

H)RAULIC PROJECT APPRO')L

RCW 77.55.100 - appeal pursuant to Chapter 34.05 RCW

State of Washington
Department of Fish and Wildlife
Habitat Program
600 Capitol Way North, MS 3155
Olympia, Washington 98501-1091

RECEIVED
MAR 1 0 2004
ENVIRONMENTAL AFFAIRS

DATE OF ISSUE: March 10, 2004 **LOG NUMBER:** GH-D9469-01

At the request of Gregor Myhr dated January 28, 2004 per JARPA, assigned WDFW Log No. JP-D9469-00, this Hydraulic Project Approval (HPA) changes and replaces all previous HPAs for this project.

PERMITTEE	AUTHORIZED AGENT OR CONTRACTOR
Washington Department of Transportation (Environmental Services) ATTENTION: Gregor Myhr 310 Maple Park Avenue SE - PO Box 47331 Olympia, WA 98504-7300 (360) 705-7487	Not Applicable

PROJECT DESCRIPTION: Marine sediment test boring. {Scientific instruments, Pending, Temporary, Moveable, Buried below bed, Natural, Earth, Sand/Gravel}

PROJECT LOCATION: All Washington State Department of Transportation (WSDOT) ferry terminals and bridge locations over marine waters (enclosed list).

#	WRIA	WATER BODY	TRIBUTARY TO	1/4 SEC.	SEC.	TOWNSHIP	RANGE	COUNTY
1	Various	All Marine Waters	Various	N/A	N/A	N/A	N/A	Various

NOTE: This Hydraulic Project Approval (HPA) pertains only to the provisions of the Washington State Fish and Wildlife Codes. It is the permittee's responsibility to apply for and obtain any additional authorization from other public agencies (local, state, and/or federal) that may be necessary for this project. Compliance with this HPA does not ensure compliance with the Federal Endangered Species Act (ESA) or any other local, state or federal laws. See the most current Memorandum of Agreement between Washington Department of Fish and Wildlife (WDFW) and WSDOT for guidance on procedures for emergencies, maintenance, and dispute resolution.

PROVISIONS

1. **TIMING LIMITATIONS:** The project may begin **Immediately** and shall be completed by **February 15, 2009**.

   a. Inter-tidal and sub-tidal sampling work shall not occur from **February 15** through **August 15** of the authorized period for the protection of migrating juvenile salmonids provided: Sub-tidal Augured Sample Boring using the rotary method completely containing drilling muds and other products is allowed year around.
   b. Inter-tidal Grab Sampling is allowed year around below + 2 feet in reference to MLLW tidal datum.
   c. Inter-tidal Grab Sampling and Augured Sample Boring using the rotary method, completely containing drilling muds and other products, may be acceptable above this tidal datum during the authorized period

Washington Department of FISH and WILDLIFE

State of Washington
Department of Fish and Wildlife
Habitat Program
600 Capitol Way North, MS 3155
Olympia, Washington 98501-1091

DATE OF ISSUE: March 10, 2004 **LOG NUMBER:** GH-D9469-01

provided: A WDFW representative confirms lack of fish spawn and spawning activity during a site inspection. Arrangements for a site inspection shall be made with the Area Habitat Biologist (AHB, enclosed list). Work shall commence within 48 hours of notification by WDFW and shall be completed with in seven days of project commencement.

2. PLANS: Work shall be accomplished per plans and specifications described in the above referenced JARPA and submitted to the WDFW, except as modified by this HPA. These plans reflect design criteria per Chapter 220-110 WAC. These plans reflect mitigation procedures to significantly reduce or eliminate impacts to fish resources. A copy of these plans shall be available on site during construction.

3. NOTIFICATION: The Regional Habitat Program Manager (RHPM), at the local regional office in the attached list of WDFW regional offices, shall be notified (telephone and fax or in-person and letter) at least five (5) days prior to the start of project activities. The notification shall include:
   a. The permittee's name, contact person and telephone number.
   b. The control number of this HPA.
   c. Project location, including water body name, local description, latitude, longitude.
   d. Starting date for work and estimated ending date for project activity.

4. ANNUAL REPORTING: WSDOT shall submit to the Habitat Program, 600 Capital Way N., Olympia, WA 98501, annual reports of Marine Sediment Test Boring Survey Projects performed with this HPA by February 1 of each year. An annual report is also required if no work was conducted. At any time if problems are experienced with implementation of this HPA, either the permittee or WDFW may request a joint review meeting. Annual reports shall include:
   a. General: Reporting agency, contact person, address, telephone number, date period of report.
   b. Summary: The HPA control number, total number of individual projects by region and statewide.
   c. Problems encountered: Provision violation, notification, corrective action, impacts to fish life and water quality resulting from the problem. If the Environmental Compliance Assurance Procedure (ECAP) was used report what activity triggered the procedure.
   d. Recommendations for improvement to BMPs and mitigation [optional].
   e. List of individual projects completed: By region including water body name, facility name, road number and milepost, latitude and longitude, date and duration of work. Report all attempted and completed borings and grab sample locations in reference to the MLLW tidal datum.

5. HAZARDOUS SPILL AND EROSION CONTROL: As stated in the above referenced JARPA, and agreed to by WSDOT, hazardous spill and erosion control prevention shall comply with the most recent version of the Water Quality Implementing Agreement (WQIA) between WSDOT and the Washington Department of Ecology (Ecology).

6. FISH KILL/ WATER QUALITY PROBLEM NOTIFICATION: If at any time, as a result of project activities, fish are observed in distress or a fish kill occurs, or water quality problems develop, immediate notification shall be made to the Regional Office of Ecology in Lacey (360- 407-6300) for the southwest region, or the Regional Office of Ecology in Bellevue (425- 649-7000) for the northwest region.

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SAMPLING ACTIVITIES

7. No other excavation or fill work is authorized by this HPA.

8. A casing or other water isolation device shall be used to contain the boring operation and prevent water entry of all associated sediments and other materials, such as the water slurry used for drill lubrication and bentonite used to seal the boring hole after data has been recorded and sampled. The discharge of turbid or slurry laden process water to state waters is not authorized by this HPA.

9. After geotechnical information has been logged the borehole and substrate surface shall be restored to pre-project configuration.

10. All waste material such as drill spoils and cuttings, construction debris, silt, excess dirt, excess gravel, or overburden resulting from this project shall be deposited above the limits of flood water in an upland disposal site that has appropriate regulatory approval.

11. Intertidal wetland vascular plants and intertidal and sub-tidal eelgrass, macro algae or kelp shall not be adversely impacted due to project activities (e.g., temporary floating work platform shall not ground, anchors shall not be set, equipment shall not operate, and other activities shall not occur in intertidal wetland vascular plants, intertidal and sub-tidal eelgrass, macro algae or kelp.

EQUIPMENT

12. This HPA authorizes only Augured Sample Boring from a temporary floating work platform and "Clam Shell" Grab Sampling as described in the JARPA dated January 28, 2004. Any other work, including Vibracore or Mudmole Sediment Sampling, requires a separate HPA from WDFW.

13. No geared mechanisms (tires, tracks) shall enter the wetted perimeter. Truck mounted and tracked drilling equipment shall work from a location outside of the wetted perimeter unless working off a temporary floating work platform.

14. The drilling water recycle system shall be self-contained, operated, and maintained such that recycle water does not enter waters of the state.

15. Anchors shall be set and retrieved vertically, anchor cable tension shall be maintained such that anchor cables do not drag.

16. All containers storing lubricants, petroleum products or other deleterious substances on the temporary work platform shall be secured during sampling operations to prevent incidental spills.

17. Drilling equipment shall be checked daily for leaks and be well-maintained and kept in good repair and shall prevent the loss of lubricants, grease, and any other deleterious materials from entering the state waters.

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18. No disturbance to the shoreline shall occur when placing, using, or removing a temporary floating work platform.

19. No temporary floating work platform anchoring or grounding shall occur that would disturb eelgrass, kelp, macro algae or intertidal wetland vascular plants.

SEPA: Exempt, no other non-exempt permits

APPLICATION ACCEPTED: February 19, 2004 **ENFORCEMENT OFFICER:** Captains Region 4 & 6 [P3]

Craig Olds (360) 902-2540 Habitat Program		**for Director** **WDFW**

Enclosure(s): Area Habitat Biologists
Washington State Ferries Terminal Information
WSDOT Marine Water Bridge Crossings

cc/enc: Sasha Visconty, Washington State Ferries
David Molenaar, Region 6
Chris Byrnes, Region 6
Key McMurry, Region 6
Doug Thompson, Region 4
Randi Thurston, Region 6
Bob Burkle, Region 6
Theresa Powell, Region 6
David Brock, Region 4
Larry Fisher, Region 4
Margie Schirato, Region 6
Brian Williams, Region 4
Pam Erstad Region 4

GENERAL PROVISIONS

This Hydraulic Project Approval (HPA) pertains only to the provisions of the Fisheries Code (RCW 77.55 - formerly RCW 75.20). Additional authorization from other public agencies may be necessary for this project.

State of Washington
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This HPA shall be available on the job site at all times and all its provisions followed by the permittee and operator(s) performing the work.

This HPA does not authorize trespass.

The person(s) to whom this HPA is issued may be held liable for any loss or damage to fish life or fish habitat which results from failure to comply with the provisions of this HPA.

Failure to comply with the provisions of this Hydraulic Project Approval could result in a civil penalty of up to one hundred dollars per day or a gross misdemeanor charge, possibly punishable by fine and/or imprisonment.

All HPAs issued pursuant to RCW 77.55.100 or 77.55.200 are subject to additional restrictions, conditions or revocation if the Department of Fish and Wildlife determines that new biological or physical information indicates the need for such action. The permittee has the right pursuant to Chapter 34.04 RCW to appeal such decisions. All HPAs issued pursuant to RCW 77.55.110 may be modified by the Department of Fish and Wildlife due to changed conditions after consultation with the permittee: PROVIDED HOWEVER, that such modifications shall be subject to appeal to the Hydraulic Appeals Board established in RCW 77.55.170.

APPEALS - GENERAL INFORMATION

IF YOU WISH TO APPEAL A DENIAL OF OR CONDITIONS PROVIDED IN A HYDRAULIC PROJECT APPROVAL, THERE ARE INFORMAL AND FORMAL APPEAL PROCESSES AVAILABLE.

A. INFORMAL APPEALS (WAC 220-110-340) OF DEPARTMENT ACTIONS TAKEN PURSUANT TO RCW 77.55.100, 77.55.110, 77.55.140, 77.55.190, 77.55.200, and 77.55.290:
A person who is aggrieved or adversely affected by the following Department actions may request an informal review of:
   (A) The denial or issuance of a HPA, or the conditions or provisions made part of a HPA; or
   (B) An order imposing civil penalties.
It is recommended that an aggrieved party contact the Area Habitat Biologist and discuss the concerns. Most problems are resolved at this level, but if not, you may elevate your concerns to his/her supervisor. A request for an INFORMAL REVIEW shall be in WRITING to the Department of Fish and Wildlife, 600 Capitol Way North, Olympia, Washington 98501-1091 and shall be RECEIVED by the Department within 30-days of the denial or issuance of a HPA or receipt of an order imposing civil penalties. The 30-day time requirement may be stayed by the Department if negotiations are occurring between the aggrieved party and the Area Habitat Biologist and/or his/her supervisor. The Habitat Protection Services Division Manager or his/her designee shall conduct a review and recommend a decision to the Director or its designee. If you are not satisfied with the results of this informal appeal, a formal appeal may be filed.

B. FORMAL APPEALS (WAC 220-110-350) OF DEPARTMENT ACTIONS TAKEN PURSUANT TO RCW 77.55.100 OR 77.55.140:

State of Washington
Department of Fish and Wildlife
Habitat Program
600 Capitol Way North, MS 3155
Olympia, Washington 98501-1091

DATE OF ISSUE: March 10, 2004 **LOG NUMBER:** GH-D9469-01

A person who is aggrieved or adversely affected by the following Department actions may request an formal review of:

(A) The denial or issuance of a HPA, or the conditions or provisions made part of a HPA;
(B) An order imposing civil penalties; or
(C) Any other "agency action" for which an adjudicative proceeding is required under the Administrative Procedure Act, Chapter 34.05 RCW.

A request for a FORMAL APPEAL shall be in WRITING to the Department of Fish and Wildlife, 600 Capitol Way North, Olympia, Washington 98501-1091, shall be plainly labeled as "REQUEST FOR FORMAL APPEAL" and shall be RECEIVED DURING OFFICE HOURS by the Department within 30-days of the Department action that is being challenged. The time period for requesting a formal appeal is suspended during consideration of a timely informal appeal. If there has been an informal appeal, the deadline for requesting a formal appeal shall be within 30-days of the date of the Department's written decision in response to the informal appeal.

C. FORMAL APPEALS OF DEPARTMENT ACTIONS TAKEN PURSUANT TO RCW 77.55.110, 77.55.200, 77.55.230, or 77.55.290:
A person who is aggrieved or adversely affected by the denial or issuance of a HPA, or the conditions or provisions made part of a HPA may request a formal appeal. The request for FORMAL APPEAL shall be in WRITING to the Hydraulic Appeals Board per WAC 259-04 at Environmental Hearings Office, 4224 Sixth Avenue SE, Building Two - Rowe Six, Lacey, Washington 98504; telephone 360/459-6327.

D. FORMAL APPEALS OF DEPARTMENT ACTIONS TAKEN PURSUANT TO CHAPTER 393, LAWS OF 2003:
A person who is aggrieved or adversely affected by the denial or issuance of a HPA, or the conditions or provisions made part of a HPA may request a formal appeal. The FORMAL APPEAL shall be in accordance with the provisions of Chapter 393. The request for FORMAL APPEAL shall be in WRITING to the Environmental and Land Use Hearings Board.

E. FAILURE TO APPEAL WITHIN THE REQUIRED TIME PERIODS RESULTS IN FORFEITURE OF ALL APPEAL RIGHTS. IF THERE IS NO TIMELY REQUEST FOR AN APPEAL, THE DEPARTMENT ACTION SHALL BE FINAL AND UNAPPEALABLE.

Table 1. Washington State Ferries Terminal Information

Terminal/County	Section, Township, Range	Latitude and Longitude (if known)	Waterbody	Shoreline Designation/ Zoning Designation	WRIA
Anacortes/Skagit County	22, 35 N, 01E	48° 30' 26" N;122° 40' 30" W	Guemes Channel	Urban II/ Commercial Marine	03 MARI
Bainbridge/Kitsap County	26, 25 N, 02E	47° 37' 21" N; 122° 30" W	Eagle Harbor	Ferry Terminal District/ Ferry Terminal District	15 MARI
Bremerton/Kitsap County	24, 24N, 01E	47° 33' 44" N; 122° 37' 23" W	Sinclair Inlet	Downtown Waterfront Upland/ Urban Renewal District	15 MARI
Clinton/Island County	30, 29N, 04E	47° 58' 30" N;122° 21' 11" W	Possession Sound	Urban/ State Highway Right of Way	06 MARI
Eagle Harbor/Kitsap County	26, 25N, 02E	47° 37' 16" N; 122° 30' 47" W	Eagle Harbor	Urban Environment/ Ferry Terminal District	15 MARI
Edmonds/Snohomish County	23, 27N, 03E	47° 48' 47"N; 122° 23' 04" W	Possession Sound	Urban Marine/ Ferry Right of Way	08 MARI
Fauntleroy/King County	35, 24 N, 03E	47°31'24"N; 122°23'37" W	Fauntleroy Cove	Urban Residential/SF	09 MARI
Friday Harbor/San Juan County	13, 35N, 03W	48° 32' 10" N; 123° 00' 50" W	San Juan Channel	Urban/Commercial	02 MARI
Keystone/Island County	22, 31N, 01E	48° 09' 33" N; 122° 40' 14" W	Admiralty Inlet	Urban/Park	06 MARI
Kingston/Kitsap County	25, 27N, 02E	47• 47' 36" N; 122• 24' 44 W	Appletree Cove	Urban/ Public Facility	15 MARI
Lopez/San Juan County	36, 36N, 02W	48° 34' 13" N; 122° 51' 35" W	Harney Channel	Conservancy/ Rural General	02 MARI
Mukilteo/Snohomish County	04, 28N, 04E	47° 57; 00" N; 122° 18' 12" W	Possession Sound	Downtown Business/ Downtown Business	08 MARI
Orcas/ San Juan County	22, 36N, 02W	48° 35' 51" N; 122° 56' 33" W	Harney Channel	Urban/Village	02 MARI
Point Defiance/Pierce County	14, 21N, 02E	47° 18' 22" N; 122° 30' 46" W	Dalco Passage	Conservancy/S-5	12 MARI
Port Townsend/Jefferson County	11, 30N, 01W	48° 06' 50" N; 122° 45' 62" W	Port Townsend Bay	Urban/Aquatic Designation/no zoning designation	17 MARI
Seattle/King County	06, 24N, 04E	47° 36' 9" N; 122° 20' 17" W	Elliot Bay	Urban Harborfront (UH)/DH1/45	08 MARI
Shaw/San Juan County	27, 36N, 02W	48° 35' 87" N; 122° 55' 40" W	Harney Channel	Rural/Rural Farm Forest	02 MARI
Southworth/Kitsap County	01, 23 N, 02E	47°30'46" N; 122°29'42" W	Colvos Passage	Rural/Residential Rural	15 MARI
Tahlequah/King County	02, 21N, 02E	47° 20' 2" N; 122° 30' 29" W	Dalco Passage	Rural/RA 2.5	15 MARI
Vashon/King County	06, 23 N, 03E	47° 30' 32" N; 122° 27' 46" W	Admiralty Inlet	Conservancy/RA-5	15 MARI

Table 2. WSDOT Salt and Brackish Water Bridge Crossings

Bridge Name	County/WRIA	WRIAs in County
Creek	Clallum	17, 18, 19, 20
W TWIN R		
BULLMAN CR.		
SEKIU RIVER BR.		
WISHKAH R. HERON	Grays Harbor	22, 23
WRECK CR.		
HOQUIAM R-SIMPSON		
WISHKAH R.		
CHAPIN CR		
STAFFORD CR		
INDIAN CR		
CAMPBELL CR		
MILL CR		
JESSIE SL		
COPALIS R		
JOHNS R		
JOE CR		
CHEHALIS R.		
NEWSKAH CR		
SOUTH BAY - ELK RIVER		
GILLIS SL		
HUMPTULIPS R		
CONNER CR		
MOCLIPS R		
GRASS CR		
CHENOIS CR		
LITTLE HOQUIAM R		
HOQUIAM R-RIVERSIDE		
FULTON CR	Jefferson County	16, 17, 18, 19, 20
KALALOCH CR		
DUCKABUSH SL		
SNOW CR		
HOOD CANAL-W.A. BUGGE BR		
PORTAGE CANAL		
LAKE WASH SHIP CANAL		
DUWAMISH RIVER	King	8, 9, 10
WETLAND MIT. CHANNEL		
MANETTE BRIDGE	Kitsap County	15
AGATE PASS		
BLACKJACK CR		
PORT WASHINGTON		
HOOD CANAL-W.A. BUGGE BR		
DOGFISH BAY BR		
GORST CREEK BRIDGE		
GORST CREEK		
N HAMMA HAMMA R	Mason County	14, 16, 22
S HAMMA HAMMA R		
LILLIWAUP R		
CUSHMAN PROJECT		
EAGLE CR		
SHERWOOD CR		
COULTER CR		

KENNEDY CR		
KENNEDY CR		
WAKETICKEH CRK		
JORSTED CREEK BRIDGE		
CHINOOK R	Pacific	22, 23, 25
GREENHEAD SL		
TEAL SL		
BONE R		
JORGENSON SL		
TIDE SL		
BEAR R		
SMITH CR		
NORTH R		
COLUMBIA R MEGLER		
COLUMBIA R - MEGLER (A)		
COLUMBIA R - MEGLER (B)		
COLUMBIA R - MEGLER (C)		
S FK WILLAPA RIVER		
STUART SL		
CARRUTHERS SL		
POTTERS SL		
WALLICUT R		
WALLICUT R		
WALLICUT R		
SKIDMORE SLOUGH		
NASELLE RIVER		
PALIX R.		
NIAWIAKUM RIVER		
NORTH FORK WILLAPA RIVER		
NORTH NEMAH RIVER		
CREEK		
CREEK		
DRAINAGE RELIEF CULV		
PURDY BR	Pierce County	11, 12, 13
TACOMA NARROWS		
MURRAY MORGAN BR		
PUYALLUP R RR SR 167 OC		
BN RR OC (GN) BLANCHARD	Skagit County	3, 4
CANOE PASS		
HIGGENS SLOUGH		
GAGES SLOUGH		
GAGES SLOUGH		
BATEY SL		
SWINOMISH-D BERENTSON BR		
SWINOMISH-D BERENTSON BR		
SNOHOMISH R CS3114	Snohomish	7
UNION SL		
STEAMBOAT SL CS3115		
EBEY SLOUGH CS3116		
DAVIS SL		
GEN MARK W. CLARK MEM BR		
EBEY SL BN RY SR 529		
SNOHOMISH R		
STEAMBOAT SL		
UNION SL		

EBEY SLOUGH BRIDGE		
EBEY-W RAMP AL RAMP		
W-EBEY RAMP DL RAMP		
UNION SLOUGH		
UNION SLOUGH		
STEAMBOAT SLOUGH		
STEAMBOAT SLOUGH		
SNOHOMISH R BN RR		
SNOHOMISH R BN RR		
SNOHOMISH RIVER BRIDGE		
EBEY ISLAND VIADUCT		
HOME ACRES RD		
EBEY SL BN RY SR 529		
EBEY SLOUGH BRIDGE		
HA LINE OVER DEADWATER		
DEADWATER SL BR		
EBEY SLOUGH		
QUILCEDA CREEK		
SNOHOMISH RIVER		
EBEY ISLAND VIADUCT		
E-S RAMP		
CAPITOL LAKE	Thurston	11, 13, 14, 22, 23
MUD BAY		
MUD BAY		
PERRY CR		
PERRY CR		
MCALLISTER CR		
MCALLISTER CR		
MCALLISTER CR		
MCALLISTER CR		
JULIA BUTLER HANSEN BR	Wahkiakum	25
SKAMOKAWA CR		
BIRNIE SL		
DAKOTA CR	Whatcom	1
DAKOTA CR		
DAKOTA CR		
CALIFORNIA CR		

Washington Department of FISH and WILDLIFE

HYDRAULIC PROJECT APPROVAL

RCW 77.55.021 - Appeal pursuant to Chapter 34.05

Statewide
600 Capitol Way N
Olympia, WA 98501-1091
(360) 902-2200

Issue Date: June 20, 2008
Project Expiration Date: June 19, 2009

Control Number: 113116-1
FPA/Public Notice #: N/A

PERMITTEE	AUTHORIZED AGENT OR CONTRACTOR
Washington State Department of Transportation ATTENTION: Gregor Myhr 310 Maple Park Avenue SE Olympia, WA 98504-7003	

Project Name: Statewide Freshwater Geotechnical Survey

Project Description: Statewide Freshwater Sediment Test Boring/Geotechnical Survey to determine sub-surface condition and design parameters for proposed WSDOT projects.

PROVISIONS

1. PROJECT DESCRIPTION: This HPA authorizes only Geotechnical Survey including sediment test sampling as described in the JARPA submitted May 27, 2008. Any additional, related work shall require a separate HPA from WDFW.

2. TIMING LIMITATIONS: The project may begin Immediately and shall be completed by June 19, 2009 provided: Work shall be conducted only during the time periods specified in the attachment Allowable In-Water Work Windows for Fresh Water.

3. Except as modified by this HPA work shall be accomplished per plans and specifications submitted by WSDOT as application and accepted by WDFW (May 27, 2008) for this HPA and:

a. WSDOT Environmental Compliance Assurance Procedure (ECAP) procedures in WSDOT Construction Manual Secion1-2.2K(1).

b. Installation of the appropriate Best Management Practices (BMPs) to control erosion, sedimentation, and contain pollutants from entering the water body.

These plans (Provision 3 a and b), including this HPA, reflect the requirements of Chapter 220-110 WAC. These plans reflect mitigation procedures to avoid impacts to fish resources. A copy of these plans shall be available on site during work.

4. HAZARDOUS SPILL AND EROSION CONTROL: As stated in the submitted plan, and agreed to by WSDOT, hazardous spill and erosion control prevention shall comply with the most current version of the Water Quality Implementing Agreement (WQIA) between WSDOT and the Washington Department of Ecology (Ecology).

5. FISH KILL/ WATER QUALITY PROBLEM NOTIFICATION: If at any time, as a result of project activities, fish are observed in distress, a fish kill occurs, or water quality problems develop (including equipment leaks or spills), immediate notification shall be made to the Washington

Military Department Emergency Management Division at 1-800-258-5990, and to the WSDOT Liaison Craig Olds, 600 Capitol Way North, MS 43200, Olympia WA 98501-1091; Telephone: 360-902-2540; FAX: 360-902-2946; Email:(oldscao@dfw.wa.gov.).

6. If fish may be adversely impacted as a result of this project, the permittee is required to capture and safely move food fish, game fish or other fish life to the nearest free-flowing water.

DRILLING ACTIVITIES
7. Woody material embedded in the bank or stream bed shall be left undisturbed and intact.

8. A casing or other water isolation device/BMP shall be used to contain the boring operation and prevent water entry of all associated sediments and other materials, such as the water slurry used for drill lubrication and bentonite used to seal the boring hole after geo-technical data has been recorded and sampled. The discharge of turbid or slurry laden process water to state waters exceeding state water-quality standards is not authorized by this HPA.

9. After geotechnical information has been logged, the borehole and surface shall be restored to pre-project condition.

10. All waste material such as drill spoils and cuttings, construction debris, silt, excess dirt, excess gravel, or overburden resulting from this project shall be deposited above the limits of flood water in an upland disposal site that has appropriate regulatory approval.

11. No other excavation or fill work is authorized under this HPA.

EQUIPMENT
12. Drilling equipment shall be checked daily for leaks, be well-maintained and kept in good repair to prevent the loss of lubricants, grease, and any other deleterious materials from entering the state waters.

13. No geared mechanisms (tires, tracks) shall enter the wetted perimeter. Truck mounted and tracked drilling equipment shall work from a location outside of the wetted perimeter unless working off of a temporary floating work platform.

14. Temporary floating work platforms shall not ground on the bed of state waters.

15. Equipment, except for barges, shall be parked above the Ordinary High Water Line (OHWL) after each days construction activities to prevent leakage or accidental spills into state waters.

16. All containers storing fuel or other deleterious substances on any temporary floating work platform shall be secured to prevent incidental spills.

RIPARIAN PROTECTION
17. Care shall be used when accessing the site to minimize the disturbance of vegetation. Vegetation shall be straddled with heavy equipment and be pruned as necessary, without

damaging the roots, or low ground pressure equipment shall be used, when possible.

18. All woody plants that were on the banks or in the bed of state waters and that were removed or damaged by the work beyond their capability to regenerate shall be replaced. Replacement shall be by replanting or natural recruitment with woody plants native to the area. Woody plants shall be replaced and maintained at a ratio of at least 1:1 by the end of the first growing season after impact. If replacement plants fail, additional plantings, or natural recruitment is required prior to the next growing season to achieve and maintain at least 1:1 replacement.

19. Within seven calendar days of project completion, all disturbed areas shall be protected from erosion using vegetation or other means. Erosion control methods may include, but are not limited to filter fabric and immediate mulching of exposed areas.

20. ANNUAL REPORTING: WSDOT shall submit to the WDFW Habitat Program, address 600 Capitol Way N. Olympia, WA 98501, a calendar year annual report of work by February 28 of the following year, or in the final year of the HPA, prior to the expiration date. An annual report is also required if no work was conducted. The annual report shall include:
a. General: HPA Control Number, permittee, contact person, address, telephone number, date of report, time period.
b. Summary: Total number of individual projects by region and statewide.
c. Problem(s) encountered: Provision violation, notification, corrective action, impacts to fish life and water quality from problem. If the Environmental Compliance Assurance Procedure (ECAP) or similar procedure was used, what activity triggered the procedure.
d. Recommendations for improvement to best management practices and mitigation [optional].
e. List of individual projects completed: By region including water body name, road number and milepost if applicable, latitude and longitude, date duration of work, description of work.
f. The information contained in item "e" above (individual projects completed) shall be provided in unlocked Microsoft Excel (.xls) format.

PROJECT LOCATIONS

Location #1

WORK START: June 20, 2008					WORK END: June 19, 2009	
WRIA: 99.0000	Waterbody: Various				Tributary to: Statewide	
1/4 SEC: All	Section: 99	Township: 99	Range: 99	Latitude: N	Longitude:	County: Multi Region
Location #1 Driving Directions						

Issue Date: June 20, 2008 | Control Number: 113116-1

Project Expiration Date: June 19, 2009 | FPA/Public Notice #: N/A

APPLY TO ALL HYDRAULIC PROJECT APPROVALS

This Hydraulic Project Approval pertains only to those requirements of the Washington State Hydraulic Code, specifically Chapter 77.55 RCW (formerly RCW 77.20). Additional authorization from other public agencies may be necessary for this project. The person(s) to whom this Hydraulic Project Approval is issued is responsible for applying for and obtaining any additional authorization from other public agencies (local, state and/or federal) that may be necessary for this project.

This Hydraulic Project Approval shall be available on the job site at all times and all its provisions followed by the person(s) to whom this Hydraulic Project Approval is issued and operator(s) performing the work.

This Hydraulic Project Approval does not authorize trespass.

The person(s) to whom this Hydraulic Project Approval is issued and operator(s) performing the work may be held liable for any loss or damage to fish life or fish habitat that results from failure to comply with the provisions of this Hydraulic Project Approval.

Failure to comply with the provisions of this Hydraulic Project Approval could result in a civil penalty of up to one hundred dollars per day and/or a gross misdemeanor charge, possibly punishable by fine and/or imprisonment.

All Hydraulic Project Approvals issued pursuant to RCW 77.55.021 (EXCEPT agricultural irrigation, stock watering or bank stabilization projects) or 77.55.141 are subject to additional restrictions, conditions or revocation if the Department of Fish and Wildlife determines that new biological or physical information indicates the need for such action. The person(s) to whom this Hydraulic Project Approval is issued has the right pursuant to Chapter 34.04 RCW to appeal such decisions. All agricultural irrigation, stock watering or bank stabilization Hydraulic Project Approvals issued pursuant to RCW 77.55.021 may be modified by the Department of Fish and Wildlife due to changed conditions after consultation with the person(s) to whom this Hydraulic Project Approval is issued: PROVIDED HOWEVER, that such modifications shall be subject to appeal to the Hydraulic Appeals Board established in RCW 77.55.301.

APPEALS INFORMATION

If you wish to appeal the issuance or denial of, or conditions provided in a Hydraulic Project Approval, there are informal and formal appeal processes available.

A. INFORMAL APPEALS (WAC 220-110-340) OF DEPARTMENT ACTIONS TAKEN PURSUANT TO RCW 77.55.021, 77.55.141, 77.55.181, and 77.55.291: A person who is aggrieved or adversely affected by the following Department actions may request an informal review of:

(A) The denial or issuance of a Hydraulic Project Approval, or the conditions or provisions made part of a Hydraulic Project Approval; or

(B) An order imposing civil penalties. A request for an INFORMAL REVIEW shall be in WRITING to the Department of Fish and Wildlife HPA Appeals Coordinator, 600 Capitol Way North, Olympia, Washington 98501-1091 and shall be RECEIVED by the Department within 30 days of the denial or issuance of a Hydraulic Project Approval or receipt of an order imposing civil penalties. If agreed to by the aggrieved party, and the aggrieved party is the Hydraulic Project Approval applicant, resolution of the concerns will be facilitated through discussions with the Area Habitat Biologist and his/her supervisor. If resolution is not reached, or the aggrieved party is not the Hydraulic Project Approval applicant, the Habitat Technical Services Division Manager or his/her designee shall conduct a review and recommend a decision to the Director or his/her designee. If you are not satisfied with the results of this informal appeal, a formal appeal may be filed.

B. FORMAL APPEALS (WAC 220-110-350) OF DEPARTMENT ACTIONS TAKEN PURSUANT TO RCW 77.55.021 (EXCEPT agricultural irrigation, stock watering or bank stabilization projects) or 77.55.291:
A person who is aggrieved or adversely affected by the following Department actions may request a formal review of:

(A) The denial or issuance of a Hydraulic Project Approval, or the conditions or provisions made part of a Hydraulic

Project Approval;
(B) An order imposing civil penalties; or
(C) Any other 'agency action' for which an adjudicative proceeding is required under the Administrative Procedure Act, Chapter 34.05 RCW.
A request for a FORMAL APPEAL shall be in WRITING to the Department of Fish and Wildlife HPA Appeals Coordinator, shall be plainly labeled as 'REQUEST FOR FORMAL APPEAL' and shall be RECEIVED DURING OFFICE HOURS by the Department at 600 Capitol Way North, Olympia, Washington 98501-1091, within 30-days of the Department action that is being challenged. The time period for requesting a formal appeal is suspended during consideration of a timely informal appeal. If there has been an informal appeal, the deadline for requesting a formal appeal shall be within 30-days of the date of the Department's written decision in response to the informal appeal.

C. FORMAL APPEALS OF DEPARTMENT ACTIONS TAKEN PURSUANT TO RCW 77.55.021 (agricultural irrigation, stock watering or bank stabilization only), 77.55.141, 77.55.181, or 77.55.241: A person who is aggrieved or adversely affected by the denial or issuance of a Hydraulic Project Approval, or the conditions or provisions made part of a Hydraulic Project Approval may request a formal appeal. The request for FORMAL APPEAL shall be in WRITING to the Hydraulic Appeals Board per WAC 259-04 at Environmental Hearings Office, 4224 Sixth Avenue SE, Building Two - Rowe Six, Lacey, Washington 98504; telephone 360/459-6327.

D. FORMAL APPEALS OF DEPARTMENT ACTIONS TAKEN PURSUANT TO CHAPTER 43.21L RCW: A person who is aggrieved or adversely affected by the denial or issuance of a Hydraulic Project Approval, or the conditions or provisions made part of a Hydraulic Project Approval may request a formal appeal. The FORMAL APPEAL shall be in accordance with the provisions of Chapter 43.21L RCW and Chapter 199-08 WAC. The request for FORMAL APPEAL shall be in WRITING to the Environmental and Land Use Hearings Board at Environmental Hearings Office, Environmental and Land Use Hearings Board, 4224 Sixth Avenue SE, Building Two - Rowe Six, P.O. Box 40903, Lacey, Washington 98504; telephone 360/459-6327.

E. FAILURE TO APPEAL WITHIN THE REQUIRED TIME PERIODS results in forfeiture of all appeal rights. If there is no timely request for an appeal, the department action shall be final and unappealable.

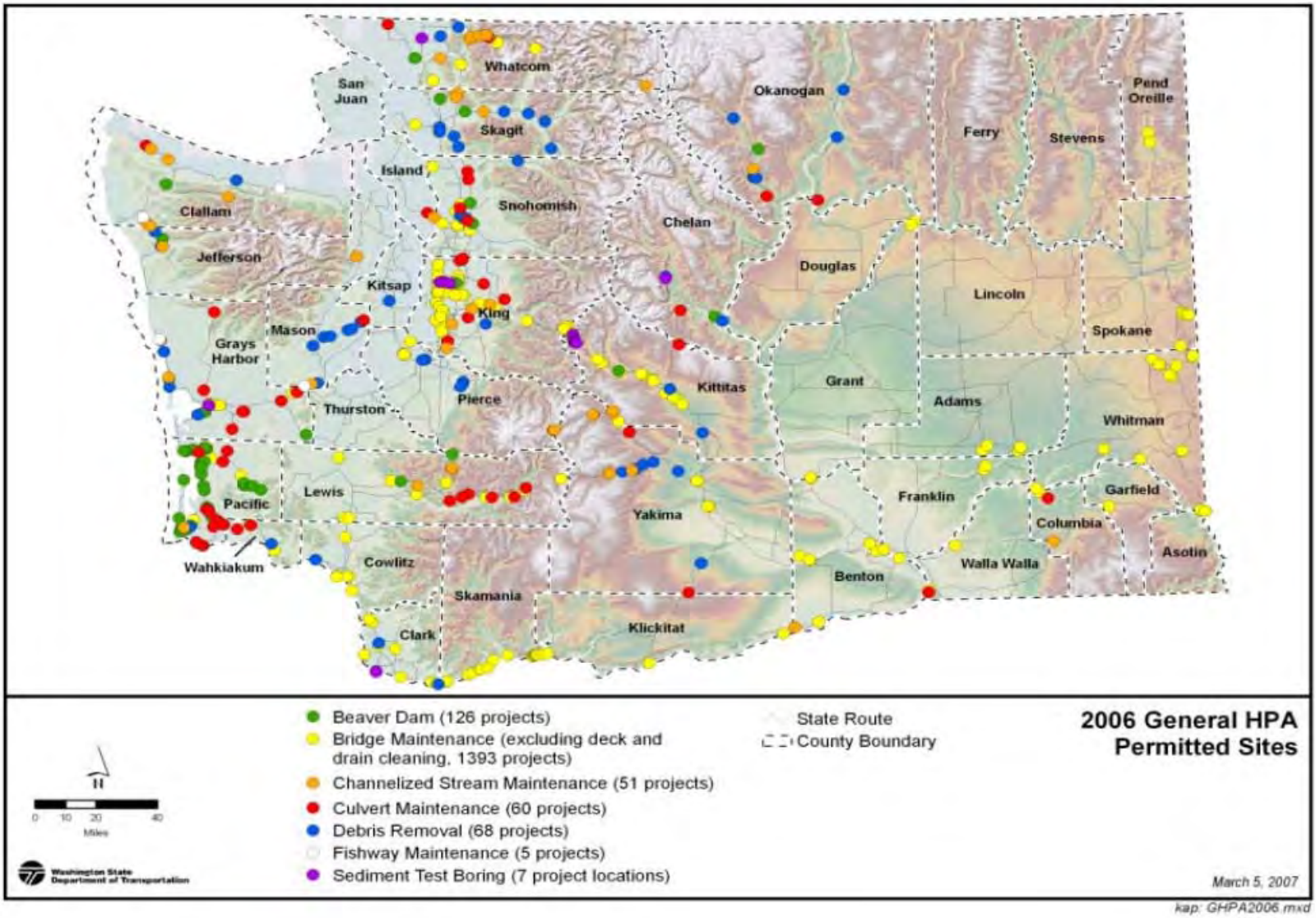
ENFORCEMENT: Sergeant Charron (43) P3

Habitat Biologist Craig Olds	360-902-2540		for Director WDFW

CC: E-Mail with Attachments:
All Area Habitat Biologists, WDFW
All Regional Habitat Program Managers, WDFW
All Assistant Regional Habitat Program Managers, WDFW
All Regulatory Services, WDFW
All Regional Enforcement Sergeants, WDFW
Ken Schlatter, WSDOT, Olympia

Attachments:
Fresh Water Work Windows
WDFW Area Habitat Biologist Contact Information

Appendix C. General Hydraulic Permit Application sites, 2006. From http://www.wsdot.wa.gov/NR/rdonlyres/A0F9DF4D-83E8-4E88-AACE-2C6C476C349C/0/GHPA2006.pdf



Washington Department of FISH and WILDLIFE

HYDRAULIC PROJECT APPROVAL

RCW 77.55.021 - Appeal pursuant to Chapter 34.05 RCW

Statewide
600 Capitol Way N
Olympia, WA 98501-1091
(360) 902-2200

Issue Date: September 25, 2007
Project Expiration Date: August 25, 2008

Control Number: 00000D9450-3
FPA/Public Notice #: N/A

PERMITTEE	AUTHORIZED AGENT OR CONTRACTOR
Washington State Department of Transportation ATTENTION: Gregor Myhr 310 Maple Park Drive SE Olympia, WA 98504 360-705-7487	

Project Name: Beaver dam removal or modification

Project Description: Removal or modification of beaver dams and associated debris one year or less old from within streams, rivers, and WSDOT owned and maintained "manufactured drainage systems."

PROVISIONS

1. PROJECT DESCRIPTION: This HPA only authorizes removal or modification of newly constructed beaver dams and associated beaver dam materials from within WSDOT owned and maintained, 'manufactured drainage systems' provided:

a. The beaver dam has been in existence for one year or less, and

b. A 'manufactured drainage system,' for the purposes of this HPA, is defined as a culvert, including a maximum of 25 feet immediately up stream of its inlet or down stream of its outlet; bridge piers; or created storm water detention/retention facility that is located within a natural watercourse or a natural watercourse that has been altered by humans, and

c. The continued existence of the beaver dam poses an imminent danger as defined in RCW 77.55.011(8) to the integrity of WSDOT owned and maintained manufactured drainage systems.

2. TIMING LIMITATIONS: This five-year HPA may begin Immediately and is valid through August 25, 2008, provided:

a. Whenever possible, projects shall be conducted only during the time periods specified in the attachment Allowable Work Windows for Fresh Water, and

b. Work shall be conducted during low stream flow conditions.

3. NOTIFICATION PRIOR TO WORK START: The permittee or contractor shall notify the WDFW Regional Habitat Program Manager (RHPM) in the attached list of WDFW regional offices prior to starting work. Notification may be by email, facsimile (FAX), telephone, or in person. If notification is by e-mail, the AHB (if known), and the WSDOT Liaison (oldscao@dfw.wa.gov) should also be notified. Notification shall include:
a. Agency name, contact person, and telephone number.
b. Water body name.

c. Work location including road number and milepost if applicable, or comparable site location information.
d. Starting date and estimated ending date for work.
e. Control Number for the Hydraulic Project Approval.

4. ANNUAL REPORTING: WSDOT shall submit to the WDFW Habitat Program, address 600 Capitol Way N. Olympia, WA 98501, a calendar year annual report of work by February 28 of the following year, or in the final year of the HPA, prior to the expiration date. An annual report is also required if no work was conducted. The annual report shall include:
a. General: HPA Control Number, permittee, contact person, address, telephone number, date of report, time period.
b. Summary: Total number of individual projects by region and statewide.
c. Problem(s) encountered: Provision violation, notification, corrective action, impacts to fish life and water quality from problem. If the Environmental Compliance Assurance Procedure (ECAP) or similar procedure was used, what activity triggered the procedure.
d. Recommendations for improvement to best management practices and mitigation [optional].
e. List of individual projects completed: By region including water body name, road number and milepost if applicable, latitude and longitude, date duration of work, description of work.
f. The information contained in item 'e' above (individual projects completed) shall be provided in unlocked Microsoft Excel (.xls) format.

5. FISH KILL/ WATER QUALITY PROBLEM NOTIFICATION: If at any time, as a result of project activities, fish are observed in distress, a fish kill occurs, or water quality problems develop (including equipment leaks or spills), immediate action shall be made to notify Washington Military Department Emergency Management Division at 1-800-258-5990, and to the WSDOT Liaison Craig Olds, 600 Capitol Way North, MS 43200, Olympia WA 98501- 1091; Telephone: 360-902-2540; FAX: 360-902-2946; Email:(oldscao@dfw.wa.gov.).

6. HAZARDOUS SPILL AND EROSION CONTROL: As stated in the submitted plan, and agreed to by WSDOT, hazardous spill and erosion control prevention shall comply with the most current version of the Water Quality Implementing Agreement (WQIA) between WSDOT and the Washington Department of Ecology (Ecology).

7. The use of explosives is NOT authorized under this HPA.

8. If fish may be adversely impacted as a result of this project, the permittee is required to capture and safely move food fish, game fish or other fish life to the nearest free-flowing water. The permittee may request the department assist in the capturing and safely moving fish life from the job site to free-flowing water, and assistance may be granted if personnel are available.

REMOVAL OR MODIFICATION ACTIVITIES
9. Large woody material embedded in the bank streambed shall be left undisturbed and intact. If not embedded, large woody material (6 feet or longer and 12 inches or greater in diameter) must be repositioned:

a. Large woody material shall be placed within the Ordinary High Water Line (OHWL) to provide stable, functional fish habitat, and

b. If anchoring repositioned material is necessary, only non-invasive streambed or stream bank anchoring techniques, such as pinning with rebar, are allowed under this HPA. Streambed or stream bank excavation is not authorized and shall require a separate written HPA.

10. With prior approval by the AHB, large woody materials may be allowed to float downstream, provided streambed/bank conditions do not obstruct the material passage for a minimum of 200 feet downstream from the removal activity.

11. Large woody material that is not positioned within the channel downstream of the structure (i.e. in back eddies or in areas where bank erosion is occurring) or released to float downstream, shall upon PRIOR consultation with the local AHB, be removed from the channel and be:

a. Set aside in a secure location for use in future fish habitat/restoration projects by WSDOT or other agencies/groups, or

b. Disposed of away from the watercourse so that it will not reenter state waters.

12. Where chronic maintenance problems exist, these sites shall be referred to the Chronic Environmental Deficiency program (CED), per MOA between WSDOT and WDFW, dated June 26, 2002. The local AHB shall be provided with a current list of these problem structures either during the annual review or earlier. WSDOT should contact the local AHB to discuss alternative solutions (i.e., trapping and relocation, beaver deceiver devices) that would avoid the need for repeated work in the water.

EQUIPMENT

13. Removal of the beaver dam shall be accomplished by hand or with hand tools, such as chain saws and vehicle winches. Winches may be used to dislodge some of the material, provided siltation to the downstream areas can be held to a minimum and impacts to fish life avoided.

14. If large equipment is needed to remove the dam:

a. It must be stationed on the bank, road or bridge, and

b. The beaver dam shall be removed gradually to provide for a controlled, slow release of impounded water. Slowly, removing portions of the material and allowing the water level to go down slowly, before removing additional portions of the material, may accomplish this.

15. Equipment crossing of the stream are not authorized by this HPA.

RIPARIAN PROTECTION

16. Measures shall be used to prevent damage to the vegetation in the riparian (streamside or shoreline) area located within 200 feet perpendicular to the water and adjacent to the structure.

Existing parking lots and open managed fields and lots located within 200 feet of the riparian areas may be used for staging work.

17. Within seven calendar days of the project completion, all disturbed areas shall be protected from erosion using vegetation or other means. Erosion control methods may include, but are not limited to filter fabric and immediate mulching of exposed areas. The use of riprap or concrete/grout is NOT authorized by this HPA.

18. Disturbance of the streambed and banks and associated wetlands and buffer vegetation shall be limited to that necessary to perform the project. Disturbed streambed and bank and wetland and buffer vegetation areas shall be restored to pre-project or improved habitat configuration. Prior to the beginning of the first growing season (March 1), the disturbed buffer areas shall have been re-vegetated with native species approved by WDFW. Vegetative cuttings shall be planted at a maximum interval of three feet (on center). Plantings shall be maintained as necessary for three years to ensure 80 percent or greater survival.

NOTES

This Hydraulic Project Approval (HPA) supercedes and modifies the previous version GH-D9450-02 by changing the provisions for notification prior to work start, annual reporting, and fish kill/water quality problem notification.

This HPA pertains only to the provisions of the Washington State Fisheries and Wildlife Codes. It is the permittee's responsibility to apply for and obtain any additional authorization from other public agencies (local, state and/or federal) that may be necessary for this project.

Compliance with this HPA does not ensure compliance with the Federal Endangered Species Act (ESA) or any other local, state or federal laws.

See the most current Memorandum of Agreement (MOA) between Washington Department of Fish and Wildlife (WDFW) and WSDOT for guidance on procedures for emergencies, maintenance, and dispute resolution.

This HPA only authorizes removal or modification of newly constructed beaver dams and associated beaver dam materials. Removal of material/debris that is not associated with a recent beaver dam is covered under a separate HPA.

This HPA supersedes any and all General HPAs for the same type of work.

WDFW Regional Offices:
Eastern Washington - Region 1: (509) 892-1001, FAX (509) 456-4071; TeamSpokane@dfw.wa.gov.
North Central Washington - Region 2: (509) 754-4624, FAX (509) 754-5257; TeamEphrata@dfw.wa.gov.
South Central Washington - Region 3: (509) 575-2740, FAX (509) 575-2474.

North Puget Sound - Region 4: (425) 775-1311, FAX (425) 338-1066; TeamMillCreek@dfw.wa.gov.
Southwest Washington - Region 5: (360) 696-6211, FAX (360) 906-6776; TeamVancouver@dfw.wa.gov.
Coastal Washington - Region 6: (360) 249-4628, FAX (360) 664-0689; TeamMontesano@dfw.wa.gov.

After hours/weekend WDFW statewide hotline: (360) 902-2537.

WDFW REGIONAL HABITAT PROGRAM MANAGERS:
Region 1: Asotin, Columbia, Ferry, Garfield, Lincoln, Pend Oreille, Spokane, Stevens, Walla Walla, Whitman: Mark Wachtel; wachtmlw@dfw.wa.gov.; WDFW, Region 1, 2315 N Discovery PL Spokane, WA. 99216-1566; (509) 892-7860 Ext. 320.

Region 2: Adams, Chelan, Douglas, Grant, Okanogan: Christine Parsons, parsocbp@dfw.wa.gov.; WDFW, Region 2, 1550 Alder ST NW Ephrata, WA 98823-9651; (509) 754-4624.

Region 3: Benton, Franklin, Kittitas, Yakima: Perry Harvester, harvepjh@dfw.wa.gov.; WDFW, Region 3, 1701 S 24th AVE Yakima WA 98902-5720; (509) 457-9314.

Region 4: King, Island, San Juan, Skagit, Snohomish, Whatcom: David Brock, brockdwb@dfw.wa.gov.; WDFW, Region 4, 16018 Mill Creek Blvd Mill Creek, WA 98012-1296; 425-775-1311 x 114.

Region 5: Clark, Cowlitz, Klickitat, Lewis, Skamania, Wahkiakum: Tim Rymer, rymertrr@dfw.wa.gov.; WDFW, Region 5, 2108 Grand Blvd Vancouver, WA 98661; (360) 906-6729.

Region 6: Clallam, Grays Harbor, Jefferson, Kitsap, Mason, Pacific, Pierce, Thurston: Steve Kalinowski, kalinsak@dfw.wa.gov.; WDFW, Region 6, 48 Devonshire RD Montesano, WA 98563-9618; (360) 249-1227.

Washington Department of Ecology Contact Numbers:
Central Region (Yakima): (509) 575-2490.
Northwest Region (Bellevue): (425) 649-7000.
Eastern Region (Spokane): (509) 456-2926.

Washington Department of FISH and WILDLIFE

HYDRAULIC PROJECT APPROVAL

RCW 77.55.021 - Appeal pursuant to Chapter 34.05 RCW

Statewide
600 Capitol Way N
Olympia, WA 98501-1091
(360) 902-2200

Issue Date: September 25, 2007 | Control Number: 00000D9450-3
Project Expiration Date: August 25, 2008 | FPA/Public Notice #: N/A

PROJECT LOCATIONS

Location #1

WORK START:					WORK END:	
September 25, 2007					August 25, 2008	
WRIA:	Waterbody:				Tributary to:	
99.0000	Various				Statewide	
1/4 SEC:	Section:	Township:	Range:	Latitude:	Longitude:	County:
All	99	99	99	N		Multiple
Location #1 Driving Directions						

APPLY TO ALL HYDRAULIC PROJECT APPROVALS

This Hydraulic Project Approval pertains only to those requirements of the Washington State Hydraulic Code, specifically Chapter 77.55 RCW (formerly RCW 77.20). Additional authorization from other public agencies may be necessary for this project. The person(s) to whom this Hydraulic Project Approval is issued is responsible for applying for and obtaining any additional authorization from other public agencies (local, state and/or federal) that may be necessary for this project.

This Hydraulic Project Approval shall be available on the job site at all times and all its provisions followed by the person(s) to whom this Hydraulic Project Approval is issued and operator(s) performing the work.

This Hydraulic Project Approval does not authorize trespass.

The person(s) to whom this Hydraulic Project Approval is issued and operator(s) performing the work may be held liable for any loss or damage to fish life or fish habitat that results from failure to comply with the provisions of this Hydraulic Project Approval.

Failure to comply with the provisions of this Hydraulic Project Approval could result in a civil penalty of up to one hundred dollars per day and/or a gross misdemeanor charge, possibly punishable by fine and/or imprisonment.

All Hydraulic Project Approvals issued pursuant to RCW 77.55.021 (EXCEPT agricultural irrigation, stock watering or bank stabilization projects) or 77.55.141 are subject to additional restrictions, conditions or revocation if the Department of Fish and Wildlife determines that new biological or physical information indicates the need for such action. The person(s) to whom this Hydraulic Project Approval is issued has the right pursuant to Chapter 34.04 RCW to appeal such decisions. All agricultural irrigation, stock watering or bank stabilization Hydraulic Project Approvals issued pursuant to RCW 77.55.021 may be modified by the Department of Fish and Wildlife due to changed conditions after consultation with the person(s) to whom this Hydraulic Project Approval is issued: PROVIDED HOWEVER, that such modifications shall be subject to appeal to the Hydraulic Appeals Board established in RCW 77.55.301.

APPEALS INFORMATION

If you wish to appeal the issuance or denial of, or conditions provided in a Hydraulic Project Approval, there are informal and formal appeal processes available.

Issue Date: September 25, 2007 | Control Number: 00000D9450-3

Project Expiration Date: August 25, 2008 | FPA/Public Notice #: N/A

A. INFORMAL APPEALS (WAC 220-110-340) OF DEPARTMENT ACTIONS TAKEN PURSUANT TO RCW 77.55.021, 77.55.141, 77.55.181, and 77.55.291: A person who is aggrieved or adversely affected by the following Department actions may request an informal review of:

(A) The denial or issuance of a Hydraulic Project Approval, or the conditions or provisions made part of a Hydraulic Project Approval; or

(B) An order imposing civil penalties. A request for an INFORMAL REVIEW shall be in WRITING to the Department of Fish and Wildlife HPA Appeals Coordinator, 600 Capitol Way North, Olympia, Washington 98501-1091 and shall be RECEIVED by the Department within 30 days of the denial or issuance of a Hydraulic Project Approval or receipt of an order imposing civil penalties. If agreed to by the aggrieved party, and the aggrieved party is the Hydraulic Project Approval applicant, resolution of the concerns will be facilitated through discussions with the Area Habitat Biologist and his/her supervisor. If resolution is not reached, or the aggrieved party is not the Hydraulic Project Approval applicant, the Habitat Technical Services Division Manager or his/her designee shall conduct a review and recommend a decision to the Director or his/her designee. If you are not satisfied with the results of this informal appeal, a formal appeal may be filed.

B. FORMAL APPEALS (WAC 220-110-350) OF DEPARTMENT ACTIONS TAKEN PURSUANT TO RCW 77.55.021 (EXCEPT agricultural irrigation, stock watering or bank stabilization projects) or 77.55.291:
A person who is aggrieved or adversely affected by the following Department actions may request a formal review of:

(A) The denial or issuance of a Hydraulic Project Approval, or the conditions or provisions made part of a Hydraulic Project Approval;

(B) An order imposing civil penalties; or

(C) Any other 'agency action' for which an adjudicative proceeding is required under the Administrative Procedure Act, Chapter 34.05 RCW.

A request for a FORMAL APPEAL shall be in WRITING to the Department of Fish and Wildlife HPA Appeals Coordinator, shall be plainly labeled as 'REQUEST FOR FORMAL APPEAL' and shall be RECEIVED DURING OFFICE HOURS by the Department at 600 Capitol Way North, Olympia, Washington 98501-1091, within 30-days of the Department action that is being challenged. The time period for requesting a formal appeal is suspended during consideration of a timely informal appeal. If there has been an informal appeal, the deadline for requesting a formal appeal shall be within 30-days of the date of the Department's written decision in response to the informal appeal.

C. FORMAL APPEALS OF DEPARTMENT ACTIONS TAKEN PURSUANT TO RCW 77.55.021 (agricultural irrigation, stock watering or bank stabilization only), 77.55.141, 77.55.181, or 77.55.241: A person who is aggrieved or adversely affected by the denial or issuance of a Hydraulic Project Approval, or the conditions or provisions made part of a Hydraulic Project Approval may request a formal appeal. The request for FORMAL APPEAL shall be in WRITING to the Hydraulic Appeals Board per WAC 259-04 at Environmental Hearings Office, 4224 Sixth Avenue SE, Building Two - Rowe Six, Lacey, Washington 98504; telephone 360/459-6327.

D. FORMAL APPEALS OF DEPARTMENT ACTIONS TAKEN PURSUANT TO CHAPTER 43.21L RCW: A person who is aggrieved or adversely affected by the denial or issuance of a Hydraulic Project Approval, or the conditions or provisions made part of a Hydraulic Project Approval may request a formal appeal. The FORMAL APPEAL shall be in accordance with the provisions of Chapter 43.21L RCW and Chapter 199-08 WAC. The request for FORMAL APPEAL shall be in WRITING to the Environmental and Land Use Hearings Board at Environmental Hearings Office, Environmental and Land Use Hearings Board, 4224 Sixth Avenue SE, Building Two - Rowe Six, P.O. Box 40903, Lacey, Washington 98504; telephone 360/459-6327.

E. FAILURE TO APPEAL WITHIN THE REQUIRED TIME PERIODS results in forfeiture of all appeal rights. If there is no timely request for an appeal, the department action shall be final and unappealable.

Issue Date: September 25, 2007 | Control Number: 00000D9450-3

Project Expiration Date: August 25, 2008 | FPA/Public Notice #: N/A

ENFORCEMENT: Sergeant Charron (43) P3

Habitat Biologist Craig Olds	360-902-2540		for Director WDFW

CC: E-Mail:

All Area Habitat Biologists, WDFW
All Regional Habitat Program Managers, WDFW
All Assistant Regional Habitat Program Managers, WDFW
All Regulatory Services, WDFW

E-Mail and Hard Copy:
All Regional Enforcement Sergeants, WDFW
Ken Schlatter, Statewide Permit Coordinator, WSDOT

Attachments:
Allowable Work Windows for Fresh Water

Washington Department of FISH and WILDLIFE

HYDRAULIC PROJECT APPROVAL

RCW 77.55.021 - Appeal pursuant to Chapter 34.05 RCW

Statewide
600 Capitol Way N
Olympia, WA 98501-1091
(360) 902-2200

Issue Date: September 25, 2007
Project Expiration Date: June 01, 2009

Control Number: 00000F3587-3
FPA/Public Notice #: N/A

PERMITTEE	AUTHORIZED AGENT OR CONTRACTOR
Washington Department of Transportation ATTENTION: Gregor Myhr 310 Maple Park Drive SE Olympia, WA 98504 360-705-7487	

Project Name: Channelized Stream Maintenance and Debris/Sediment

Project Description: Channelized Stream Maintenance and Debris/Sediment removal statewide on WSDOT Rights of Way

PROVISIONS

1.TIMING LIMITATIONS: The project may begin immediately and shall be completed by June 1, 2009, provided:

a. Scheduled work shall be conducted in the natural dry stream channel during summer months (June 1 - October 15).
b. If work occurs in the wetted perimeter it shall be done during the attached work windows (Attachment 1).

2. NOTIFICATION PRIOR TO WORK START: The permittee or contractor shall notify the WDFW Regional Habitat Program Manager (RHPM) in the attached list of WDFW regional offices prior to starting work. Notification may be by email, facsimile (FAX), telephone, or in person. If notification is by e-mail, the AHB (if known), and the WSDOT Liaison (oldscao@dfw.wa.gov) should also be notified. Notification shall include:
a. Agency name, contact person, and telephone number.
b. Water body name.
c. Work location including road number and milepost if applicable, or comparable site location information.
d. Starting date and estimated ending date for work.
e. Control Number for the Hydraulic Project Approval.

3. ANNUAL REPORTING: WSDOT shall submit to the WDFW Habitat Program, address 600 Capitol Way N. Olympia, WA 98501, a calendar year annual report of work by February 28 of the following year, or in the final year of the HPA, prior to the expiration date. An annual report is also required if no work was conducted. The annual report shall include:
a. General: HPA Control Number, permittee, contact person, address, telephone number, date of report, time period.
b. Summary: Total number of individual projects by region and statewide.
c. Problem(s) encountered: Provision violation, notification, corrective action, impacts to fish life and water quality from problem. If the Environmental Compliance Assurance Procedure (ECAP) or similar procedure was used, what activity triggered the procedure.

d. Recommendations for improvement to best management practices and mitigation [optional].
e. List of individual projects completed: By region including water body name, road number and milepost if applicable, latitude and longitude, date duration of work, description of work.
f. The information contained in item 'e' above (individual projects completed) shall be provided in unlocked Microsoft Excel (.xls) format.

4. FISH KILL/ WATER QUALITY PROBLEM NOTIFICATION: If at any time, as a result of project activities, fish are observed in distress, a fish kill occurs, or water quality problems develop (including equipment leaks or spills), immediate action shall be made to notify Washington Military Department Emergency Management Division at 1-800-258-5990, and to the WSDOT Liaison Craig Olds, 600 Capitol Way North, MS 43200, Olympia WA 98501-1091; Telephone: 360-902-2540; FAX: 360-902-2946; Email:(oldscao@dfw.wa.gov.).

WATER QUALITY
5. Best Management Practices shall be implemented during all phases of the project to ensure that sediment-laden water does not enter waters of the state.

6. If flow conditions occur that may cause siltation during a project, work shall stop until the flow subsides.

7. Water removed from within the work area shall be routed to an area landward of the OHWL to allow removal of fine sediment and other contaminants prior to being discharged to the waters of the state.

8. Water discharged back to the receiving water shall comply with state surface water quality standards.

9. The de-watering discharge point shall be designed and operated so as not to cause erosion or scour in the stream channel, banks or vegetation.

10. All material excavated from channelized streams shall be completely removed and disposed of at an upland location. No material shall be side cast into adjacent wetlands, or other waters of the state, unless authorized by WDFW for stream habitat improvement.

11. There shall be no visible sheen from petroleum products in the receiving water as a result of the activity.

12. No petroleum products, hydraulic fluid, fresh cement, sediments, sediment-laden water, chemicals, or any other toxic or deleterious materials are allowed to enter or leach into waters of the state.

13. In the event that only hand tools (come-along, chain saw winch, etc.) are used to conduct the activity, no bypass is necessary.

14. A temporary bypass to divert flow around the work area shall be in place prior to initiation of

work in the wetted perimeter except as specified above (Provision #13).

15. Sandbagging and hard pipe flumes or pumping shall be the approved bypass method. Other methods may be utilized if a positive separation can be maintained between the work area and waters of the state.

16. In the event that maintenance work involves the use of equipment other than hand tools, temporary filter fabric, straw bale, or pea gravel-filled burlap bag check dam(s) shall be installed downstream prior to starting work in flowing waters. Accumulated sediments shall be removed during the project and prior to removing the check dam(s) or temporary sediment trap after completion of work.

17. A sandbag revetment or similar device shall be installed at the bypass inlet to divert the entire flow through the bypass.

18. A sandbag revetment or similar device shall be installed at the downstream end of the bypass to prevent backwater from entering the work area.

19. In the event a hard pipe bypass is used, it shall be of sufficient size to pass all flows and debris for the duration of the project.

20. Prior to releasing the water flow to the project area, all bank protection or armoring shall be completed.

21. Upon completion of the project, all material used in the temporary bypass shall be removed from the site and the site returned to pre-project or improved conditions.

22. Reintroduction of water to the channel shall be done gradually and in stages so as to minimize the mobilization of sediments and fines into downstream waters.

FISH REMOVAL AND SCREENING (FOR WORKING IN WETTED PERIMETER)
23. The permittee shall capture and safely move food fish, game fish, and other fish life from the job site. The permittee shall have fish exclusion, fish capture, and transportation equipment ready and on the job site. Captured fish shall be immediately and safely transferred to free-flowing water downstream of the project site. The permittee may request that WDFW assist in capturing and safely moving fish life from the job site to free-flowing water, and assistance may be granted if personnel are available.

24. Any device used for diverting water from a fish-bearing stream shall be equipped with a fish guard to prevent passage of fish into the diversion device pursuant to RCW 77.57.70. The pump intake shall be screened with 3/32-inch mesh to prevent fish from entering the system. The screened intake shall consist of a facility with enough surface area to ensure that the velocity through the screen is less than 0.4 feet per second. Screen maintenance shall be adequate to prevent injury or entrapment to juvenile fish and the screen shall remain in place whenever water is withdrawn from the stream through the pump intake.

EQUIPMENT LIMITATIONS

25. Machinery and equipment used during maintenance work shall be serviced, fueled, and maintained on uplands in order to prevent contamination to surface waters. When practicable, fueling equipment and vehicles should be more than 200 feet away from waters of the state (except small equipment necessary as part of the BMP's for the project e.g., water pumps). Fueling areas shall be provided with adequate spill containment.

26. Equipment used for a project shall be free of external petroleum-based products while working around the channel. Accumulation of soils or debris shall be removed from the drive mechanisms (wheels, tires, tracks, etc.) and undercarriage of equipment prior to its working below the OHWL. Equipment shall be checked daily for leaks and any necessary repairs shall be completed prior to commencing work activities along the channel.

27. Equipment used for a project shall operate stationed on the roadway, shoulder or bank.

28. Equipment used for a project may operate below the OHWL, provided the drive mechanisms (wheels, tracks, tires, etc.) shall not enter or operate below the OHWL unless the channelized stream is dry or a bypass is in place.

29. There shall be no visible sheen from petroleum products in the receiving water as a result of channelized stream maintenance and repair activities.

30. Equipment crossings of the channelized stream shall not be conducted.

SEDIMENT REMOVAL

31. No more than 50 cubic yards of material per project per year shall be removed without separate written approval from WDFW.

32. Sediment removal shall not be conducted in fish spawning areas.

33. Sediment removal shall be accomplished by starting at the upstream end of the project boundary and working downstream.

34. Sediment removal shall be limited to restoring the channelized stream to as-built condition with a gradual taper of the ground line to meet the native stream bed.

35. At the end of the maintenance activity, the channelized stream shall contain no pits, potholes, or depressions that may trap fish as a result of fluctuation in water levels.

LARGE WOODY MATERIAL (LWM) AND DEBRIS REMOVAL

36. If LWM must be removed, it shall be repositioned below the OHWL downstream of the channelized stream to provide stable, functional fish habitat. If anchoring repositioned LWM is necessary, only non-invasive streambed or stream bank anchoring techniques, such as pinning with rebar, rock drilling and cable, etc., may be used. Streambed or stream bank excavation, or

removal of embedded material is not authorized. Streambed or stream bank excavation or removal of embedded LWM shall require separate, written approval from WDFW.

37. If, due to compelling safety or habitat concerns (i.e. in eddies or in areas where bank erosion is occurring), LWM cannot be repositioned within the channelized stream downstream of the structure or released to float downstream, said LWM shall be:

a. Set aside in a location that ensures availability for use in future fish habitat/ restoration projects by agencies or other entities, or
b. Disposed of away from the watercourse so that it will not reenter state waters.

In either case, prior consultation and separate, written approval from the local AHB is required before removing the LWM.

38. Debris shall be removed gradually and in a controlled manner to prevent a sudden release of any impounded water, logs, other material or sediments which may result in downstream bed and bank degradation, sedimentation or flooding. Slowly removing portions of the debris and allowing the water level to go down slowly, before removing additional portions of the debris, may accomplish this.

39. LWM removal shall be conducted with equipment stationed on the bank, road shoulder, or bridge.

40. Smaller limb and bark debris that is removed from LWM shall be disposed of so it shall not re-enter the waters of the state.

41. LWM removal or repositioning shall be accomplished in a manner that minimizes the release of sediment or debris downstream. This activity shall not exceed the water quality standards for turbidity.

EROSION REPAIR/PROTECTION
42. Encroachment of riprap or other repairs into waters of the state shall be held to an absolute minimum as described in WDFW's Integrated Streambank Protection Guidelines. The work shall not exceed that necessary to stabilize the site and shall in no case exceed as-built conditions.

43. Riprap shall be clean and durable, free from dirt, sand, clay and rock fines and shall be installed to withstand the 100-year flow flood event.

44. Riprap shall be placed using equipment operating from the roadbed, shoulder, bank, or bridge.

45. A toe of rock shall be installed prior to placement of the riprap.

46. Filter fabric shall be installed prior to placement of riprap.

REVEGETATION PROVISIONS

47. Alteration or disturbance of the bank and bank vegetation shall be limited to that necessary to construct the project. Within seven calendar days of project completion, all disturbed areas shall be protected from erosion using vegetation or other BMPs. Within the first planting season, the banks, including riprap areas, shall be revegetated with native or other approved woody species. Vegetative cuttings shall be planted at a maximum interval of three feet (on center) and maintained as necessary for three years to ensure 80 percent survival.

48. Existing riparian vegetation outside of the work area shall not be removed or disturbed.

49. Care shall be used when accessing the site to minimize the disturbance of riparian vegetation. Riparian vegetation shall be straddled with heavy equipment or be pruned as necessary without damaging the roots, to allow the operation of heavy equipment.

NOTE: This Hydraulic Project Approval pertains only to the provisions of the Washington State Fisheries and Wildlife Codes. It is the permittee's responsibility to apply for and obtain any additional authorization from other public agencies (local, state and/or federal) that may be necessary for this project.

NOTE: These activities are proposed in state waters that contain federally threatened or endangered species of fish. Compliance with the provisions of this approval does not ensure compliance with the Endangered Species Act. For further information, contact the National Marine Fisheries Service at (360) 753-9090 and/or the United States Fish and Wildlife Service at (360) 753 -9564.

NOTE: This approval supersedes any and all General HPAs for the same type of work. This statewide general HPA GH-F3587-03 modifies and supercedes GH-F3587-02 by modification of Provisions 2, 3 and 4.

NOTE: In the event that the applicant cannot comply with the provisions of this approval due to site specific or other concerns, separate written approval may be sought from the local Area Habitat Biologist for the project.

DEFINITIONS
As-built Condition: The original design and/or constructed features of the structure or facility including the line, depth, grade, toe of slope and cross-section, or same as constructed/permitted.

Channelized stream: A man-made feature that intercepts and conveys a natural stream parallel or perpendicular to the roadway structure. If a ditch conveys water through a jurisdictional wetland it will be considered a channelized stream.

Culvert: Conduit or pipe used as an artificial channel under a roadway or embankment to maintain flow from a natural stream, channel or drainage ditch.

Debris: Small woody material and large and small inorganic material including trash, tires and garbage etc. This definition does not include new construction waste or woody debris resulting from

beaver activity. Debris does not include woody debris placed in channels for an environmentally beneficial purpose.

Ditch: Man-made (i.e. not a channelized stream) conveyance system that collects, carries, holds, inhibits or diverts the movement of stormwater or groundwater from the facility or adjacent properties. Determinations for what is a stream, channelized stream, or ditch for HPA purposes will be made by the WDFW Area Habitat Biologist.

Embedded: Condition in which debris or large woody material is buried by bed material exceeding 50 cubic yards.

Environmental Compliance Assurance Procedure: WSDOT communication protocol to monitor and measure compliance performance.

Fill Material: Any material that replaces an aquatic area with dry land or changes the bottom elevation of a water body. Examples of fill that might be used in channel maintenance include gravel, rock, riprap, sand, wood chips, (etc.).

Fish Bearing Stream: Any state waters (river, creek, stream, channel), fresh, salt or estuarine, that contains any fish will be considered a fish-bearing stream. If there is a question regarding whether a stream is fish bearing or not, the local WDFW Area Habitat Biologist will make the determination.

Fishway Facility: Any facility or device that is designed to enable fish to effectively pass around or through an obstruction without undue stress or delay.

Incidental Fallback: The small amount of material that may fall off of a shovel or excavator bucket back into substantially the same place from which it was lifted. Fallback occurs incidental to excavation and does not include the movement of material during grading activities.

Large Woody Material (LWM): Trees or tree parts larger than four inches in diameter and longer than six feet in length, including rootwads (WAC 220 -110 020 (48)). This material is located wholly or partially waterward of the ordinary high water line (OHWL).

Maintenance: Activities that (a) are conducted on currently serviceable structures, facilities, and equipment; and (b) involve no expansion of or change in use of such structures, facilities, and equipment beyond those that existed previously; and (c) do not result in significant negative hydrological impacts.

Scheduled Maintenance: Budgeted work, performed routinely on a regular basis. It is intended to maintain the roadway facility/element so that it substantially retains its original intended use and function.

Unscheduled Maintenance: Unanticipated activities that occur due to unusual weather condition, vandalism, accident, (etc.). Work activities are conducted similar to routine maintenance activities except that work is unanticipated and poses an imminent danger to the existing structures or

traveling public.

Navigable Waters (Reference 33 CFR): A list of navigable waters for the state of Washington can be found at the following web site managed by the Corps: (http://www.nws.usace.army.mil/reg.html).

Ordinary High Water Line (OHWL): The mark on the shores of all waters that will be found by examining the bed and banks and ascertaining where the presence and action of waters are so common and usual and so long continued in ordinary years, as to mark upon the soil or vegetation a character distinct from that of the abutting upland provided that in any area where the ordinary high water line cannot be found the ordinary high water line adjoining saltwater shall be the line of mean higher high water and the ordinary high water line adjoining freshwater shall be the elevation of the mean annual flood (WAC 220-110-020 (57)).

Permittee: The entity to whom the permit is issued.

Riprap: Material used for bank protection that does not include waste concrete or asphalt material.

Sediment(s): Settled particulate matter located in the predominant biologically active aquatic zone, or exposed to the water column. Sediment also includes settled particulate matter exposed by human activity (e.g., dredging) to the biologically active aquatic zone or to the water column. (WAC 173 -204.200 (26)).

Serviceable Condition: A structure or element of the structure that can be repaired, maintained, or replaced without the redevelopment of the whole right of way structure.

Waters of the State: Waters of the state or "state waters" means all salt waters and fresh waters waterward of ordinary high water lines and within the territorial boundaries of the state (WAC 220-110-020 (85)).

Wetted Perimeter: The areas of a watercourse covered with water, flowing or non-flowing (WAC 220-110-020-(88)).

PROJECT LOCATIONS

Location #1

WORK START: September 25, 2007					WORK END: June 01, 2009	
WRIA: 99.0000	Waterbody: Various				Tributary to: Statewide	
1/4 SEC: All	Section: 99	Township: 99	Range: 99	Latitude: N	Longitude:	County: Multiple
Location #1 Driving Directions						

APPLY TO ALL HYDRAULIC PROJECT APPROVALS

This Hydraulic Project Approval pertains only to those requirements of the Washington State Hydraulic Code, specifically Chapter 77.55 RCW (formerly RCW 77.20). Additional authorization from other public agencies may be necessary for this project. The person(s) to whom this Hydraulic Project Approval is issued is responsible for applying for and obtaining any additional authorization from other public agencies (local, state and/or federal) that may be necessary for this project.

This Hydraulic Project Approval shall be available on the job site at all times and all its provisions followed by the person(s) to whom this Hydraulic Project Approval is issued and operator(s) performing the work.

This Hydraulic Project Approval does not authorize trespass.

The person(s) to whom this Hydraulic Project Approval is issued and operator(s) performing the work may be held liable for any loss or damage to fish life or fish habitat that results from failure to comply with the provisions of this Hydraulic Project Approval.

Failure to comply with the provisions of this Hydraulic Project Approval could result in a civil penalty of up to one hundred dollars per day and/or a gross misdemeanor charge, possibly punishable by fine and/or imprisonment.

All Hydraulic Project Approvals issued pursuant to RCW 77.55.021 (EXCEPT agricultural irrigation, stock watering or bank stabilization projects) or 77.55.141 are subject to additional restrictions, conditions or revocation if the Department of Fish and Wildlife determines that new biological or physical information indicates the need for such action. The person(s) to whom this Hydraulic Project Approval is issued has the right pursuant to Chapter 34.04 RCW to appeal such decisions. All agricultural irrigation, stock watering or bank stabilization Hydraulic Project Approvals issued pursuant to RCW 77.55.021 may be modified by the Department of Fish and Wildlife due to changed conditions after consultation with the person(s) to whom this Hydraulic Project Approval is issued: PROVIDED HOWEVER, that such modifications shall be subject to appeal to the Hydraulic Appeals Board established in RCW 77.55.301.

APPEALS INFORMATION

If you wish to appeal the issuance or denial of, or conditions provided in a Hydraulic Project Approval, there are informal and formal appeal processes available.

A. INFORMAL APPEALS (WAC 220-110-340) OF DEPARTMENT ACTIONS TAKEN PURSUANT TO RCW 77.55.021, 77.55.141, 77.55.181, and 77.55.291: A person who is aggrieved or adversely affected by the following Department actions may request an informal review of:

(A) The denial or issuance of a Hydraulic Project Approval, or the conditions or provisions made part of a Hydraulic Project Approval; or

(B) An order imposing civil penalties. A request for an INFORMAL REVIEW shall be in WRITING to the Department of Fish and Wildlife HPA Appeals Coordinator, 600 Capitol Way North, Olympia, Washington 98501-1091 and shall be RECEIVED by the Department within 30 days of the denial or issuance of a Hydraulic Project Approval or receipt of an order imposing civil penalties. If agreed to by the aggrieved party, and the aggrieved party is the Hydraulic Project Approval applicant, resolution of the concerns will be facilitated through discussions with the Area Habitat Biologist and his/her supervisor. If resolution is not reached, or the aggrieved party is not the Hydraulic Project Approval applicant, the Habitat Technical Services Division Manager or his/her designee shall conduct a review and recommend a decision to the Director or his/her designee. If you are not satisfied with the results of this informal appeal, a formal appeal may be filed.

B. FORMAL APPEALS (WAC 220-110-350) OF DEPARTMENT ACTIONS TAKEN PURSUANT TO RCW 77.55.021 (EXCEPT agricultural irrigation, stock watering or bank stabilization projects) or 77.55.291:
A person who is aggrieved or adversely affected by the following Department actions may request a formal review of:
(A) The denial or issuance of a Hydraulic Project Approval, or the conditions or provisions made part of a Hydraulic Project Approval;
(B) An order imposing civil penalties; or
(C) Any other 'agency action' for which an adjudicative proceeding is required under the Administrative Procedure Act, Chapter 34.05 RCW.
A request for a FORMAL APPEAL shall be in WRITING to the Department of Fish and Wildlife HPA Appeals Coordinator, shall be plainly labeled as 'REQUEST FOR FORMAL APPEAL' and shall be RECEIVED DURING OFFICE HOURS by the Department at 600 Capitol Way North, Olympia, Washington 98501-1091, within 30-days of the Department action that is being challenged. The time period for requesting a formal appeal is suspended during consideration of a timely informal appeal. If there has been an informal appeal, the deadline for requesting a formal appeal shall be within 30-days of the date of the Department's written decision in response to the informal appeal.

C. FORMAL APPEALS OF DEPARTMENT ACTIONS TAKEN PURSUANT TO RCW 77.55.021 (agricultural irrigation, stock watering or bank stabilization only), 77.55.141, 77.55.181, or 77.55.241: A person who is aggrieved or adversely affected by the denial or issuance of a Hydraulic Project Approval, or the conditions or provisions made part of a Hydraulic Project Approval may request a formal appeal. The request for FORMAL APPEAL shall be in WRITING to the Hydraulic Appeals Board per WAC 259-04 at Environmental Hearings Office, 4224 Sixth Avenue SE, Building Two - Rowe Six, Lacey, Washington 98504; telephone 360/459-6327.

D. FORMAL APPEALS OF DEPARTMENT ACTIONS TAKEN PURSUANT TO CHAPTER 43.21L RCW: A person who is aggrieved or adversely affected by the denial or issuance of a Hydraulic Project Approval, or the conditions or provisions made part of a Hydraulic Project Approval may request a formal appeal. The FORMAL APPEAL shall be in accordance with the provisions of Chapter 43.21L RCW and Chapter 199-08 WAC. The request for FORMAL APPEAL shall be in WRITING to the Environmental and Land Use Hearings Board at Environmental Hearings Office, Environmental and Land Use Hearings Board, 4224 Sixth Avenue SE, Building Two - Rowe Six, P.O. Box 40903, Lacey, Washington 98504; telephone 360/459-6327.

E. FAILURE TO APPEAL WITHIN THE REQUIRED TIME PERIODS results in forfeiture of all appeal rights. If there is no timely request for an appeal, the department action shall be final and unappealable.

ENFORCEMENT: Sergeant Charron (43) P3

Habitat Biologist Craig Olds	360-902-2540		for Director WDFW

CC: E-Mail without Attachments:
All Area Habitat Biologists, WDFW
All Regional Habitat Program Managers, WDFW
All Assistant Regional Habitat Program Managers, WDFW
All Regulatory Services, WDFW

E-Mail and Hard Copy:
All Regional Enforcement Sergeants, WDFW
Ken Schlatter, Statewide Permit Coordinator, WSDOT

Attachment: WDFW Regional Habitat Program Manager List, Fresh Water Work Windows.

Washington Department of FISH and WILDLIFE

HYDRAULIC PROJECT APPROVAL

RCW 77.55.021 - Appeal pursuant to Chapter 34.05 RCW

Statewide
600 Capitol Way N
Olympia, WA 98501-1091
(360) 902-2200

Issue Date: September 25, 2007
Project Expiration Date: June 01, 2009

Control Number: 00000F3589-3
FPA/Public Notice #: N/A

PERMITTEE	AUTHORIZED AGENT OR CONTRACTOR
Washington Department of Transportation ATTENTION: Gregor Myhr 310 Maple Park Drive SE Olympia, WA 98504 360-705-7487	

Project Name: Culvert Maintenance

Project Description: Culvert maintenance statewide on WSDOT Rights of Way.

PROVISIONS

1. TIMING LIMITATIONS: The project may begin immediately and shall be completed by June 1, 2009, provided:

a. Scheduled work shall be conducted in the natural dry stream channel during summer months (June 1 - October 15).
b. If work occurs in the wetted perimeter it shall be done during the attached work windows (Attachment 1).

2. NOTIFICATION PRIOR TO WORK START: The permittee or contractor shall notify the WDFW Regional Habitat Program Manager (RHPM) in the attached list of WDFW regional offices prior to starting work. Notification may be by email, facsimile (FAX), telephone, or in person. If notification is by e-mail, the AHB (if known), and the WSDOT Liaison (oldscao@dfw.wa.gov) should also be notified. Notification shall include:
a. Agency name, contact person, and telephone number.
b. Water body name.
c. Work location including road number and milepost if applicable, or comparable site location information.
d. Starting date and estimated ending date for work.
e. Control Number for the Hydraulic Project Approval.

3. ANNUAL REPORTING: WSDOT shall submit to the WDFW Habitat Program, address 600 Capitol Way N. Olympia, WA 98501, a calendar year annual report of work by February 28 of the following year, or in the final year of the HPA, prior to the expiration date. An annual report is also required if no work was conducted. The annual report shall include:
a. General: HPA Control Number, permittee, contact person, address, telephone number, date of report, time period.
b. Summary: Total number of individual projects by region and statewide.
c. Problem(s) encountered: Provision violation, notification, corrective action, impacts to fish life and water quality from problem. If the Environmental Compliance Assurance Procedure (ECAP) or similar procedure was used, what activity triggered the procedure.
d. Recommendations for improvement to best management practices and mitigation [optional].

e. List of individual projects completed: By region including water body name, road number and milepost if applicable, latitude and longitude, date duration of work, description of work.
f. The information contained in item 'e' above (individual projects completed) shall be provided in unlocked Microsoft Excel (.xls) format.

4. FISH KILL/ WATER QUALITY PROBLEM NOTIFICATION: If at any time, as a result of project activities, fish are observed in distress, a fish kill occurs, or water quality problems develop (including equipment leaks or spills), immediate action shall be made to notify Washington Military Department Emergency Management Division at 1-800-258-5990, and to the WSDOT Liaison Craig Olds, 600 Capitol Way North, MS 43200, Olympia WA 98501-1091; Telephone: 360-902-2540; FAX: 360-902-2946; Email:(oldscao@dfw.wa.gov.).

WATER QUALITY
5. Best Management Practices shall be implemented during all phases of the project to ensure that sediment-laden water does not enter waters of the state.

6. If flow conditions occur that may cause siltation during a project, work shall stop until the flow subsides.

7. Water removed from within the work area shall be routed to an area landward of the OHWL to allow removal of fine sediment and other contaminants prior to being discharged to the waters of the state.

8. Water discharged back to the receiving water shall comply with state surface water quality standards.

9. The de-watering discharge point shall be designed and operated so as not to cause erosion or scour in the stream channel, banks or vegetation.

10. All material excavated from channelized streams shall be completely removed and disposed of at an upland location. No material shall be side cast into adjacent wetlands, or other waters of the state, unless authorized by WDFW for stream habitat improvement.

11. There shall be no visible sheen from petroleum products in the receiving water as a result of the activity.

12. No petroleum products, hydraulic fluid, fresh cement, sediments, sediment-laden water, chemicals, or any other toxic or deleterious materials are allowed to enter or leach into waters of the state.

13. In the event that only hand tools (come-along, chain saw winch, etc.) are used to conduct the activity, no bypass is necessary.

14. A temporary bypass to divert flow around the work area shall be in place prior to initiation of work in the wetted perimeter except as specified above (Provision #13).

15. Sandbagging and hard pipe flumes or pumping shall be the approved bypass method. Other methods may be utilized if a positive separation can be maintained between the work area and waters of the state.

16. In the event that maintenance work involves the use of equipment other than hand tools, temporary filter fabric, straw bale, or pea gravel-filled burlap bag check dam(s) shall be installed downstream prior to starting work in flowing waters. Accumulated sediments shall be removed during the project and prior to removing the check dam(s) (or temporary sediment trap) after completion of work.

17. A sandbag revetment or similar device shall be installed at the bypass inlet to divert the entire flow through the bypass.

18. A sandbag revetment or similar device shall be installed at the downstream end of the bypass to prevent backwater from entering the work area.

19. In the event a hard pipe bypass is used, it shall be of sufficient size to pass all flows and debris for the duration of the project.

20. Prior to releasing the water flow to the project area, all bank protection or armoring shall be completed.

21. Upon completion of the project, all material used in the temporary bypass shall be removed from the site and the site returned to pre-project or improved conditions.

22. Reintroduction of water to the channel shall be done gradually and in stages so as to minimize the mobilization of sediments and fines into downstream waters.

FISH REMOVAL AND SCREENING (FOR WORKING IN WETTED PERIMETER)
23. The permittee shall capture and safely move food fish, game fish, and other fish life from the job site. The permittee shall have fish exclusion, fish capture, and transportation equipment ready and on the job site. Captured fish shall be immediately and safely transferred to free-flowing water downstream of the project site. The permittee may request that WDFW assist in capturing and safely moving fish life from the job site to free-flowing water, and assistance may be granted if personnel are available.

24. Any device used for diverting water from a fish-bearing stream shall be equipped with a fish guard to prevent passage of fish into the diversion device pursuant to RCW 77.57.070. The pump intake shall be screened with 3/32-inch mesh to prevent fish from entering the system. The screened intake shall consist of a facility with enough surface area to ensure that the velocity through the screen is less than 0.4 feet per second. Screen maintenance shall be adequate to prevent injury or entrapment to juvenile fish and the screen shall remain in place whenever water is withdrawn from the stream through the pump intake.

EQUIPMENT LIMITATIONS

25. Machinery and equipment used during maintenance work shall be serviced, fueled, and maintained on uplands in order to prevent contamination to surface waters. When practicable, fueling equipment and vehicles should be more than 200 feet away from waters of the state (except small equipment necessary as part of the BMPs for the project e.g., water pumps). Fueling areas shall be provided with adequate spill containment.

26. Equipment used for a project shall be free of external petroleum-based products while working around the channel. Accumulation of soils or debris shall be removed from the drive mechanisms (wheels, tires, tracks, etc.) and undercarriage of equipment prior to its working below the OHWL. Equipment shall be checked daily for leaks and any necessary repairs shall be completed prior to commencing work activities along the channel.

27. Where appropriate and based upon site conditions and maintenance activity to be conducted, work shall be accomplished by hand or with hand tools such as chain saws or vehicle winches. If the use of heavy equipment is necessary, equipment shall be stationed on and operate from the top of the bank or roadway. When absolutely necessary, equipment may operate stationed on dry gravel bars at low stream flow.

28. Equipment crossings to gain access for work shall be on roadway structures.

29. Equipment used for this project may operate below the OHWL, provided the drive mechanisms (wheels, tracks, tires, etc.) shall not enter or operate below the OHWL unless the stream is dry or a bypass is in place.

LARGE WOODY MATERIAL AND DEBRIS REMOVAL

30. Structures that tend to accumulate debris and LWM shall be inspected and LWM/debris removal and/or repositioning shall be frequent enough to prevent the build up of large debris jams. The frequency of inspection and LWM/debris removal and/or repositioning shall depend upon the site and weather conditions.

31. Embedded debris or LWM shall not be removed. A separate individual HPA is required to remove embedded material.

32. LWM/debris shall be removed gradually and in a controlled manner to prevent a sudden release of any impounded water, bed, logs, other material or sediments which may result in downstream bed and bank degradation, sedimentation or flooding. Slowly removing portions of the debris and allowing the water level to go down slowly, before removing additional portions of the debris, may accomplish this.

33. If LWM must be removed, it shall be repositioned below the OHWL downstream of the culvert to provide stable, functional fish habitat. If anchoring repositioned LWM is necessary, only non-invasive streambed or stream bank anchoring techniques, such as pinning with rebar, rock drilling and cable, etc., may be used. Streambed or stream bank excavation, or removal of embedded material is not authorized. Streambed or stream bank excavation or removal of embedded LWM

shall require separate, written approval from WDFW.

34. If, due to compelling safety or habitat concerns (i.e. in eddies or in areas where bank erosion is occurring), LWM cannot be repositioned within the channelized stream downstream of the structure or released to float downstream, said LWM shall be:

a. Set aside in a location that ensures availability for use in future fish habitat/ restoration projects by agencies or other entities, or
b. Disposed of away from the watercourse so that it will not reenter state waters.

In either case, prior consultation and separate, written approval from the local AHB is required before removing the LWM.

35. LWM removal shall be conducted with equipment stationed on the bank, shoulder or bridge.

36. Smaller limb and bark debris that is removed from LWM shall be disposed of so it shall not re-enter the stream.

37. LWM removal or repositioning shall be accomplished in a manner, which minimizes the release of sediment or debris downstream. This activity shall not exceed the water quality standards for turbidity.

SEDIMENT REMOVAL PROVISIONS
38. No more than 50 cubic yards of material per project (within the culvert and 25 feet downstream of the outlet or 25 feet upstream of the inlet) per year shall be removed without separate written approval from WDFW.

39. Sediment removal shall be limited to restoring the inlet of the culvert to as-built condition with a gradual taper of the ground line to meet the native stream bed.

40. At the end of the maintenance activity, the work area shall contain no pits, or potholes, or depressions that may trap fish as a result of fluctuation in water levels.

41. Sediment removal shall be accomplished by starting at the upstream end of the project boundary and working downstream.

42. Sediment removal shall not be conducted in fish spawning areas.

43. Removal of material shall not result in destabilization of the streambed or banks. Installation of grade control structures shall require a separate written HPA.

CULVERT REPAIR PROVISIONS
44. Culverts may be repaired to as-built conditions. In the event that such repairs create or perpetuate a fish passage blockage in violation of Chapter 77.57.030 RCW, separate written approval from the local Area Habitat Biologist is required before conducting the repair work.

45. Culverts shall be repaired so as to maintain structural integrity to the 100-year peak flow with consideration of the debris likely to be encountered.

46. Fill associated with the culvert shall be protected from erosion to the 100-year peak flow.

47. Encroachment of riprap or other repairs into waters of the state shall be held to an absolute minimum.

48. Riprap shall be clean and durable, free from dirt, sand, clay and rock fines and shall be installed to withstand the 100 year flow flood event.

49. Riprap shall be placed using equipment operating from the roadbed, shoulder, or bank.

50. A toe of rock shall be installed prior to placement of the riprap.

51. Filter fabric shall be installed prior to placement of riprap.

52. Fresh concrete or concrete by-products shall not be allowed to enter the stream at any time during this project. All forms used for concrete shall be completely sealed to prevent the possibility of fresh concrete from getting into the stream.

53. All concrete shall be allowed to cure a minimum of seven (7) days before contact with water. The waters of the state shall not come in contact with the concrete structure while the concrete is curing. Any dewatering required from a contained area with curing concrete shall be discharged to land with no possible entry to waters of the state.

REVEGETATION PROVISIONS

54. Alteration or disturbance of the bank and bank vegetation shall be limited to that necessary to construct the project. Within seven calendar days of project completion, all disturbed areas shall be protected from erosion using vegetation or other BMPs. Within the first planting season, the banks, including riprap areas, shall be revegetated with native or other approved woody species. Vegetative cuttings shall be planted at a maximum interval of three feet (on center) and maintained as necessary for three years to ensure 80 percent survival.

55. Existing riparian vegetation outside of the work area shall not be removed or disturbed.

56. Care shall be used when accessing the site to minimize the disturbance of riparian vegetation. Riparian vegetation shall be straddled with heavy equipment or be pruned as necessary without damaging the roots, to allow the operation of heavy equipment.

NOTE: This Hydraulic Project Approval pertains only to the provisions of the Washington State Fisheries and Wildlife Codes. It is the permittee's responsibility to apply for and obtain any additional authorization from other public agencies (local, state and/or federal) that may be

necessary for this project.

NOTE: These activities are proposed in state waters that contain federally threatened or endangered species of fish. Compliance with the provisions of this approval does not ensure compliance with the Endangered Species Act. For further information, contact the National Marine Fisheries Service at (360) 753-9090 and/or the United States Fish and Wildlife Service at (360) 753 -9564.

NOTE: This approval supersedes any and all General HPAs for the same type of work. This statewide general HPA GH-F3589-03 modifies and supercedes GH-F3589-02 by modification of Provisions 2, 3 and 4.

NOTE: In the event that the applicant cannot comply with the provisions of this approval due to site specific or other concerns, separate written approval may be sought from the local Area Habitat Biologist for the project.

DEFINITIONS
As-built Condition: The original design and/or constructed features of the structure or facility including the line, depth, grade, toe of slope and cross-section, or same as constructed/permitted.

Channelized stream: A man-made feature that intercepts and conveys a natural stream parallel or perpendicular to the roadway structure.If a ditch conveys water through a jurisdictional wetland it will be considered a channelized stream.

Culvert: Conduit or pipe used as an artificial channel under a roadway or embankment to maintain flow from a natural stream, channel or drainage ditch.

Debris: Small woody material and large and small inorganic material including trash, tires and garbage (etc.). This definition does not include new construction waste or woody debris resulting from beaver activity. Debris does not include woody debris placed in channels for an environmentally beneficial purpose.

Ditch: Man-made (i.e. not a channelized stream) conveyance system that collects, carries, holds, inhibits or diverts the movement of stormwater or groundwater from the facility or adjacent properties. Determinations for what is a stream, channelized stream, or ditch for HPA purposes will be made by the WDFW Area Habitat Biologist.

Embedded: Condition in which debris or large woody material is buried by bed material exceeding 50 cubic yards.

Environmental Compliance Assurance Procedure: WSDOT communication protocol to monitor and measure compliance performance.

Fill Material: Any material that replaces an aquatic area with dry land or changes the bottom elevation of a water body. Examples of fill that might be used in channel maintenance include

gravel, rock, riprap, sand, wood chips, (etc.).

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Fishway Facility: Any facility or device that is designed to enable fish to effectively pass around or through an obstruction without undue stress or delay.

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Large Woody Material (LWM): Trees or tree parts larger than four inches in diameter and longer than six feet in length, including rootwads (WAC 220 -110 020 (48)). This material is located wholly or partially waterward of the ordinary high water line (OHWL).

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Unscheduled Maintenance: Unanticipated activities that occur due to unusual weather condition, vandalism, accident, (etc.). Work activities are conducted similar to routine maintenance activities except that work is unanticipated and poses an imminent danger to the existing structures or traveling public.

Navigable Waters (Reference 33 CFR): A list of navigable waters for the state of Washington can be found at the following web site managed by the Corps: (http://www.nws.usace.army.mil/reg.html).

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Permittee: The entity to whom the permit is issued.

Riprap: Material used for bank protection that does not include waste concrete or asphalt material.

Sediment(s): Settled particulate matter located in the predominant biologically active aquatic zone, or exposed to the water column. Sediment also includes settled particulate matter exposed by human activity (e.g., dredging) to the biologically active aquatic zone or to the water column. (WAC 173 -204.200 (26)).

Serviceable Condition: A structure or element of the structure that can be repaired, maintained, or replaced without the redevelopment of the whole right of way structure.

Waters of the State: Waters of the state or "state waters" means all salt waters and fresh waters waterward of ordinary high water lines and within the territorial boundaries of the state (WAC 220-110-020 (85)).

Wetted Perimeter: The areas of a watercourse covered with water, flowing or non-flowing (WAC 220-110-020-(88)).

PROJECT LOCATIONS

Location #1

WORK START: September 25, 2007					WORK END: June 01, 2009	
WRIA: 99.0000	Waterbody: Various				Tributary to: Statewide	
1/4 SEC: All	Section: 99	Township: 99	Range: 99	Latitude: N	Longitude:	County: Multiple
Location #1 Driving Directions						

APPLY TO ALL HYDRAULIC PROJECT APPROVALS

This Hydraulic Project Approval pertains only to those requirements of the Washington State Hydraulic Code, specifically Chapter 77.55 RCW (formerly RCW 77.20). Additional authorization from other public agencies may be necessary for this project. The person(s) to whom this Hydraulic Project Approval is issued is responsible for applying for and obtaining any additional authorization from other public agencies (local, state and/or federal) that may be necessary for this project.

This Hydraulic Project Approval shall be available on the job site at all times and all its provisions followed by the person(s) to whom this Hydraulic Project Approval is issued and operator(s) performing the work.

This Hydraulic Project Approval does not authorize trespass.

The person(s) to whom this Hydraulic Project Approval is issued and operator(s) performing the work may be held liable for any loss or damage to fish life or fish habitat that results from failure to comply with the provisions of this Hydraulic Project Approval.

Failure to comply with the provisions of this Hydraulic Project Approval could result in a civil penalty of up to one hundred dollars per day and/or a gross misdemeanor charge, possibly punishable by fine and/or imprisonment.

All Hydraulic Project Approvals issued pursuant to RCW 77.55.021 (EXCEPT agricultural irrigation, stock watering or bank stabilization projects) or 77.55.141 are subject to additional restrictions, conditions or revocation if the Department of Fish and Wildlife determines that new biological or physical information indicates the need for such action. The person(s) to whom this Hydraulic Project Approval is issued has the right pursuant to Chapter 34.04 RCW to appeal such decisions. All agricultural irrigation, stock watering or bank stabilization Hydraulic Project Approvals issued pursuant to RCW 77.55.021 may be modified by the Department of Fish and Wildlife due to changed conditions after consultation with the person(s) to whom this Hydraulic Project Approval is issued: PROVIDED HOWEVER, that such modifications shall be subject to appeal to the Hydraulic Appeals Board established in RCW 77.55.301.

APPEALS INFORMATION

If you wish to appeal the issuance or denial of, or conditions provided in a Hydraulic Project Approval, there are informal and formal appeal processes available.

A. INFORMAL APPEALS (WAC 220-110-340) OF DEPARTMENT ACTIONS TAKEN PURSUANT TO RCW 77.55.021, 77.55.141, 77.55.181, and 77.55.291: A person who is aggrieved or adversely affected by the following Department actions may request an informal review of:
(A) The denial or issuance of a Hydraulic Project Approval, or the conditions or provisions made part of a Hydraulic Project Approval; or
(B) An order imposing civil penalties. A request for an INFORMAL REVIEW shall be in WRITING to the Department of Fish and Wildlife HPA Appeals Coordinator, 600 Capitol Way North, Olympia, Washington 98501-1091 and shall be RECEIVED by the Department within 30 days of the denial or issuance of a Hydraulic Project Approval or receipt of an order imposing civil penalties. If agreed to by the aggrieved party, and the aggrieved party is the Hydraulic Project Approval applicant, resolution of the concerns will be facilitated through discussions with the Area Habitat Biologist and his/her supervisor. If resolution is not reached, or the aggrieved party is not the Hydraulic Project Approval applicant, the Habitat Technical Services Division Manager or his/her designee shall conduct a review and recommend a decision to the Director or his/her designee. If you are not satisfied with the results of this informal appeal, a formal appeal may be filed.

B. FORMAL APPEALS (WAC 220-110-350) OF DEPARTMENT ACTIONS TAKEN PURSUANT TO RCW 77.55.021 (EXCEPT agricultural irrigation, stock watering or bank stabilization projects) or 77.55.291:
A person who is aggrieved or adversely affected by the following Department actions may request a formal review of:
(A) The denial or issuance of a Hydraulic Project Approval, or the conditions or provisions made part of a Hydraulic Project Approval;
(B) An order imposing civil penalties; or
(C) Any other 'agency action' for which an adjudicative proceeding is required under the Administrative Procedure Act, Chapter 34.05 RCW.
A request for a FORMAL APPEAL shall be in WRITING to the Department of Fish and Wildlife HPA Appeals Coordinator, shall be plainly labeled as 'REQUEST FOR FORMAL APPEAL' and shall be RECEIVED DURING OFFICE HOURS by the Department at 600 Capitol Way North, Olympia, Washington 98501-1091, within 30-days of the Department action that is being challenged. The time period for requesting a formal appeal is suspended during consideration of a timely informal appeal. If there has been an informal appeal, the deadline for requesting a formal appeal shall be within 30-days of the date of the Department's written decision in response to the informal appeal.

C. FORMAL APPEALS OF DEPARTMENT ACTIONS TAKEN PURSUANT TO RCW 77.55.021 (agricultural irrigation, stock watering or bank stabilization only), 77.55.141, 77.55.181, or 77.55.241: A person who is aggrieved or adversely affected by the denial or issuance of a Hydraulic Project Approval, or the conditions or provisions made part of a

Issue Date: September 25, 2007 | Control Number: 00000F3589-3

Project Expiration Date: June 01, 2009 | FPA/Public Notice #: N/A

Hydraulic Project Approval may request a formal appeal. The request for FORMAL APPEAL shall be in WRITING to the Hydraulic Appeals Board per WAC 259-04 at Environmental Hearings Office, 4224 Sixth Avenue SE, Building Two - Rowe Six, Lacey, Washington 98504; telephone 360/459-6327.

D. FORMAL APPEALS OF DEPARTMENT ACTIONS TAKEN PURSUANT TO CHAPTER 43.21L RCW: A person who is aggrieved or adversely affected by the denial or issuance of a Hydraulic Project Approval, or the conditions or provisions made part of a Hydraulic Project Approval may request a formal appeal. The FORMAL APPEAL shall be in accordance with the provisions of Chapter 43.21L RCW and Chapter 199-08 WAC. The request for FORMAL APPEAL shall be in WRITING to the Environmental and Land Use Hearings Board at Environmental Hearings Office, Environmental and Land Use Hearings Board, 4224 Sixth Avenue SE, Building Two - Rowe Six, P.O. Box 40903, Lacey, Washington 98504; telephone 360/459-6327.

E. FAILURE TO APPEAL WITHIN THE REQUIRED TIME PERIODS results in forfeiture of all appeal rights. If there is no timely request for an appeal, the department action shall be final and unappealable.

ENFORCEMENT: Sergeant Charron (43) P3

Habitat Biologist Craig Olds	360-902-2540		for Director WDFW

CC: E-Mail without Attachments:
All Area Habitat Biologists, WDFW
All Regional Habitat Program Managers, WDFW
All Assistant Regional Habitat Program Managers, WDFW
All Regulatory Services, WDFW

E-Mail and Hard Copy:
All Regional Enforcement Sergeants, WDFW
Ken Schlatter, Statewide Permit Coordinator, WSDOT

Attachment: WDFW Regional Habitat Program Manager List, Fresh Water Work Windows.

Washington Department of FISH and WILDLIFE

HYDRAULIC PROJECT APPROVAL

RCW 77.55.021 - Appeal pursuant to Chapter 34.05 RCW

Statewide
600 Capitol Way N
Olympia, WA 98501-1091
(360) 902-2200

Issue Date: September 25, 2007
Project Expiration Date: June 01, 2009

Control Number: 00000F3591-2
FPA/Public Notice #: N/A

PERMITTEE	AUTHORIZED AGENT OR CONTRACTOR
Washington State Department of Transportation ATTENTION: Gregor Myhr 310 Maple Park Avenue SE Olympia, WA 98504 360-705-7487	

Project Name: LWM/Debris removal, relocation, from WSDOT bridges

Project Description: LWM/Debris removal and relocation from WSDOT bridges statewide on WSDOT Rights-of-Way, Freshwater

PROVISIONS

1.TIMING LIMITATIONS: The project may begin immediately and shall be completed by June 1, 2009, provided:
a. Scheduled work will be conducted in the natural dry stream channel during summer months (June 1 - October 15).
b. If work occurs in the wetted perimeter it will be done during the attached work windows (Attachment 1).

2. NOTIFICATION PRIOR TO WORK START: The permittee or contractor shall notify the WDFW Regional Habitat Program Manager (RHPM) in the attached list of WDFW regional offices prior to starting work. Notification may be by email, facsimile (FAX), telephone, or in person. If notification is by e-mail, the AHB (if known), and the WSDOT Liaison (oldscao@dfw.wa.gov) should also be notified. Notification shall include:
a. Agency name, contact person, and telephone number.
b. Water body name.
c. Work location including road number and milepost if applicable, or comparable site location information.
d. Starting date and estimated ending date for work.
e. Control Number for the Hydraulic Project Approval.

3. ANNUAL REPORTING: WSDOT shall submit to the WDFW Habitat Program, address 600 Capitol Way N. Olympia, WA 98501, a calendar year annual report of work by February 28 of the following year, or in the final year of the HPA, prior to the expiration date. An annual report is also required if no work was conducted. The annual report shall include:
a. General: HPA Control Number, permittee, contact person, address, telephone number, date of report, time period.
b. Summary: Total number of individual projects by region and statewide.
c. Problem(s) encountered: Provision violation, notification, corrective action, impacts to fish life and water quality from problem. If the Environmental Compliance Assurance Procedure (ECAP) or similar procedure was used, what activity triggered the procedure.
d. Recommendations for improvement to best management practices and mitigation [optional].

e. List of individual projects completed: By region including water body name, road number and milepost if applicable, latitude and longitude, date duration of work, description of work.
f. The information contained in item 'e' above (individual projects completed) shall be provided in unlocked Microsoft Excel (.xls) format.

4. FISH KILL/ WATER QUALITY PROBLEM NOTIFICATION: If at any time, as a result of project activities, fish are observed in distress, a fish kill occurs, or water quality problems develop (including equipment leaks or spills), immediate action shall be made to notify Washington Military Department Emergency Management Division at 1-800-258-5990, and to the WSDOT Liaison Craig Olds, 600 Capitol Way North, MS 43200, Olympia WA 98501-1091; Telephone: 360-902-2540; FAX: 360-902-2946; Email:(oldscao@dfw.wa.gov.).

5. This HPA does NOT authorize structure (i.e., culvert, bridge, wingwall/bulkhead, etc.) or riprap installation, repair, or replacement, dredging, sediment removal (except that incidental to LWM or debris removal), channel changes, pile driving, brushing, (etc.). This HPA is for removal and/or repositioning of non-embedded LWM and/or debris only.

WATER QUALITY
6. Best Management Practices shall be implemented during all phases of the project to ensure that sediment-laden water does not enter waters of the state.

7. If flow conditions occur that may cause siltation during a project, work shall stop until the flow subsides.

8. There shall be no visible sheen from petroleum products in the receiving water as a result of the activity.

9. No petroleum products, hydraulic fluid, fresh cement, sediments, sediment-laden water, chemicals, or any other toxic or deleterious materials are allowed to enter or leach into waters of the state.

10. Where appropriate and based upon site conditions and maintenance activity to be conducted, work shall be accomplished by hand or with hand tools such as chain saws or vehicle winches. If the use of heavy equipment is necessary, equipment shall be stationed on and operate from the bridge, top of the bank, or roadway. When absolutely necessary, equipment may operate stationed on dry gravel bars at low stream flow, provided the drive mechanisms (wheels, tracks, tires, etc.) shall not enter or operate below the OHWL.

11. Equipment crossings to gain access for work shall be on roadway structures.

LARGE WOODY MATERIAL AND DEBRIS REMOVAL
12. Structures that tend to accumulate LWM/debris shall be inspected and LWM/debris removal or repositioning shall be frequent enough to prevent the build up of large debris jams. The frequency of inspection and LWM/debris removal or repositioning shall depend upon the site and weather conditions.

13. Embedded LWM/debris shall not be removed. A separate individual HPA is required to remove embedded LWM/debris.

14. LWM/debris shall be removed gradually and in a controlled manner to prevent a sudden release of any impounded water, bed, logs, other material or sediments which may result in downstream bed and bank degradation, sedimentation or flooding. Slowly removing portions of the LWM/debris and allowing the water level to go down slowly, before removing additional portions of the LWM/debris, may accomplish this.

15. If LWM must be removed, it shall be repositioned below the OHWL downstream of the bridge to provide stable, functional fish habitat. If anchoring repositioned LWM is necessary, only non-invasive streambed or stream bank anchoring techniques, such as pinning with rebar, rock drilling and cable, etc., may be used. Streambed or stream bank excavation, or removal of embedded material is not authorized. Streambed or stream bank excavation or removal of embedded LWM shall require separate, written approval from WDFW.

16. If, due to compelling safety or habitat concerns (i.e. in eddies or in areas where bank erosion is occurring), LWM cannot be repositioned within the channelized stream downstream of the structure or released to float downstream, said LWM shall be:

a. Set aside in a location that ensures availability for use in future fish habitat/ restoration projects by agencies or other entities, or
b. Disposed of away from the watercourse so that it will not reenter state waters.

In either case, prior consultation and separate, written approval from the local AHB is required before removing the LWM.

17. Smaller limb and bark debris that is removed from LWM shall be disposed of so it shall not re-enter the stream.

18. Whenever possible, material shall be lifted out with full suspension to eliminate or minimize watercourse bed and bank disturbance. Material shall not be dragged across the bed or bank, except where debris cannot be suspended above the bed and banks. Where debris cannot be suspended above the bed and banks, skid logs or similar methods shall be used to minimize bank damage.

BED LOAD MATERIAL REMOVAL
19. Bed load material be removed only in conjunction with and to facilitate LWM/debris removal. Less than 50 cubic yards of bed load material may be removed per site per year.

20. Stream banks and fish spawning areas shall not be disturbed without prior consultation with and separate, written approval from the local AHB.

21. Bed load material shall be removed with a clamshell, backhoe, or equivalent equipment. The

equipment shall be operated to minimize turbidity. During excavation, each pass with the bucket shall be complete. Dredged material shall not be stockpiled waterward of the OHWL.

22. Bed load material shall be disposed of upland so it will not reenter state waters. Bed load material shall not be placed on or over existing riparian vegetation.

23. Upon completion of the bed load material removal, the streambed shall contain no pits, potholes, or large depressions so as to avoid stranding of fish.

24. Whenever practicable, removal shall be accomplished in the dry.

25. Removal shall be accomplished by starting at the upstream end of the project boundary and working downstream.

REVEGETATION PROVISIONS
26. Alteration or disturbance of the bank and bank vegetation shall be limited to that necessary to construct the project. Within seven calendar days of project completion, all disturbed areas shall be protected from erosion using vegetation or other BMPs. Within the first planting season, the banks, including riprap areas, shall be revegetated with native or other approved woody species. Vegetative cuttings shall be planted at a maximum interval of three feet (on center) and maintained as necessary for three years to ensure 80 percent survival.

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NOTE: The previous version of the GHPA for debris removal from DOT rights-of-way (Control Number GH-D9416-04) included debris and LWM removal work on both culverts and bridges. Since the culvert work has been called out in a separate GHPA (Control Number GH-F3589-03), this approval is only for LWM/debris and bedload removal from WSDOT bridges. This approval supersedes any and all HPAs for the same type of work, including the following: GH-D9416-04, GH -F3266-02. This approval supersedes any and all General HPAs for the same type of work. This

statewide general HPA GH-F3591-02 modifies and supercedes GH-F3588-01 by modification of Provisions 2, 3 and 4.

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1/4 SEC: All	Section: 99	Township: 99	Range: 99	Latitude: N	Longitude:	County: Multiple
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Failure to comply with the provisions of this Hydraulic Project Approval could result in a civil penalty of up to one hundred dollars per day and/or a gross misdemeanor charge, possibly punishable by fine and/or imprisonment.

All Hydraulic Project Approvals issued pursuant to RCW 77.55.021 (EXCEPT agricultural irrigation, stock watering or bank stabilization projects) or 77.55.141 are subject to additional restrictions, conditions or revocation if the Department of Fish and Wildlife determines that new biological or physical information indicates the need for such action. The person(s) to whom this Hydraulic Project Approval is issued has the right pursuant to Chapter 34.04 RCW to appeal such decisions. All agricultural irrigation, stock watering or bank stabilization Hydraulic Project Approvals issued

pursuant to RCW 77.55.021 may be modified by the Department of Fish and Wildlife due to changed conditions after consultation with the person(s) to whom this Hydraulic Project Approval is issued: PROVIDED HOWEVER, that such modifications shall be subject to appeal to the Hydraulic Appeals Board established in RCW 77.55.301.

APPEALS INFORMATION

If you wish to appeal the issuance or denial of, or conditions provided in a Hydraulic Project Approval, there are informal and formal appeal processes available.

A. INFORMAL APPEALS (WAC 220-110-340) OF DEPARTMENT ACTIONS TAKEN PURSUANT TO RCW 77.55.021, 77.55.141, 77.55.181, and 77.55.291: A person who is aggrieved or adversely affected by the following Department actions may request an informal review of:

(A) The denial or issuance of a Hydraulic Project Approval, or the conditions or provisions made part of a Hydraulic Project Approval; or

(B) An order imposing civil penalties. A request for an INFORMAL REVIEW shall be in WRITING to the Department of Fish and Wildlife HPA Appeals Coordinator, 600 Capitol Way North, Olympia, Washington 98501-1091 and shall be RECEIVED by the Department within 30 days of the denial or issuance of a Hydraulic Project Approval or receipt of an order imposing civil penalties. If agreed to by the aggrieved party, and the aggrieved party is the Hydraulic Project Approval applicant, resolution of the concerns will be facilitated through discussions with the Area Habitat Biologist and his/her supervisor. If resolution is not reached, or the aggrieved party is not the Hydraulic Project Approval applicant, the Habitat Technical Services Division Manager or his/her designee shall conduct a review and recommend a decision to the Director or his/her designee. If you are not satisfied with the results of this informal appeal, a formal appeal may be filed.

B. FORMAL APPEALS (WAC 220-110-350) OF DEPARTMENT ACTIONS TAKEN PURSUANT TO RCW 77.55.021 (EXCEPT agricultural irrigation, stock watering or bank stabilization projects) or 77.55.291:
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(C) Any other 'agency action' for which an adjudicative proceeding is required under the Administrative Procedure Act, Chapter 34.05 RCW.

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C. FORMAL APPEALS OF DEPARTMENT ACTIONS TAKEN PURSUANT TO RCW 77.55.021 (agricultural irrigation, stock watering or bank stabilization only), 77.55.141, 77.55.181, or 77.55.241: A person who is aggrieved or adversely affected by the denial or issuance of a Hydraulic Project Approval, or the conditions or provisions made part of a Hydraulic Project Approval may request a formal appeal. The request for FORMAL APPEAL shall be in WRITING to the Hydraulic Appeals Board per WAC 259-04 at Environmental Hearings Office, 4224 Sixth Avenue SE, Building Two - Rowe Six, Lacey, Washington 98504; telephone 360/459-6327.

D. FORMAL APPEALS OF DEPARTMENT ACTIONS TAKEN PURSUANT TO CHAPTER 43.21L RCW: A person who is aggrieved or adversely affected by the denial or issuance of a Hydraulic Project Approval, or the conditions or provisions made part of a Hydraulic Project Approval may request a formal appeal. The FORMAL APPEAL shall be in accordance with the provisions of Chapter 43.21L RCW and Chapter 199-08 WAC. The request for FORMAL APPEAL shall be in WRITING to the Environmental and Land Use Hearings Board at Environmental Hearings Office, Environmental and Land Use Hearings Board, 4224 Sixth Avenue SE, Building Two - Rowe Six, P.O. Box 40903, Lacey, Washington 98504; telephone 360/459-6327.

E. FAILURE TO APPEAL WITHIN THE REQUIRED TIME PERIODS results in forfeiture of all appeal rights. If there is no timely request for an appeal, the department action shall be final and unappealable.

ENFORCEMENT: Sergeant Charron (43) P3

Habitat Biologist Craig Olds	360-902-2540		for Director WDFW

CC: E-Mail without Attachments:
All Area Habitat Biologists, WDFW
All Regional Habitat Program Managers, WDFW
All Assistant Regional Habitat Program Managers, WDFW
All Regulatory Services, WDFW

E-Mail and Hard Copy:
All Regional Enforcement Sergeants, WDFW
Ken Schlatter, Statewide Permit Coordinator, WSDOT

Attachment: WDFW Regional Habitat Program Manager List, Fresh Water Work Windows.

Washington Department of FISH and WILDLIFE

HYDRAULIC PROJECT APPROVAL

RCW 77.55.021 - Appeal pursuant to Chapter 34.05 RCW

Statewide
600 Capitol Way N
Olympia, WA 98501-1091
(360) 902-2200

Issue Date: September 25, 2007
Project Expiration Date: June 01, 2009

Control Number: 00000F3588-3
FPA/Public Notice #: N/A

PERMITTEE	AUTHORIZED AGENT OR CONTRACTOR
Washington Department of Transportation ATTENTION: Gregor Myhr 310 Maple Park Drive SE Olympia, WA 98504 360-705-7487	

Project Name: Maintenance of Existing Fishway Facilities

Project Description: Fishway facility maintenance statewide on WSDOT Rights of Way

PROVISIONS

1.TIMING LIMITATIONS: The project may begin immediately and shall be completed by June 1, 2009, provided:

a. Scheduled work will be conducted in the natural dry stream channel during summer months (June 1 - October 15).
b. If work occurs in the wetted perimeter it will be done during the attached work windows (Attachment 1).

2. NOTIFICATION PRIOR TO WORK START: The permittee or contractor shall notify the WDFW Regional Habitat Program Manager (RHPM) in the attached list of WDFW regional offices prior to starting work. Notification may be by email, facsimile (FAX), telephone, or in person. If notification is by e-mail, the AHB (if known), and the WSDOT Liaison (oldscao@dfw.wa.gov) should also be notified. Notification shall include:
a. Agency name, contact person, and telephone number.
b. Water body name.
c. Work location including road number and milepost if applicable, or comparable site location information.
d. Starting date and estimated ending date for work.
e. Control Number for the Hydraulic Project Approval.

3. ANNUAL REPORTING: WSDOT shall submit to the WDFW Habitat Program, address 600 Capitol Way N. Olympia, WA 98501, a calendar year annual report of work by February 28 of the following year, or in the final year of the HPA, prior to the expiration date. An annual report is also required if no work was conducted. The annual report shall include:
a. General: HPA Control Number, permittee, contact person, address, telephone number, date of report, time period.
b. Summary: Total number of individual projects by region and statewide.
c. Problem(s) encountered: Provision violation, notification, corrective action, impacts to fish life and water quality from problem. If the Environmental Compliance Assurance Procedure (ECAP) or similar procedure was used, what activity triggered the procedure.
d. Recommendations for improvement to best management practices and mitigation [optional].

e. List of individual projects completed: By region including water body name, road number and milepost if applicable, latitude and longitude, date duration of work, description of work.
f. The information contained in item "e" above (individual projects completed) shall be provided in unlocked Microsoft Excel (.xls) format.

4. FISH KILL/ WATER QUALITY PROBLEM NOTIFICATION: If at any time, as a result of project activities, fish are observed in distress, a fish kill occurs, or water quality problems develop (including equipment leaks or spills), immediate action shall be made to notify Washington Military Department Emergency Management Division at 1-800-258-5990, and to the WSDOT Liaison Craig Olds, 600 Capitol Way North, MS 43200, Olympia WA 98501- 1091; Telephone: 360-902-2540; FAX: 360-902-2946; Email:(oldscao@dfw.wa.gov.).

5. All work (repair, retrofits, alterations, maintenance, etc.) shall be scheduled and accomplished only as directed by WDFW in response to individual fishway repair guidance.

WATER QUALITY

6. Best Management Practices shall be implemented during all phases of the project to ensure that sediment-laden water does not enter waters of the state.

7. If flow conditions occur that may cause siltation during a project, work shall stop until the flow subsides.

8. Water removed from within the work area shall be routed to an area landward of the OHWL to allow removal of fine sediment and other contaminants prior to being discharged to the waters of the state.

9. Water discharged back to the receiving water shall comply with state surface water quality standards.

10. The de-watering discharge point shall be designed and operated so as not to cause erosion or scour in the stream channel, banks or vegetation.

11. All material excavated from fishways shall be completely removed and disposed of at an upland location. No material shall be side cast into adjacent wetlands, or other waters of the state, unless authorized by WDFW for stream habitat improvement.

12. There shall be no visible sheen from petroleum products in the receiving water as a result of the activity.

13. No petroleum products, hydraulic fluid, fresh cement, sediments, sediment-laden water, chemicals, or any other toxic or deleterious materials are allowed to enter or leach into waters of the state.

14. Fresh concrete or concrete byproducts shall not be allowed to enter the stream at any time

during this project. All forms used for concrete shall be completely sealed to prevent the possibility of fresh concrete from getting into the stream.

15. All concrete shall be allowed to cure a minimum of seven (7) days before contact with water. The waters of the state shall not come in contact with the concrete structure while the concrete is curing. Any dewatering required from a contained area with curing concrete shall be discharged to land with no possible entry to surface waters.

BYPASS PROVISIONS

16. In the event that only hand tools (come-along, chain saw winch, etc.) are used to conduct the activity, no bypass is necessary.

17. A temporary bypass to divert flow around the work area shall be in place prior to initiation of work in the wetted perimeter except as specified above (Provision #16).

18. Sandbagging and hard pipe flumes or pumping shall be the approved bypass method. Other methods may be utilized if a positive separation can be maintained between the work area and waters of the state.

19. In the event that maintenance work involves the use of equipment other than hand tools, temporary filter fabric, straw bale, or pea gravel-filled burlap bag check dam(s) shall be installed downstream prior to starting work in flowing waters. Accumulated sediments shall be removed during the project and prior to removing the check dam(s) or temporary sediment trap(s) after completion of work.

20. A sandbag revetment or similar device shall be installed at the bypass inlet to divert the entire flow through the bypass.

21. A sandbag revetment or similar device shall be installed at the downstream end of the bypass to prevent backwater from entering the work area.

22. In the event a hard pipe bypass is used, it shall be of sufficient size to pass all flows and debris for the duration of the project.

23. Prior to releasing the water flow to the project area, all bank protection or armoring shall be completed.

24. Upon completion of the project, all material used in the temporary bypass shall be removed from the site and the site returned to pre-project or improved conditions.

25. Reintroduction of water to the channel shall be done gradually and in stages so as to minimize the mobilization of sediments and fines into downstream waters.

FISH REMOVAL AND SCREENING

26. The permittee shall capture and safely move food fish, game fish, and other fish life from the job site. The permittee shall have fish exclusion, fish capture, and transportation equipment ready and on the job site. Captured fish shall be immediately and safely transferred to free-flowing water downstream of the project site. The permittee may request that WDFW assist in capturing and safely moving fish life from the job site to free-flowing water, and assistance may be granted if personnel are available.

27. Any device used for diverting water from a fish-bearing stream shall be equipped with a fish guard to prevent passage of fish into the diversion device pursuant to RCW 77.57.70. The pump intake shall be screened with 3/32-inch mesh to prevent fish from entering the system. The screened intake shall consist of a facility with enough surface area to ensure that the velocity through the screen is less than 0.4 feet per second. Screen maintenance shall be adequate to prevent injury or entrapment to juvenile fish and the screen shall remain in place whenever water is withdrawn from the stream through the pump intake.

EQUIPMENT LIMITATIONS

28. Machinery and equipment used during maintenance work shall be serviced, fueled, and maintained on uplands in order to prevent contamination to surface waters. When practicable, fueling equipment and vehicles should be more than 200 feet away from waters of the state (except small equipment necessary as part of the BMPs for the project e.g., water pumps). Fueling areas shall be provided with adequate spill containment.

29. Equipment used for a project shall be free of external petroleum-based products while working around the stream. Accumulation of soils or debris shall be removed from the drive mechanisms (wheels, tires, tracks, etc.) and undercarriage of equipment prior to its working below the OHWL. Equipment shall be checked daily for leaks and any necessary repairs shall be completed prior to commencing work activities around the stream.

30. Where appropriate, and based upon site conditions and maintenance activity to be conducted, work shall be accomplished by hand or with hand tools such as chain saws and chain saw or vehicle winches. If the use of heavy equipment is necessary equipment shall be stationed on and operate from the top of the bank or roadway. When absolutely necessary, equipment may operate stationed on dry gravel bars at low stream flow.

31. Equipment crossings to gain access for work shall be on roadway structures or at established fords only. Equipment crossings at established fords shall be kept to the minimum necessary to accomplish the project.

32. Equipment used for this project may operate below the OHWL, provided the drive mechanisms(wheels, tracks, tires, etc.) shall not enter or operate below the OHWL unless the stream is dry or a bypass is in place (except fords).

33. Equipment crossings of the stream (except fords) shall not be conducted without separate

written approval from WDFW.

DEBRIS/SEDIMENT REMOVAL

34. No more than 50 cubic yards of material per project per year shall be removed without separate written approval from WDFW.

35. If LWM must be removed, it shall be repositioned below the OHWL downstream of the fishway to provide stable, functional fish habitat. If anchoring repositioned LWM is necessary, only non-invasive streambed or stream bank anchoring techniques, such as pinning with rebar, rock drilling and cable, etc., may be used. Streambed or stream bank excavation, or removal of embedded material is not authorized. Streambed or stream bank excavation or removal of embedded LWM shall require separate, written approval from WDFW.

36. If, due to compelling safety or habitat concerns (i.e. in eddies or in areas where bank erosion is occurring), LWM cannot be repositioned within the channelized stream downstream of the structure or released to float downstream, said LWM shall be:
a. Set aside in a location that ensures availability for use in future fish habitat restoration projects by agencies or other entities, or
b. disposed of away from the watercourse so that it will not reenter state waters.

In either case, prior consultation and separate, written approval from the local AHB is required before removing the LWM.

37. Structures that tend to accumulate debris shall be inspected and debris removal and/or repositioning shall be frequent enough to prevent the build up of large debris jams. The frequency of inspection and debris removal and/or repositioning shall depend upon the site and weather conditions.

STRUCTURAL MAINTENANCE (STRUCTURE REPAIR/REPLACEMENT)

38. The repair or replacement of concrete weirs, sills, walls, log or rock controls and stop logs and guides shall be allowed. Repair or replacement shall be to return the structure to its originally installed design.

39. All lumber to be used in the repair of the fishway (including log controls) shall not contain creosote, pentachlorophenol, or other preservatives or substances that are toxic to fish. All lumber used shall comply with treated wood standards identified in the Western Wood Preservers Institute Guidelines: (http://www.deq.state.mi.us/documents/deq-lwm-nfip-WoodPreservativeBMPManualFinalCopy.pdf).

REVEGETATION PROVISIONS

40. Alteration or disturbance of the bank and bank vegetation shall be limited to that necessary to construct the project. Within seven calendar days of project completion, all disturbed areas shall be

protected from erosion using vegetation or other BMPs. Within the first planting season, the banks, including riprap areas, shall be revegetated with native or other approved woody species. Vegetative cuttings shall be planted at a maximum interval of three feet (on center) and maintained as necessary for three years to ensure 80 percent survival.

41. Existing riparian vegetation outside of the work area shall not be removed or disturbed.

42. Care shall be used when accessing the site to minimize the disturbance of riparian vegetation. Riparian vegetation shall be straddled with heavy equipment or be pruned as necessary without damaging the roots, to allow the operation of heavy equipment.

NOTE: This Hydraulic Project Approval pertains only to the provisions of the Washington State Fisheries and Wildlife Codes. It is the permittee's responsibility to apply for and obtain any additional authorization from other public agencies (local, state and/or federal) that may be necessary for this project.

NOTE: These activities are proposed in state waters that contain federally threatened or endangered species of fish. Compliance with the provisions of this approval does not ensure compliance with the Endangered Species Act. For further information, contact the National Marine Fisheries Service at (360) 753-9090 and/or the United States Fish and Wildlife Service at (360) 753 -9564.

NOTE: This approval supersedes any and all General HPAs for the same type of work. This statewide general HPA GH-F3588-03 modifies and supercedes GH-F3588-02 by modification of Provisions 2, 3 and 4.

NOTE: In the event that the applicant cannot comply with the provisions of this approval due to site specific or other concerns, separate written approval may be sought from the local Area Habitat Biologist for the project.

DEFINITIONS

As-built Condition: The original design and/or constructed features of the structure or facility including the line, depth, grade, toe of slope and cross-section, or same as constructed/permitted.

Channelized stream: A man-made feature that intercepts and conveys a natural stream parallel or perpendicular to the roadway structure. If a ditch conveys water through a jurisdictional wetland it will be considered a channelized stream.

Culvert: Conduit or pipe used as an artificial channel under a roadway or embankment to maintain flow from a natural stream, channel or drainage ditch.

Debris: Small woody material and large and small inorganic material including trash, tires and garbage etc. This definition does not include new construction waste or woody debris resulting from beaver activity. Debris does not include woody debris placed in channels for an environmentally

beneficial purpose.

Ditch: Man-made (i.e. not a channelized stream) conveyance system that collects, carries, holds, inhibits or diverts the movement of stormwater or groundwater from the facility or adjacent properties. Determinations for what is a stream, channelized stream, or ditch for HPA purposes will be made by the WDFW Area Habitat Biologist.

Embedded: Condition in which debris or large woody material is buried by bed material exceeding 50 cubic yards.

Environmental Compliance Assurance Procedure: WSDOT communication protocol to monitor and measure compliance performance.

Fill Material: Any material that replaces an aquatic area with dry land or changes the bottom elevation of a water body. Examples of fill that might be used in channel maintenance include gravel, rock, riprap, sand, wood chips, (etc.).

Fish Bearing Stream: Any state waters (river, creek, stream, channel), fresh, salt or estuarine, that contains any fish will be considered a fish-bearing stream. If there is a question regarding whether a stream is fish bearing or not, the local WDFW Area Habitat Biologist will make the determination.

Fishway Facility: Any facility or device that is designed to enable fish to effectively pass around or through an obstruction without undue stress or delay.

Incidental Fallback: The small amount of material that may fall off of a shovel or excavator bucket back into substantially the same place from which it was lifted. Fallback occurs incidental to excavation and does not include the movement of material during grading activities.

Large Woody Material (LWM): Trees or tree parts larger than four inches in diameter and longer than six feet in length, including rootwads (WAC 220 -110 020 (48)). This material is located wholly or partially waterward of the ordinary high water line (OHWL).

Maintenance: Activities that (a) are conducted on currently serviceable structures, facilities, and equipment; and (b) involve no expansion of or change in use of such structures, facilities, and equipment beyond those that existed previously; and (c) do not result in significant negative hydrological impacts.

Scheduled Maintenance: Budgeted work, performed routinely on a regular basis. It is intended to maintain the roadway facility/element so that it substantially retains its original intended use and function.

Unscheduled Maintenance: Unanticipated activities that occur due to unusual weather condition, vandalism, accident, (etc.). Work activities are conducted similar to routine maintenance activities except that work is unanticipated and poses an imminent danger to the existing structures or traveling public.

Navigable Waters (Reference 33 CFR): A list of navigable waters for the state of Washington can be found at the following web site managed by the Corps: (http://www.nws.usace.army.mil/reg.html).

Ordinary High Water Line (OHWL): The mark on the shores of all waters that will be found by examining the bed and banks and ascertaining where the presence and action of waters are so common and usual and so long continued in ordinary years, as to mark upon the soil or vegetation a character distinct from that of the abutting upland provided that in any area where the ordinary high water line cannot be found the ordinary high water line adjoining saltwater shall be the line of mean higher high water and the ordinary high water line adjoining freshwater shall be the elevation of the mean annual flood (WAC 220-110-020 (57)).

Permittee: The entity to whom the permit is issued.

Riprap: Material used for bank protection that does not include waste concrete or asphalt material.

Sediment(s): Settled particulate matter located in the predominant biologically active aquatic zone, or exposed to the water column. Sediment also includes settled particulate matter exposed by human activity (e.g., dredging) to the biologically active aquatic zone or to the water column. (WAC 173 -204.200 (26)).

Serviceable Condition: A structure or element of the structure that can be repaired, maintained, or replaced without the redevelopment of the whole right of way structure.

Waters of the State: Waters of the state or "state waters" means all salt waters and fresh waters waterward of ordinary high water lines and within the territorial boundaries of the state (WAC 220-110-020 (85)).

Wetted Perimeter: The areas of a watercourse covered with water, flowing or non-flowing (WAC 220-110-020-(88)).

PROJECT LOCATIONS

Location #1

WORK START: September 25, 2007					WORK END: June 01, 2009	
WRIA: 99.0000	Waterbody: Various				Tributary to: Statewide	
1/4 SEC: All	Section: 99	Township: 99	Range: 99	Latitude: N	Longitude:	County: Multiple
Location #1 Driving Directions						

APPLY TO ALL HYDRAULIC PROJECT APPROVALS

This Hydraulic Project Approval pertains only to those requirements of the Washington State Hydraulic Code, specifically Chapter 77.55 RCW (formerly RCW 77.20). Additional authorization from other public agencies may be necessary for this project. The person(s) to whom this Hydraulic Project Approval is issued is responsible for applying for and obtaining any additional authorization from other public agencies (local, state and/or federal) that may be necessary for this project.

This Hydraulic Project Approval shall be available on the job site at all times and all its provisions followed by the person(s) to whom this Hydraulic Project Approval is issued and operator(s) performing the work.

This Hydraulic Project Approval does not authorize trespass.

The person(s) to whom this Hydraulic Project Approval is issued and operator(s) performing the work may be held liable for any loss or damage to fish life or fish habitat that results from failure to comply with the provisions of this Hydraulic Project Approval.

Failure to comply with the provisions of this Hydraulic Project Approval could result in a civil penalty of up to one hundred dollars per day and/or a gross misdemeanor charge, possibly punishable by fine and/or imprisonment.

All Hydraulic Project Approvals issued pursuant to RCW 77.55.021 (EXCEPT agricultural irrigation, stock watering or bank stabilization projects) or 77.55.141 are subject to additional restrictions, conditions or revocation if the Department of Fish and Wildlife determines that new biological or physical information indicates the need for such action. The person(s) to whom this Hydraulic Project Approval is issued has the right pursuant to Chapter 34.04 RCW to appeal such decisions. All agricultural irrigation, stock watering or bank stabilization Hydraulic Project Approvals issued pursuant to RCW 77.55.021 may be modified by the Department of Fish and Wildlife due to changed conditions after consultation with the person(s) to whom this Hydraulic Project Approval is issued: PROVIDED HOWEVER, that such modifications shall be subject to appeal to the Hydraulic Appeals Board established in RCW 77.55.301.

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ENFORCEMENT: Sergeant Charron (43) P3

Habitat Biologist Craig Olds	360-902-2540		for Director WDFW

CC: E-Mail without Attachments:
All Area Habitat Biologists, WDFW
All Regional Habitat Program Managers, WDFW
All Assistant Regional Habitat Managers, WDFW
All Regulatory Services, WDFW
Tom Burns, Statewide Fish Passage Habitat Biologist, WDFW

E-Mail and Hard Copy:
All Regional Enforcement Sergeants, WDFW
Ken Schlatter, WSDOT Statewide Permit Coordinator

Attachments: WDFW Regional Habitat Program Manager List, Fresh Water Work Windows.

Washington Department of FISH and WILDLIFE

HYDRAULIC PROJECT APPROVAL

RCW 77.55.021 - Appeal pursuant to Chapter 34.05

Statewide
600 Capitol Way N
Olympia, WA 98501-1091
(360) 902-2200

Issue Date: January 22, 2008
Project Expiration Date: January 21, 2013

Control Number: 111325-1
FPA/Public Notice #: N/A

PERMITTEE	AUTHORIZED AGENT OR CONTRACTOR
Washington Department of Transportation ATTENTION: Gregor Myhr 310 Maple Park Drive Olympia, WA 98504 360-705-7487 Fax: 360-705-6833	

Project Name: Statewide Bridge and Ferry Terminal Maintenance

Project Description: Statewide Bridge and Ferry Terminal Cleaning, Painting, and General Maintenance and Repair.

PROVISIONS

PROVISIONS APPLICABLE TO ALL WORK ACTIVITIES UNLESS PROVIDED OTHERWISE IN SECTIONS A THROUGH I ARE:

1. TIMING LIMITATIONS: The project may begin immediately and shall be completed by January 16, 2013 provided: The specific timing listed in Section shall be followed.

2. Except as modified by this HPA work shall be accomplished per plans and specifications submitted by WSDOT as application and accepted by WDFW (December 3, 2007) for this HPA entitled:

a. WSDOT Environmental Compliance Assurance Procedure (ECAP) for Maintenance Environmental Procedures Manual Section 790 (3). For construction projects use ECAP procedures in WSDOT Construction Manual Secion1-2.2K(1).

b. The Best Management Practices Field Guide consistent with the most recent version of the Regional Road Maintenance Endangered Species Act Program Guidelines (RRMP) Part 2: Best Management Practices. For construction projects, the requirements of Section 1-07.15 and 1-07.15(1) of WSDOT Standard Specifications.

These plans (Provisions 2a and 2b), including this HPA, reflect the requirements of Chapter 220-110 WAC. These plans reflect mitigation procedures to avoid impacts to fish resources. A copy of these plans shall be available on site during work.

3. NOTIFICATION PRIOR TO WORK START: The permittee or contractor shall notify the WDFW Regional Habitat Program Manager (RHPM, Contact List follows Section I, below) prior to starting work. Notification may be by email, facsimile (FAX), telephone, or in person. If notification is by e-mail, the AHB (if known), and the WSDOT Liaison (oldscao@dfw.wa.gov) should also be notified. Notification shall include:
a. Agency name, contact person, and telephone number.
b. Water body name.

c. Work location including road number and milepost if applicable, or comparable site location information.
d. Starting date and estimated ending date for work.
e. Control Number for the Hydraulic Project Approval.

4. FISH KILL/ WATER QUALITY PROBLEM NOTIFICATION: If at any time, as a result of project activities, fish are observed in distress, a fish kill occurs, or water quality problems develop (including equipment leaks or spills), immediate notification shall be made to the Washington Military Department Emergency Management Division at 1-800-258-5990, and to the WSDOT Liaison Craig Olds, 600 Capitol Way North, MS 43200, Olympia WA 98501- 1091; Telephone: 360-902-2540; FAX: 360-902-2946; Email: (oldscao@dfw.wa.gov.).

5. Riparian vegetation (streamside or shoreline) within 200 feet perpendicular to the Ordinary High Water Line (OHWL) and adjacent to the structure shall not be damaged. Within the riparian area existing parking lots and open managed fields and lots may be used for staging work.

6. Cleaned debris and other polluting substances from this project shall be collected and then contained and deposited above the limits of flood water or extreme high tide in a disposal site that has the appropriate regulatory approval. No debris and substances shall be placed in road drainages, wetlands, riparian (streamside or shoreline) areas, or on adjacent land where they may erode into state waters. No petroleum products, hydraulic fluids, chemicals, or any other polluting substances shall be allowed to enter state waters.

7. Washing shall be done with clean water. No detergents or other cleaning agents shall be used except:

a. A 5.25% sodium hypochlorite solution may be directly applied onto areas of bird guano or fungus growth remaining after removal and any pressure washing of bulk deposit or growth. The sodium hypochlorite solution shall not be used as an additive to the water used for pressure washing. Wash water associated with the use of sodium hypochlorite must be fully contained and shall not be allowed to enter state waters.

b. A degreaser on an absorbent material may be used to remove residual grease after hand cleaning the surface, provided none of this material shall enter states water.

8. The use of wood treated with creosote or pentachlorophenol is not authorized.

9. All treated wood to be used for these projects shall meet or exceed the most current standards established in: "Best Management Practices for the Use of Treated Wood in Aquatic Environments" developed by the Western Wood Preservers Institute. Certification that the wood material was produced according to these BMPs shall be presented upon request by WDFW.

10. Any deployed containment, boom or filter structure shall be routinely inspected and repaired as necessary to ensure its function. Debris and substances collected in the containment, boom or filter structure shall be removed from the structure at least daily, whenever accumulation place the

structure at risk, and before relocation or the removal of the structure.

11. ANNUAL REPORTING: WSDOT shall submit to the WDFW Habitat Program, 600 Capitol Way N. Olympia, WA 98501-1091, a calendar year annual report of work conducted under approval of this HPA by February 28 of the following year, or in the final year of the HPA, prior to the expiration date. An annual report is also required if no work was conducted. The annual report shall include:

a. General: HPA Control Number, permittee, contact person, address, telephone number, date of report, time period.
b. Summary: Total number of individual projects by region and statewide.
c. Problem(s) encountered: Provision violation, notification, corrective action, impacts to fish life and water quality from problem. If the Environmental Compliance Assurance Procedure (ECAP) or similar procedure was used, what activity triggered the procedure.
d. Recommendations for improvement to best management practices and mitigation [optional].
e. List of individual projects completed: By region including water body name, road number and milepost if applicable, latitude and longitude, date duration of work, description of work.
f. The information contained in item "e" above (individual projects completed) shall be provided in unlocked Microsoft Excel (.xls) format.

12. WORK SITE RESTORATION: Upon project completion all temporary work structures, devices, equipment, materials, man-made debris and wastes from the project shall be completely removed from within the OHWL, adjacent shoreline, and riparian areas.

Nine separate work activities are included in Sections A through I and include:

A.BRIDGE AND FERRY TERMINAL DECK AND DRAIN CLEANING.
B.BRIDGE CLEANING AND WASHING.
C.BRIDGE PAINTING, INCLUDING PREPARATORY CLEANING, WASHING, AND ABRASIVE BLASTING.
D.BRIDGE GENERAL MAINTENANCE AND REPAIR.
E.BRIDGE AND FERRY TERMINAL DECK OVERLAY REPLACEMENT.
F.FERRY TERMINAL CLEANING, WASHING, AND MARINE GROWTH REMOVAL.
G.FERRY TERMINAL PAINTING, INCLUDING PREPARATORY CLEANING, WASHING, ABRASIVE BLASTING, AND MARINE GROWTH REMOVAL.
H.FERRY TERMINAL GENERAL MAINTENANCE AND REPAIR.
I.BRIDGE SPOT CLEANING.

SECTION A

PROJECT DEFINITION: BRIDGE AND FERRY TERMINAL DECK AND DRAIN CLEANING: This work occurs frequently for bridge and ferry terminal safety and appearance and includes sweeping and/or vacuuming the deck, sidewalks, gutters, and drains. The only wash water that may enter state waters is direct drain flushing water after dry cleaning methods have been used in the drains.

1. TIMING LIMITATIONS: Work may occur year -around.

2. NOTIFICATION PRIOR TO STARTING WORK and ANNUAL REPORTING are not required for this work.

3. No work or equipment use shall occur below the ordinary high water line (OHWL) or affect the bed of state waters.

4. The deck shall first be cleaned using dry methods and equipment (scraping, sweeping, vacuuming) that will prevent debris and substances from entering state waters.

5. Cleaned debris, substances, and/or deck wash water shall not enter state waters through deck drains.

6. After cleaning operations have been completed, debris accumulations remaining in the drains may be flushed with clean water.

SECTION B

PROJECT DEFINITION: BRIDGE CLEANING AND WASHING: This work is bridge superstructure cleaning and washing required to prevent deterioration. First dry cleaning using scraping, sweeping, and vacuuming methods and equipment is completed. Then the superstructure is washed. The wash water may enter state waters. This work is not involved with preparation for structure painting.

1. TIMING LIMITATIONS: Work shall only occur during the following times:

a. West of the Cascade Mountain Crest: November 1 to May 31.
b. East of the Cascade Mountain Crest: December 1 to June 30.

2. No work or equipment use shall occur below the ordinary high water line (OHWL) or shall affect the bed of state waters.

3. The bridge shall first be cleaned using dry methods and equipment (scraping, sweeping, vacuuming) that will prevent debris and substances from entering state waters.

4. Washing shall occur with the minimum water pressure necessary to accomplish the work to prevent existing paint from being removed and entering state waters.

5. Cleaned debris, substances, and/or deck wash water shall not enter state waters through deck drains.

6. After dry cleaning methods have been completed debris accumulations remaining in the drains may be flushed with clean water.

SECTION C

PROJECT DEFINITION: BRIDGE PAINTING, INCLUDING PREPARATORY CLEANING, WASHING, AND ABRASIVE BLASTING: This painting work includes preparatory dry cleaning the superstructure to be painted using scraping, sweeping, and vacuuming methods and equipment. A debris and paint collection containment and water filter structure is required. After dry cleaning, washing of the superstructure to be painted is done with high pressure equipment followed by selective areas abrasive blasting. The filtered wash water may enter state waters.

1. TIMING LIMITATIONS:

a. Saltwater: If the bridge is less than fifty (50) feet in elevation above the water and the project includes a containment or filter structure or a temporary floating or pier mounted work platform that would result in temporary new area shading of eelgrass, kelp, and/or other intertidal wetland vascular plants longer than 72 hours, the shading part of the work shall only occur from October 1 to April 30 to prevent shading impacts to such saltwater vegetation habitat.

b. Freshwater: Work may occur year-around.

2. No work or equipment use shall occur below the ordinary high water line (OHWL) or shall affect the bed of state waters, except the use of temporary floating or pier mounted work platform.

3. No disturbance to the stream banks or shoreline shall occur when placing, using, or removing a temporary floating or pier mounted work platform.

4. Any temporary floating platform shall not ground on the bed of state waters.

5. No temporary floating platform anchoring or pier mounted work platform shall occur in freshwater that would disturb fish spawning areas or in saltwater that would disturb eelgrass, kelp, and/or other intertidal wetland vascular plants.

6. The bridge shall first be cleaned using dry methods and equipment (scraping, sweeping, vacuuming) that will prevent debris and substances from entering state waters.

7. Wet method work wash water and debris resulting from pressure washing, including but not restricted to dirt and old paint chips, shall be filtered through a filter structure with a minimum # 100 sieve.

8. Dry method work that would result in debris and substances entering state waters, including but not restricted to dirt, abrasive blasting medium, old paint chips, and new paint, shall include a containment structure capable of collecting all such debris and substances.

9. Cleaned debris, substances, and/or deck wash water shall not enter state waters through deck drains.

10. After dry cleaning methods have been completed debris accumulations remaining in the drains may be flushed with clean water.

SECTION D

PROJECT DEFINITION: BRIDGE GENERAL MAINTENANCE AND REPAIR: This work is to maintain the bridge structure and is maintenance, repair, or replacement of structure components above state waters. This work does not include new construction, replacement or expansion of the existing structure. The work may include use of temporary floating platform, temporary work or jacking platforms in the dry, as provided below:

1. TIMING LIMITATIONS:

a. Saltwater: If the structure is less than fifty (50) feet in elevation above the water and the project includes a containment or filter structure or a temporary floating platform that would result in temporary new area shading of eelgrass, kelp, and/or other intertidal wetland vascular plants longer than 72 hours, the shading part of the work shall only occur from October 1 to April, to prevent shading impacts to such saltwater vegetation habitat. Temporary work or jacking platforms located on the bed below the OHWL may only be constructed during the applicable fish life work windows (Allowable Forage Fish Work Window, Attachment 1). Pier-mounted temporary work or jacking platforms may be constructed and used year around.

b. Freshwater: Work may occur year-around except: Temporary work or jacking platform located on the streambed below the OHWL may only be constructed during the applicable fish life work windows (Allowable Freshwater Work Window, Attachment 2). Pier-mounted temporary work or jacking platform may be constructed and used year around.

2. NOTIFICATION PRIOR TO STARTING WORK is not required for this work.

3. No work or equipment use shall occur below the ordinary high water line (OHWL) or shall affect the bed of state waters, except for the use of one or more temporary floating platform, temporary work or jacking platform.

4. No disturbance to the stream bed, banks or shoreline shall occur when placing or removing temporary platforms.

5. Any temporary floating platform shall not ground on the bed of state waters.

6. No temporary floating platform anchoring or temporary work or jacking platform construction shall occur in freshwater that would disturb fish spawning areas or in saltwater that would disturb eelgrass, kelp, and/or other intertidal wetland vascular plants.

7. Work that would result in debris and substances entering state waters shall include a containment structure capable of collecting all such debris and substances.

SECTION E

PROJECT DEFINITION: BRIDGE AND FERRY TERMINAL DECK OVERLAY REPLACEMENT: This work includes removal and replacement of existing concrete or asphalt overlay of the deck road surface, gutters, and sidewalks only where a structurally sound subsurface exists that will prevent existing or new overlay material from entering state waters. A debris, material, and substance collection containment structure is required if any of these materials may enter state waters. This work does not allow: Debris, materials, or substances entering state waters; new construction activities, or replacement of stringers and/or other structural supports.

1. TIMING LIMITATIONS: Work may occur year-around.

2. No work or equipment use shall occur below the ordinary high water line (OHWL) or shall affect the bed of state waters.

3. An existing structurally sound impervious subsurface shall be required to prevent existing deck material and new surfacing material from entering state waters.

4. During physical or hydraulic removal of the existing surface, the water and all removed debris and substances shall be fully contained to prevent them from entering state waters.

5. Bridge drains shall be blocked during existing surface removal and new surface installation and shall prevent water, debris, and substances from entering state waters.

6. New overlay material shall not be allowed to enter state waters.

SECTION F

PROJECT DEFINITION: FERRY TERMINAL CLEANING, WASHING, AND MARINE GROWTH REMOVAL: This work is ferry terminal superstructure cleaning, washing and marine growth removal. This work is not involved with preparation for structure painting. This work entails first dry cleaning the superstructure using scraping, sweeping, and vacuuming, then washing of the superstructure. The wash water may enter state waters. The work may include use of a temporary floating work platform for marine growth removal as provided below:

1. TIMING LIMITATIONS:

a. SALTWATER VEGETATION PROTECTION: If the project would result in temporary new shading of eelgrass, kelp, and/or other intertidal wetland vascular plants longer than 72 hours, the work that produces the shadow shall only occur from October 1 through April 30 to prevent shading impacts to saltwater vegetation fish habitat.

b. JUVENILE SALMONID MIGRATION PROTECTION: If a temporary floating work platform is used shoreward of minus 10 feet (tidal reference MLLW=0.0 feet) and/or closer than 25 feet from the waters edge at any water level, the use of a temporary floating work platform in this area shall

only occur from July 1 through February 15 for the protection of outmigrating juvenile salmonids.

2. NOTIFICATION PRIOR TO STARTING WORK is not required for this work except:
If a temporary floating work platform greater than 20 feet wide is used the Regional Habitat Program Manager (RHPM, contact list follows Section I, below) shall be notified prior to start of work. Notification may be by email, facsimile (FAX), telephone, or in person. If notification is by e-mail, the AHB (if known), and the WSDOT Liaison (oldscao@dfw.wa.gov) should also be notified. No other notification prior to start of work is required. Notification shall include:
a. Agency name, contact person, and telephone number
b. Water body name
c. Ferry terminal location
d. Starting date and estimated ending date for work
e. The control number of the permit and the Section for the work activity being performed.

3. No work or equipment use shall occur below the ordinary high water line (OHWL) or shall affect the bed of state waters, except the use of a temporary floating work platform and marine growth removal.

4. No disturbance to the shoreline shall occur when placing or removing a temporary floating work platform.

5. No temporary floating work platform anchoring or grounding shall occur in saltwater that would disturb eelgrass, kelp, and/or other intertidal wetland vascular plants.

6. No grounding of a temporary floating work platform greater than 20 feet wide shall occur.

7. The ferry terminal shall first be cleaned using dry methods and equipment (scraping, sweeping, vacuuming) that will prevent debris and substances from entering state waters.

8. Cleaned debris, substances, and/or deck wash water shall not enter state waters through deck drains.

9. Removed marine growth may be released to state waters provided the marine growth shall not accumulate or be spoiled on the sea bed.

10. Marine growth removal from creosote or any other treated wood shall be restricted to the use of methods and tools that shall avoid removal of creosote or treated wood fibers.

11. Washing shall occur with the minimum water pressure to prevent existing paint from being removed and entering state waters.

12. After cleaning operations have been completed, debris accumulations remaining in the drains may be flushed with clean water.

SECTION G

PROJECT DEFINITION: FERRY TERMINAL PAINTING, INCLUDING PREPARATORY CLEANING, WASHING, ABRASIVE BLASTING, AND MARINE GROWTH REMOVAL: This painting work includes dry cleaning, washing and marine growth removal. A debris and paint collection containment and water filter structure is required. After dry cleaning, washing of the superstructure to be painted is done with high pressure equipment followed by abrasive blasting. The filtered wash water may enter state waters. Work may include use of a temporary floating work platform and marine growth removal as provided below:

1. TIMING LIMITATIONS:

a. Washing shall only be done in weeks of maximum tidal exchange (spring tide) and at time of maximum daily tidal flows.

b. SALTWATER VEGETATION PROTECTION: If the project would result in temporary new shading of eelgrass, kelp, and/or other intertidal wetland vascular plants longer than 72 hours, the work that produces the shadow shall only occur from October 1 through April 30 to prevent shading impacts to saltwater vegetation fish habitat.

c. JUVENILE SALMONID MIGRATION PROTECTION: If a temporary floating work platform is used shoreward of minus 10 feet (tidal reference MLLW=0.0 feet) and/or closer than 25 feet from the waters edge at any water level the use of a temporary floating work platform in this area shall only occur from July 1 through February 15 for the protection of outmigrating juvenile salmonids.

2. No work or equipment use shall occur below the ordinary high water line (OHWL) or shall affect the bed of state waters, except the use of a temporary floating work platform and marine growth removal.

3. No disturbance to the shoreline shall occur when placing or removing a temporary floating work platform.

4. No temporary floating work platform anchoring or grounding shall occur in saltwater that would disturb eelgrass, kelp, and/or other intertidal wetland vascular plants.

5. No grounding of a temporary floating work platform greater than 20 feet wide shall occur.

6. Ferry terminal shall first be cleaned using dry methods and equipment (scraping, sweeping, vacuuming) that will prevent debris and substances from entering state waters.

7. Dry method work that would result in debris and substances entering state waters, including but not restricted to dirt, abrasive blasting medium, old paint chips, and new paint, shall include a containment structure capable of collecting all such debris and substances.

8. Wet method work wash water and debris resulting from pressure washing, including but not restricted to dirt and old paint chips, shall be filtered through a filter tarp with a minimum # 100

sieve.

9. Removed marine growth may be released to state waters provided the marine growth shall not accumulate or be spoiled on the sea bed.

10. Marine growth removal from creosote or any other treated wood shall be restricted to the use of hand tools and methods that shall avoid removal of the creosote or treated wood fibers.

11. Cleaned debris, substances, and/or deck wash water shall not enter state waters through deck drains.

12. After cleaning operations have been completed, debris accumulations remaining in the drains may be flushed with clean water.

SECTION H

PROJECT DEFINITION: FERRY TERMINAL GENERAL MAINTENANCE AND REPAIR: This work is ferry terminal maintenance and repair of the facility in existing location and configuration. This work occurs over water and may include in-water or intertidal sea bed work including diving, marine growth removal, structural bracing replacement, or use of a temporary floating work platform. A containment structure is required if any polluting debris, material, or substance may enter state waters. This work shall not include any penetration of the sea bed by excavation, boring, or pile driving new construction or expansion of any structure.

1. TIMING LIMITATIONS:

a. SALTWATER VEGETATION PROTECTION: If the project would result in temporary new shading of eelgrass, kelp, and/or other intertidal wetland vascular plants longer than 72 hours, the work that produces the shadow shall only occur from October 1 through April 30 to prevent shading impacts to such saltwater vegetation fish habitat.

b. JUVENILE SALMONID MIGRATION PROTECTION: If a temporary floating work platform is used shoreward of minus 10 feet (tidal reference MLLW=0.0 feet) and/or closer than 50 feet from the waters edge at any water level, the use of a temporary floating work platform in this area shall only occur from July 1 through February 15 for the protection of outmigrating juvenile salmonids.

2. NOTIFICATION PRIOR TO STARTING WORK is not required for this work except: If a temporary floating work platform greater than 20 feet wide is used the Regional Habitat Program Manager (RHPM, contact list follows Section I, below) shall be notified prior to start of work. Notification may be by email, facsimile (FAX), telephone, or in person. If notification is by e-mail, the AHB (if known), and the WSDOT Liaison (oldscao@dfw.wa.gov) should also be notified. No other notification prior to start of work is required. Notification shall include:
a. Agency name, contact person, and telephone number
b. Water body name
c. Ferry terminal location

d. Starting date and estimated ending date for work
e. The control number of the permit and the Section for the work activity being performed

3. Geared mechanisms (wheels, tracks) of equipment shall not operate in the intertidal area.

4. This work shall not include any penetration of the sea bed by excavation, boring, or pile driving.

5. A temporary floating work platform may be used, provided no damage to the shoreline shall occur when placing or removing a temporary floating work platform.

6. No grounding of a temporary floating work platform greater than 20 feet wide shall occur.

7. No temporary floating work platform anchoring or grounding shall occur in saltwater that would disturb eelgrass, kelp, and/or other intertidal wetland vascular plants.

8. Work that would result in debris or substances entering state waters, including but not restricted to treated wood sawdust and cuttings, shall include a containment structure capable of collecting all such debris or substances.

9. If a containment structure cannot be used because of restricted or difficult location or type of structure, a containment boom shall be placed around the work area to capture debris and cuttings.

10. Removed marine growth may be released to state waters provided the marine growth shall not accumulate or be spoiled on the sea bed.

11. Marine growth removal from creosote or any other treated wood shall be restricted to the use of hydraulic suctioning or hand tools and methods that shall avoid removal of the creosote or treated wood fibers.

SECTION I

PROJECT DEFINITION: BRIDGE SPOT CLEANING: Spot Cleaning is a bridge maintenance activity where fracture critical points on a bridge are cleaned to prepare the bridge for inspection. The purpose of the inspection is to determine if a bridge is in need of painting or repair and to prepare areas for repair.

1. TIMING LIMITATIONS: Work shall only occur during the following times and water conditions, to increase dilution of a potential concentration of sedimentation and associated pollutants in state waters:

a. West of the Cascade Mountain Crest: November 1 to May 31. East of the Cascade Mountain Crest: December 1 to June 30.

b. Bridge washing work that will result in wash water entering state waters shall be restricted to when the bed of the water body under the part of the structure to be washed is covered with water.

2. No work or equipment use shall occur below the ordinary high water line (OHWL) or shall affect the bed of state waters.

3. The bridge shall be spot cleaned using dry and/or wet methods: Hand/dry scraping, sweeping, vacuuming, low-pressure high volume washing.

4. If a filter trap containment system is used during spot cleaning activities, the tarp shall be a minimum of # 100 sieve.

5. Cleaned debris, substances, and/or deck wash water shall not enter state waters through deck drains.

6. Washing shall occur with the minimum water pressure necessary to accomplish the work to prevent existing paint from being removed and entering state waters.

NOTES:

1. This statewide general Hydraulic Project Approval (HPA) includes nine separate work activities included in bridge and ferry terminal cleaning, painting, and general maintenance and repair which are separated by description and provisions for the convenience of the permittee and the various work crews and contractors doing distinct work. Provisions common to all work are listed first. The provisions specific to each work activity are included in the sections A through I of this HPA.

2. This statewide general HPA replaces statewide general HPA GH-D9448-03 and all regionally issued general HPAs for any bridge and ferry terminal cleaning, painting, and general maintenance and repair as defined in the distinct project descriptions in the sections (A through I). All other bridge and ferry terminal work shall require individual HPA.

WDFW Regional Offices
Eastern Washington - Region 1: (509) 892-1001, FAX (509) 456-4071.
TeamSpokane@dfw.wa.gov.

North Central Washington - Region 2: (509) 754-4624509, FAX (509) 754-5257.
TeamEphrata@dfw.wa.gov.

South Central Washington - Region 3: (509) 575-2740. FAX (509) 575-2474.

North Puget Sound - Region 4: (425) 775-1311. FAX (425) 338-1066. TeamMillCreek@dfw.wa.gov.

Southwest Washington - Region 5: (360) 696-6211. FAX (360) 906-6776.
TeamVancouver@dfw.wa.gov.

Coastal Washington - Region 6: (360) 249-4628. FAX (360) 664-0689.
TeamMontesano@dfw.wa.gov.

After hours/weekend statewide hotline: (360) 902-2537.

WDFW REGIONAL HABITAT PROGRAM MANAGERS

Region 1: Asotin, Columbia, Ferry, Garfield, Lincoln, Pend Oreille, Spokane, Stevens, Walla Walla, Whitman. Mark Wachtel (wachtmlw@dfw.wa.gov); WDFW, Region 1, 2315 N Discovery PL Spokane, WA 99216-1566. (509) 892-7860 Ext. 320.

Region 2: Adams, Chelan, Douglas, Grant, Okanogan. Christine Parsons (parsocbp@dfw.wa.gov); WDFW, Region 2, 1550 Alder ST NW Ephrata, WA 98823-9651. (509) 754-4624.

Region 3: Benton, Franklin, Kittitas, Yakima. Perry Harvester (harvepjh@dfw.wa.gov); WDFW, Region 3, 1701 S 24th AVE Yakima WA 98902-5720. (509) 457-9314.

Region 4: King, Island, San Juan, Skagit, Snohomish, Whatcom. David Brock (brockdwb@dfw.wa.gov). WDFW, Region 4, 16018 Mill Creek Blvd Mill Creek, WA 98012-1296. (425)-775-1311 x 114.

Region 5: Clark, Cowlitz, Klickitat, Lewis, Skamania, Wahkiakum. Tim Rymer (rymertrr@dfw.wa.gov). WDFW, Region 5, 2108 Grand Blvd Vancouver, WA 98661. (360) 906-6729.

Region 6: Clallam, Grays Harbor, Jefferson, Kitsap, Mason, Pacific, Pierce, Thurston. Steve Kalinowski (kalinsak@dfw.wa.gov). WDFW, Region 6, 48 Devonshire RD Montesano, WA 98563-9618. (360) 249-1227.

Issue Date: January 22, 2008 | Control Number: 111325-1

Project Expiration Date: January 21, 2013 | FPA/Public Notice #: N/A

PROJECT LOCATIONS

Location #1

WORK START: January 22, 2008					WORK END: January 21, 2013	
WRIA: 99.0000	Waterbody: Various				Tributary to: Statewide	
1/4 SEC: All	Section: 99	Township: 99	Range: 99	Latitude: N	Longitude:	County: Multiple
Location #1 Driving Directions						

APPLY TO ALL HYDRAULIC PROJECT APPROVALS

This Hydraulic Project Approval pertains only to those requirements of the Washington State Hydraulic Code, specifically Chapter 77.55 RCW (formerly RCW 77.20). Additional authorization from other public agencies may be necessary for this project. The person(s) to whom this Hydraulic Project Approval is issued is responsible for applying for and obtaining any additional authorization from other public agencies (local, state and/or federal) that may be necessary for this project.

This Hydraulic Project Approval shall be available on the job site at all times and all its provisions followed by the person(s) to whom this Hydraulic Project Approval is issued and operator(s) performing the work.

This Hydraulic Project Approval does not authorize trespass.

The person(s) to whom this Hydraulic Project Approval is issued and operator(s) performing the work may be held liable for any loss or damage to fish life or fish habitat that results from failure to comply with the provisions of this Hydraulic Project Approval.

Failure to comply with the provisions of this Hydraulic Project Approval could result in a civil penalty of up to one hundred dollars per day and/or a gross misdemeanor charge, possibly punishable by fine and/or imprisonment.

All Hydraulic Project Approvals issued pursuant to RCW 77.55.021 (EXCEPT agricultural irrigation, stock watering or bank stabilization projects) or 77.55.141 are subject to additional restrictions, conditions or revocation if the Department of Fish and Wildlife determines that new biological or physical information indicates the need for such action. The person(s) to whom this Hydraulic Project Approval is issued has the right pursuant to Chapter 34.04 RCW to appeal such decisions. All agricultural irrigation, stock watering or bank stabilization Hydraulic Project Approvals issued pursuant to RCW 77.55.021 may be modified by the Department of Fish and Wildlife due to changed conditions after consultation with the person(s) to whom this Hydraulic Project Approval is issued: PROVIDED HOWEVER, that such modifications shall be subject to appeal to the Hydraulic Appeals Board established in RCW 77.55.301.

APPEALS INFORMATION

If you wish to appeal the issuance or denial of, or conditions provided in a Hydraulic Project Approval, there are informal and formal appeal processes available.

A. INFORMAL APPEALS (WAC 220-110-340) OF DEPARTMENT ACTIONS TAKEN PURSUANT TO RCW 77.55.021, 77.55.141, 77.55.181, and 77.55.291: A person who is aggrieved or adversely affected by the following Department actions may request an informal review of:

(A) The denial or issuance of a Hydraulic Project Approval, or the conditions or provisions made part of a Hydraulic Project Approval; or

(B) An order imposing civil penalties. A request for an INFORMAL REVIEW shall be in WRITING to the Department of Fish and Wildlife HPA Appeals Coordinator, 600 Capitol Way North, Olympia, Washington 98501-1091 and shall be RECEIVED by the Department within 30 days of the denial or issuance of a Hydraulic Project Approval or receipt of an order imposing civil penalties. If agreed to by the aggrieved party, and the aggrieved party is the Hydraulic Project Approval applicant, resolution of the concerns will be facilitated through discussions with the Area Habitat Biologist and his/her supervisor. If resolution is not reached, or the aggrieved party is not the Hydraulic Project Approval applicant, the Habitat Technical Services Division Manager or his/her designee shall conduct a review and recommend a decision to the Director or his/her designee. If you are not satisfied with the results of this informal appeal, a formal appeal may be filed.

B. FORMAL APPEALS (WAC 220-110-350) OF DEPARTMENT ACTIONS TAKEN PURSUANT TO RCW 77.55.021 (EXCEPT agricultural irrigation, stock watering or bank stabilization projects) or 77.55.291:
A person who is aggrieved or adversely affected by the following Department actions may request a formal review of:

(A) The denial or issuance of a Hydraulic Project Approval, or the conditions or provisions made part of a Hydraulic Project Approval;

(B) An order imposing civil penalties; or

(C) Any other 'agency action' for which an adjudicative proceeding is required under the Administrative Procedure Act, Chapter 34.05 RCW.

A request for a FORMAL APPEAL shall be in WRITING to the Department of Fish and Wildlife HPA Appeals Coordinator, shall be plainly labeled as 'REQUEST FOR FORMAL APPEAL' and shall be RECEIVED DURING OFFICE HOURS by the Department at 600 Capitol Way North, Olympia, Washington 98501-1091, within 30-days of the Department action that is being challenged. The time period for requesting a formal appeal is suspended during consideration of a timely informal appeal. If there has been an informal appeal, the deadline for requesting a formal appeal shall be within 30-days of the date of the Department's written decision in response to the informal appeal.

C. FORMAL APPEALS OF DEPARTMENT ACTIONS TAKEN PURSUANT TO RCW 77.55.021 (agricultural irrigation, stock watering or bank stabilization only), 77.55.141, 77.55.181, or 77.55.241: A person who is aggrieved or adversely affected by the denial or issuance of a Hydraulic Project Approval, or the conditions or provisions made part of a Hydraulic Project Approval may request a formal appeal. The request for FORMAL APPEAL shall be in WRITING to the Hydraulic Appeals Board per WAC 259-04 at Environmental Hearings Office, 4224 Sixth Avenue SE, Building Two - Rowe Six, Lacey, Washington 98504; telephone 360/459-6327.

D. FORMAL APPEALS OF DEPARTMENT ACTIONS TAKEN PURSUANT TO CHAPTER 43.21L RCW: A person who is aggrieved or adversely affected by the denial or issuance of a Hydraulic Project Approval, or the conditions or provisions made part of a Hydraulic Project Approval may request a formal appeal. The FORMAL APPEAL shall be in accordance with the provisions of Chapter 43.21L RCW and Chapter 199-08 WAC. The request for FORMAL APPEAL shall be in WRITING to the Environmental and Land Use Hearings Board at Environmental Hearings Office, Environmental and Land Use Hearings Board, 4224 Sixth Avenue SE, Building Two - Rowe Six, P.O. Box 40903, Lacey, Washington 98504; telephone 360/459-6327.

E. FAILURE TO APPEAL WITHIN THE REQUIRED TIME PERIODS results in forfeiture of all appeal rights. If there is no timely request for an appeal, the department action shall be final and unappealable.

Issue Date: January 22, 2008 | Control Number: 111325-1

Project Expiration Date: January 21, 2013 | FPA/Public Notice #: N/A

ENFORCEMENT: Sergeant Nixon (42) P3

Habitat Biologist Craig Olds	360-902-2540		for Director WDFW

CC: E-Mail
All Area Habitat Biologists, WDFW
All Regional Habitat Program Managers, WDFW
All Assistant Regional Habitat Program Managers, WDFW
All Regulatory Services, Habitat Program, WDFW

E-Mail and Hard Copy
All Regional Enforcement Sargents, WDFW
Ken Schlatter, WSDOT

ATTACHMENTS (2)
Allowable Forage Fish Work Window
Allowable Fresh Water Work Window

Effective Date: April 3, 2004
Expiration Date: April 3, 2009
First Modification Date: February 11, 2007

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM WASTE DISCHARGE PERMIT No. WA-0039039

State of Washington
DEPARTMENT OF ECOLOGY
Olympia, Washington 98504-7600

In compliance with the provisions of
The State of Washington Water Pollution Control Law
Chapter 90.48 Revised Code of Washington
and
The Federal Water Pollution Control Act
(The Clean Water Act)
Title 33 United States Code, Section 1251 et seq.

Washington State Department of Transportation
310 Maple Park Ave SE
PO Box 47331
Olympia, WA 98501

Facility Location: NA	Receiving Water: Statewide Fresh and Marine Waters
Water Body I.D. No.: NA	Discharge Location: NA
Industry Type: Washing and Pressure Washing of Bridges and Ferry Terminals	

is authorized to discharge in accordance with the special and general conditions which follow.

Nancy L. Winters

Nancy Winters, Manager
Program Development Services Section
Washington State Department of Ecology

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SUMMARY OF PERMIT REPORT SUBMITTALS

Permit Section	Submittal	Frequency	First Submittal Date
S3.B	Annual Project Completion Report	Annually	Winter 2004/2005
S3.B	Annual Proposed Project List	Annually	Spring 2004
S3.E	Noncompliance Notification	As necessary	
G1.	Notice of Change in Authorization	As necessary	
G4.	Permit Application for Substantive Changes to the Discharge	As necessary	
G5.	Engineering Report for Construction or Modification Activities	As necessary	
G7.	Application for Permit Renewal	1/permit cycle	March 1, 2008
G8	Notice of Permit Transfer	As necessary	
G21	Reporting Anticipated Non-compliance	As necessary	
G22.	Reporting Other Information	As necessary	

SPECIAL CONDITIONS

All discharges and activities authorized by this permit shall be consistent with the terms and conditions of this permit.

In the event that the permittee cannot adhere to the conditions of this permit on a specific site or project due to human health or safety reasons, the permittee may apply for a separate permit for that project from the appropriate regional office of the Department of Ecology.

The discharge of pollutants more frequently than, or at a level in excess of, that identified and authorized by this permit shall constitute a violation of the terms and conditions of this permit.

S1. DISCHARGE LIMITATIONS

Beginning on the effective date of this permit and lasting through the expiration date, the Permittee is authorized to discharge high pressure wash water or low pressure wash water from bridges, ferry terminals and ferry transfer spans in Washington State subject to the following limitations:

A. Bridge Routine Maintenance Cleaning and Washing (This section applicable to operations described in the fact sheet and is not applicable to operations such as street sweepers which are covered by the Water Quality Implementing Agreement).

1. Work shall only occur during the following times:

   West of the Cascade Mountain Crest: November 1 to May 31.
   East of the Cascade Mountain Crest: December 1 to June 30.

2. Measures shall be used to prevent damage to the vegetation in the riparian (streamside or shoreline) area located within 200 feet perpendicular to the water and adjacent to the structure. Within the riparian area existing parking lots and open managed fields and lots may be used for staging work.

3. No work or equipment use shall occur below the ordinary high water line (OHWL).

4. The bridge shall first be cleaned using dry methods and equipment (scraping, sweeping, vacuuming) that will prevent debris and substances from entering state waters. Residual grease is to be removed by hand methods and degreaser on absorbent material, provided none of this material shall enter state waters. Examples of debris and substances include, but are not restricted to:
   a. bird nests and fecal material
   b. dirt, moss, sediments, and rust
   c. old paint chips and residue
   d. petroleum products
   e. cement chips

f. construction materials
g. chemicals or any other toxic or deleterious substances

5. During bridge cleaning and low pressure washing, if debris, substances, or wash water could enter state waters through deck drains, the drains shall be temporarily blocked to route water to the landward end(s) of the structure and onto vegetative areas, where practicable.

6. Debris and substances resulting from bridge maintenance cleaning shall be collected, contained, and deposited above the limits of flood water or extreme high tide in a site that has the appropriate regulatory approval. No debris, marine growth, or substances shall be placed in road drainages, wetlands, riparian (streamside or shoreline) areas, or on adjacent land where they may be eroded into state waters.

7. Washing shall be done with clean water. No detergents or other cleaning agents shall be used.

8. Washing shall occur with the minimum water pressure necessary to accomplish the work to prevent existing paint from being removed and entering state waters.

9. After dry cleaning methods have been completed, debris accumulations remaining in the drains may be flushed with clean water.

10. No petroleum products, hydraulic fluids, chemicals, or any other polluting substances shall be allowed to enter state waters.

<u>B. Bridge Spot Cleaning (This section applicable to operations described in the fact sheet, Appendix E and is not applicable to operations such as street sweepers which are covered by the Water Quality Implementing Agreement).</u>

1. Work shall only occur during the following times:

West of the Cascade Mountain Crest: November 1 to May 31.
East of the Cascade Mountain Crest: December 1 to June 30.

2 Measures shall be used to prevent damage to the vegetation in the riparian (streamside or shoreline) area located within 200 feet perpendicular to the water and adjacent to the structure. Within the riparian area existing parking lots and open managed fields and lots may be used for staging work.

3. No work or equipment use shall occur below the ordinary high water line (OHWL).

4. The bridge shall be spot cleaned using dry and wet methods, such as, but not limited to, hand/dry scraping, sweeping, vacuuming, low pressure high volume washing. These cleaning methods shall be used in combination with Best Management Practices identified in the most current *Regional Road Maintenance Endangered Species Act Program Guidelines* to prevent debris and substances from entering state waters.

Residual grease is to be removed by hand methods and degreaser on absorbent material, provided none of this material shall enter state waters. Examples of debris and substances include, but are not restricted to:

a. bird nests and fecal material
b. dirt, moss, sediments, and rust
c. old paint chips and residue
d. petroleum products
e. cement chips
f. construction materials
g. chemicals or any other toxic or deleterious substances

5. If a filter tarp containment system is used during spot cleaning activities, the tarp shall be a minimum of #100 sieve.

6. During bridge spot cleaning, if debris, substances, or wash water could enter state waters through deck drains, the drains shall be temporarily blocked to route water to the landward end(s) of the structure and onto vegetative areas, where practicable.

7. Debris and substances resulting from bridge spot cleaning shall be collected, contained, and deposited above the limits of flood water or extreme high tide in a site that has the appropriate regulatory approval. No debris, marine growth, or substances shall be placed in road drainages, wetlands, riparian (streamside or shoreline) areas, or on adjacent land where they may be eroded into state waters.

8. Washing shall be done with clean water. No detergents or other cleaning agents shall be used.

9. Washing shall occur with the minimum water pressure necessary to accomplish the work to prevent existing paint from being removed and entering state waters.

10. No petroleum products, hydraulic fluids, chemicals, or any other polluting substances shall be allowed to enter state waters.

11. Bridge Spot cleaning work resulting in wash water entering state waters shall be restricted to when the bed of the receiving water under the part of the structure to be washed is covered with water.

C. Ferry Terminal/Transfer Span Maintenance Cleaning and Washing and Marine Growth Removal

1. Measures shall be used to prevent damage to the vegetation in the riparian (streamside or shoreline) area located within 200 feet perpendicular to the water and adjacent to the

structure. Within the riparian area existing parking lots and open managed fields and lots may be used for staging work.

2. No work or equipment use shall occur below the ordinary high water line (OHWL) except the use of a temporary floating work platform for marine growth removal.

3. No disturbance to the shoreline shall occur when placing or removing a temporary floating work platform.

4. Ferry terminals and spans shall first be cleaned using dry methods and equipment (scraping, sweeping, vacuuming) that will prevent debris and substances from entering state waters. Residual grease may be removed by hand methods and degreaser on absorbent material, provided none of this material shall enter state waters. Examples of debris and substances include, but are not restricted to:
   a. bird nests and associated fecal material
   b. dirt, moss, sediments, and rust
   c. old paint chips and residue
   d. petroleum products
   e. cement chips
   f. construction materials
   g. chemicals or any other toxic or deleterious substances

5. If debris, substances, and/or wash water could enter state waters through drains, the drains shall be temporarily blocked to route water to the landward end of the ferry terminal and onto vegetative areas, where practicable.

6. Marine growth removal from creosote or any other treated wood shall be restricted to the use of methods and tools that will minimize removal of the creosote or treated wood fibers.

7. Debris and substances resulting from this cleaning project shall be contained and deposited above the limits of extreme high tide in a site that has the appropriate regulatory approval. No debris, marine growth, and substances shall be placed in road drainages, wetlands, riparian (shoreline) areas, or on adjacent land where they may be eroded into state waters.

8. Washing shall be done with clean water. No detergents or other cleaning agents shall be used.

9. Washing shall occur with the minimum water pressure in order to prevent paint from being removed and entering state waters.

10. After dry cleaning methods have been completed, debris accumulations remaining in the drains may be flushed with clean water.

12. No petroleum products, hydraulic fluids, chemicals, or any other polluting substances shall be allowed to enter state waters.

D. Bridge Preparatory Washing (Pre-painting)

1. For bridges over lakes and wetlands or over rivers listed on the 303(d) list for copper, zinc or lead - No discharge to surface waters.

   For rivers with flows of 55 cfs or less in Eastern Washington or 89 cfs or less in Western Washington at the time of washing – No discharge to surface waters.

   These wastewaters may be directed to ground discharge at a location near the bridge if the soils are suitable for infiltration. These wastewaters must be filtered with #100 sieve fabric prior to discharge to ground. This authorization is contingent upon timely completion of ground water evaluation as given in condition S6.

2. For bridges over rivers with flows of 56 cfs to 325 cfs at the time of washing (Eastern Washington) or 90 cfs to 532 cfs (Western Washington) – The permittee will explain in their Annual Proposed Project List (see Monitoring and Reporting) the mitigation measures for meeting water quality standards and must include plans for using less than six pressure washers operating simultaneously. Wash water and debris resulting from pressure washing, including but not restricted to dirt and old paint chips, shall be filtered through a filter tarp of a minimum of # 100 sieve before discharge to surface waters. This authorization is contingent upon timely completion of a effluent specific translator study as given in S6.

3. For bridges over rivers with flows of 326 cfs to 4260 cfs (Eastern Washington) or 533 cfs to 7930 (Western Washington) at the time of washing – The permittee will explain in their Annual Proposed Project List the mitigation measures to meet water quality standards. Wash water and debris resulting from pressure washing, including but not restricted to dirt and old paint chips, shall be filtered through a filter tarp of a minimum of # 100 sieve before discharge to surface waters. A maximum of six pressure washers may be used. This authorization is contingent upon timely completion of a effluent specific translator study as given in S6.

4. For bridges over rivers with flows of 4261 or greater (Eastern Washington) or 7931 or greater cfs (Western Washington) at the time of washing - Wash water and debris resulting from pressure washing, including but not restricted to dirt and old paint chips, shall be filtered through a filter tarp of a minimum of #100 sieve before discharge to surface waters. A maximum of six pressure washers may be used.

5. For bridges over marine waters - The permittee will explain in their Annual Proposed Project List the mitigation measures for meeting water quality standards. Wash water and debris resulting from pressure washing, including but not restricted to dirt and old paint chips, shall be filtered through a filter tarp of a minimum of # 100 sieve before discharge to surface waters.

6. Measures shall be used to prevent damage to the vegetation in the riparian (streamside or shoreline) area located within 200 feet perpendicular to the water and adjacent to the structure. Within the riparian area existing parking lots and open managed fields and lots may be used for staging work..

7. No work or equipment use shall occur below the ordinary high water line (OHWL) except the use of a temporary floating work platform.

8. No disturbance to the stream banks or shoreline shall occur when placing or removing a temporary floating work platform.

9. Bridges shall first be cleaned using dry methods and equipment (scraping, sweeping, vacuuming) that will prevent debris and substances from entering state waters. Residual grease may be removed by hand methods and degreaser on absorbent material, provided none of this material shall enter state waters. Examples of debris and substances include, but are not restricted to:
   a. bird nests and fecal material
   b. dirt, moss, sediments, and rust
   c. old paint chips and residue
   d. blasting medium
   e. petroleum products
   f. cement chips
   g. construction materials
   h. chemicals or any other toxic or deleterious substances

10. If debris, substances, or wash water could enter state waters through deck drains, the drains shall be temporarily blocked to route water to the landward end(s) of the structure and onto vegetative areas where practicable.

11. Work that would result in debris and substances entering state waters, including but not restricted to dirt, abrasive blasting medium, old paint chips, and new paint, shall include a containment structure capable of collecting all such debris and substances.

12. Debris and substances collected in the containment or filter structure shall be removed from the structure;
    a. daily,
    b. whenever accumulations may place the structure at risk,
    c. and whenever its moved or removed.

13. Work shall not occur when weather conditions would place the containment or filter structure at risk, or result in loss of contained material or the loss of filtering function.

14. Any containment or filter structure shall be routinely inspected and repaired as necessary to ensure its function.

15. Debris and substances from this project shall be collected, contained and then deposited above the limits of flood water or extreme high tide in a site that has the appropriate regulatory approval. No debris and substances shall be placed in road drainages, wetlands, riparian (streamside and shoreline) areas, or on adjacent land where they may be eroded into state waters.

16. Pressure washing and washing shall be done with clean water. No detergents or other cleaning agents shall be used.

17. After dry cleaning methods have been completed, debris accumulations remaining in the drains may be flushed with clean water.

18. No cleaning of any painting or other equipment or mixing or storing of paint and other polluting materials and substances shall be done over the water or in an area where a spill would result in these materials and substances entering state waters.

19. For brush and/or roller paint application methods, painters shall work from pails containing a maximum of two (2) gallons of paint to minimize the impact of accidental spillage.

20. No cleaning solvents or chemicals utilized for tool or equipment cleaning may be discharged to the ground or water. Cleaning of painting and maintenance equipment shall not be done in state waters nor shall resultant cleaning runoff be allowed to enter state waters. No paint cans, lids, brushes, or other debris shall be allowed to enter state waters.

21. All liquid products shall be stored and mixed on impervious surfaces in secure and contained location to eliminate the potential for spills into state waters.

22. Drip pans or other protective devise shall be required for all paint mixing and solvent transfer operations.

23. Drip tarps shall be suspended below paint platforms to prevent spilled paint, buckets, brushes, etc., from being lost to state waters.

24. Paint and solvent spills shall be treated as oil spills and shall be prevented from reaching storm drains and subsequent discharge into the water. Any such spill shall be reported to the appropriate Ecology Regional Office immediately.

25. The project Engineer or Inspector shall be on site or on call, and be readily accessible to the site at all times while cleaning and painting activities are occurring that may affect the quality of surface water of the state.

26. No petroleum products, hydraulic fluids, chemicals, or any other polluting substances shall be allowed to enter state waters.

27. Pressure washing of concrete structures shall be held to the minimum necessary to maintain structural integrity.

E. Ferry Transfer Span Preparatory Washing

1. Washing shall only be done in weeks of maximum tidal exchange (spring tide) and at time of maximum daily tidal flows.

2. Wash water and debris resulting from pressure washing, including but not restricted to dirt and old paint chips, shall be filtered through a filter tarp of a minimum of # 100 sieve before discharge to surface waters.

3. The number of pressure washers at any time shall be four or less.

4. Measures shall be used to prevent damage to the vegetation in the riparian (streamside or shoreline) area located within 200 feet perpendicular to the water and adjacent to the structure. Within the riparian area existing parking lots and open managed fields and lots may be used for staging work.

5. No work or equipment use shall occur below the ordinary high water line (OHWL) except the use of a temporary floating work platform for marine growth removal.

6. No petroleum products, hydraulic fluids, chemicals, or any other polluting substances shall be allowed to enter state waters.

7. No disturbance to the shoreline shall occur when placing or removing a temporary floating work platform.

8. Ferry terminals shall first be cleaned using dry methods and equipment (scraping, sweeping, vacuuming) that will prevent debris and substances from entering state waters, except residual grease may be removed by hand methods and degreaser on absorbent material, provided none of this material shall enter state waters. Examples of debris and substances include, but are not restricted to:
   a. bird nests and associated fecal material
   b. dirt, moss, sediments, and rust
   c. old paint chips and residue
   d. petroleum products
   e. cement chips
   f. construction materials
   g. chemicals or any other toxic or deleterious substances

9. If cleaned debris, substances, and/or wash water could enter state waters through deck drains, the drains shall be temporarily blocked to route water to the landward end of the ferry terminal and onto vegetative areas where practicable.

10. Work that would result in debris and substances entering state waters, including but not restricted to dirt, abrasive blasting medium, old paint chips, and new paint, shall include a containment structure capable of collecting all such debris and substances.

13. Debris and substances collected in the containment or filter structure shall be removed from the structure;
    a. daily,
    b. whenever accumulations may place the structure at risk,
    c. and whenever its moved or removed.

14. Work shall not occur when weather conditions would place the containment or filter structure at risk, result in loss of contained material or loss of filtering function.

15. Any containment or filter structure shall be routinely inspected and repaired as necessary to ensure its function.

16. Marine growth removal from creosote or any other treated wood shall be restricted to the use of hand tools and methods that will minimize removal of the creosote or treated wood fibers.

17. Debris, marine growth, and substances from this project shall be collected and then contained and deposited above the limits of extreme high tide in a site that has the appropriate regulatory approval. No debris, marine growth, and substances shall be placed in road drainages, wetlands, riparian (shoreline) areas, or on adjacent land where they may be eroded into state waters.

18. Washing shall be done with clean water. No detergents or other cleaning agents shall be used.

19. After dry cleaning methods have been completed, debris accumulations remaining in the drains may be flushed with clean water.

20. No cleaning of any painting or other equipment or mixing or storing of paint and other polluting materials and substances shall be done over the water or in an area where a spill would result in these materials and substances entering state waters.

21. For brush and/or roller paint application methods, painters shall work from pails containing a maximum of two (2) gallons of paint to minimize the impact of accidental spillage.

22. No cleaning solvents or chemicals utilized for tool or equipment cleaning may be discharged to the ground or water. Cleaning of painting and maintenance equipment shall not be done in sate waters nor shall resultant cleaning runoff be allowed to enter state waters. No paint cans, lids, brushes, or other debris shall be allowed to enter state waters

23. All liquid products shall be stored and mixed on impervious surfaces in secure and contained location to eliminate the potential for spills into state waters.

24. Drip pans or other protective device shall be required for all paint mixing and solvent transfer operations.

25. Drip Tarps shall be suspended below paint platforms to prevent spilled paint, buckets, brushes, etc., from being lost to state waters.

26. Paint and solvent spills shall be treated as oil spills and shall be prevented from reaching storm drains and subsequent discharge into the water. Any such spill shall be reported to the appropriate Ecology Regional Office immediately.

27. The project Engineer or Inspector shall be on site or on call, and be readily accessible to the site at all times while cleaning and painting activities are occurring that may affect the quality of surface water of the state.

F. Mixing Zone Descriptions for D. and E. above

An acute mixing zone is authorized for Bridge Preparatory Washing over rivers. The maximum allowance for the mixing zone is defined as follows:

Acute – 2.5% of the river flow at the time of washing

The dilution factor from this mixing zone varies with the number of pressure washers and the river flow at the time of washing.

An acute mixing zone is authorized for Ferry Transfer Span Preparatory Washing over marine waters. The maximum boundaries of the mixing zone is as follows:

Acute – Twenty feet around the point of discharge.

The dilution factor resulting from this mixing zone varies with the number of pressure washers and receiving water current velocity.

S2. MONITORING REQUIREMENTS

A. Wash Water and Pressure Wash Water Monitoring:

The permittee shall monitor wash and pressure wash water as follows:

1. Bridge and Ferry Transfer Span Maintenance Routine Washing

The permittee shall monitor one representative project (bridge or ferry transfer span) per year. The permittee shall collect a composite sample of effluent and analyze for total hardness, dissolved and total recoverable copper, dissolved and total recoverable lead, and dissolved and total recoverable zinc.

2. Bridge and Ferry Transfer Span Preparatory Washing
   The permittee shall sample one representative project (bridge or ferry transfer span) per year. The permittee shall collect a composite sample of effluent after passing through the filter tarp. The sample shall be analyzed for dissolved and total recoverable copper, dissolved and total recoverable lead, dissolved and total recoverable zinc, total hardness, and acute toxicity to *Ceriodaphnia dubia*, *Daphnia pulex*, or *Daphnia magna* (48 hour static test, method: EPA/600/4-90/027F) and to Fathead minnow, *Pimephales promelas* (96 hour static-renewal test, method: EPA/600/4-90/027F). The permittee shall also collect samples of the receiving water "upstream" of the project bridge or transfer span and analyze the water for dissolved and total recoverable copper, dissolved and total recoverable lead, dissolved and total recoverable zinc, and total hardness.

3. The permittee shall monitor the volume of wash water used during spot cleaning to estimate the amount of water being discharged to waters of the state during this activity.

B. Sampling and Analytical Procedures

Samples and measurements collected to meet the requirements of this permit shall be representative of the volume and nature of the monitored parameters, including representative sampling of any unusual discharge or discharge condition, including bypasses, upsets, and maintenance-related conditions affecting effluent quality.

Sampling and analytical methods used to meet the monitoring requirements specified in this permit shall conform to the latest revision of the *Guidelines Establishing Test Procedures for the Analysis of Pollutants* contained in 40 CFR Part 136 or to the latest revision of *Standard Methods for the Examination of Water and Wastewater* (APHA), unless otherwise specified in this permit or approved in writing by the Department of Ecology (Department).

C. Laboratory Accreditation

All monitoring data required by the Department shall be prepared by a laboratory registered or accredited under the provisions of, *Accreditation of Environmental Laboratories*, Chapter 173-50 WAC.

S3. NOTIFICATION, REPORTING, AND RECORDKEEPING REQUIREMENTS

The Permittee shall notify, monitor and report in accordance with the following conditions. Notification, as required under S3 A.1 PROJECT NOTIFICATION (below), applies to all activities covered under this permit except ferry transfer span maintenance cleaning and

washing. The falsification of information submitted to the Department shall constitute a violation of the terms and conditions of this permit.

A. Notification

1. PROJECT NOTIFICATION: The Ecology Regional Office Water Quality Program shall be notified (letter or fax) at least three (3) working days prior to start of work. Notification shall include:

    a. Agency name, contact person, and telephone number
    b. Type of activity
    c. Water body name
    d. Bridge location, including road number, milepost
    e. Latitude and longitude (S1.C and S1.D only)
    f. Starting date and estimated ending date for work

2. NOTIFICATION OF FISH KILL, PERMIT VIOLATION, WATER QUALITY PROBLEM: If at any time, as a result of project activities, fish are observed in distress, a fish kill occurs, a water quality problem occurs, or a permit violation occurs the Permittee shall:
    a. Immediately take action to stop, contain, and clean up unauthorized discharges or otherwise stop the noncompliance, correct the problem and, if applicable, repeat sampling and analysis of any discharge immediately and submit the results to the Department within thirty (30) days after becoming aware of the violation.
    b. Immediately notify the Department of Ecology of the failure to comply.
    c. Submit a detailed written report to the Department of Ecology within thirty (30) days (five [5] days for upsets and bypasses), unless requested earlier by the Department. The report shall contain a description of the noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and the steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

Compliance with these requirements does not relieve the Permittee from responsibility to maintain continuous compliance with the terms and conditions of this permit or the resulting liability for failure to comply.

B. Reporting

The first monitoring period begins on the effective date of the permit.

Annual Proposed Project List Report – Each year the permittee shall submit a list of bridges and ferry transfer spans expected to be pressure washed and painted that year. The report shall be submitted at least 90 days prior to the start of activity. The report shall list the expected projects for that year and the river flows (for bridges) expected at time of preparatory washing. The report shall specify the expected monitoring, mitigation measures (condition S1.C), and any special studies which are planned for that year. For discharges to ground, the permittee shall

specify the approximate location and the soil suitability for infiltration. The report shall be submitted to Department of Ecology, SEA Program, PO Box 47600, Olympia, WA 98504-7600.

Annual Project Completion Report: The permittee shall submit to the Department of Ecology, SEA Program, PO Box 47600, Olympia, WA 98504-7600, a calendar year annual report of Bridge Routine Cleaning and Washing work and Bridge Spot Cleaning by January 31 of the following year. An annual report is also required if no work was conducted. The annual report shall include:

1. General: Reporting agency, contact person, address, telephone number, date of report, time period.

2. Summary: Total number of individual projects by region and statewide.

3. Problem(s) encountered: Provision violation, notification, corrective action, impacts to fish life and water quality from problem. If the Environmental Compliance Assurance Procedure (ECAP) was used, what activity triggered the procedure. *[these may be highlighted and specified in this section or included in the full list of projects completed below]*

4. Recommendations for improvement to BMPs and mitigation *[optional]*

5. List of individual projects completed: By region including water body name, bridge name, road number and milepost, latitude and longitude, and date of work.

6. Water Quality Data: All data and analysis required under S2. and S6. of this permit for Bridge Routine Cleaning and Washing work.

All laboratory reports providing data for organic and metal parameters shall include the following information: sampling date, sample location, date of analysis, parameter name, CAS number, analytical method/ number, method detection limit (MDL), laboratory practical quantitation limit (PQL), reporting units, and concentration detected.

Regional Road Maintenance Endangered Species Act Program Guidelines: WSDOT shall notify Ecology of any proposed changes for bridge maintenance within the Regional Road Maintenance Program guidelines and if those changes result in a revision to the current guidelines document.

C. Records Retention

The Permittee shall retain records of all monitoring information for a minimum of three (3) years. Such information shall include all calibration and maintenance records and all original recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit. This period of retention shall be extended during the course of any unresolved litigation regarding the discharge of pollutants by the Permittee or when requested by the Director.

D. Recording of Results

For each measurement or sample taken, the Permittee shall record the following information: (1) the date, exact place, method, and time of sampling or measurement; (2) the individual or laboratory who performed the sampling or measurement; (3) the dates the analyses were performed; (4) the individual who performed the analyses; (5) the analytical techniques or methods used; and (6) the results of all analyses.

E. Additional Monitoring by the Permittee

If the Permittee monitors any pollutant more frequently than required by this permit using test procedures specified by Condition S2. of this permit, then the results of this monitoring shall be included in the calculation and reporting of the data submitted in the Permittee's Annual Project Completion Report.

F. Maintaining a Copy of This Permit

A copy of this permit or a document containing relevant conditions must be kept at the project site (bridge and ferry transfer span preparatory washing only) and be made available upon request to Ecology inspectors.

S4. OPERATION AND MAINTENANCE

The Permittee shall, at all times, properly operate and maintain all facilities or systems of treatment and control (and related appurtenances) which are installed to achieve compliance with the terms and conditions of this permit. Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems, which are installed by a Permittee only when the operation is necessary to achieve compliance with the conditions of this permit.

The Permittee is required to take all reasonable steps to minimize or prevent any discharge or sludge use or disposal in violation of this permit that has a reasonable likelihood of adversely affecting human health or the environment.

S5. SOLID WASTE DISPOSAL

A. Solid Waste Handling

The Permittee shall handle and dispose of all solid waste material in such a manner as to prevent its entry into state ground or surface water.

B. Leachate

The Permittee shall not allow leachate from its solid waste material to enter state waters without providing all known, available and reasonable methods of treatment, nor allow such leachate to

cause violations of the State Surface Water Quality Standards, Chapter 173-201A WAC, or the State Ground Water Quality Standards, Chapter 173-200 WAC. The Permittee shall apply for a permit or permit modification as may be required for such discharges to state ground or surface waters.

S6. COMPLIANCE SCHEDULE

A. Waste-Specific Translator.

The permittee is allowed to discharge filtered waste water resulting from pressure washing to rivers with flows between 55 cfs and 4200 cfs (7900 cfs in Western Washington) only if the permittee is in compliance with the following condition to develop a waste-specific translator or a comparable assessment that further defines the effluent characteristics or mixing zone effects:

By Spring of 2005 the permittee shall submit to Ecology for review and approval, a study plan to develop a waste-specific translator or comparable assessment. The plan shall identify the University contractor, contain the quality assurance plan for the chemical analysis, and the time schedule for completing the study within the period of this permit. The objective of the study is to determine the dynamics of conversion of total recoverable metal in the effluent to dissolved metal in the receiving water.

B. Ground Discharge Study.

An evaluation of the impacts of discharge to ground is required. The evaluation report is due one year after three pressure wash projects using #100 filter tarp have been completed and evaluated. The report shall use the effluent analysis required elsewhere in this permit and evaluate the potential of this discharge for violation of ground water standards (Chapter 173-200).

C. Water Effect Ratio.

The permittee may develop a water effect ratio to demonstrate the mitigating effects of the receiving water on the dissolved metal fraction of the wastewater. The development of a water effect ratio may be a combination of in-stream studies and literature reviews. If the permittee elects to perform a study of the water effect ratio, the permittee shall submit a study plan for review and approval to the Department of Ecology. The study plan must adhere to guidance given in publications EPA -823-B-94-001 and Ecology 92-109.

D. Mixing Zone Study.

A mixing zone study may be performed to determine effective dilution of pressure washing wastewater in marine waters. If the permittee elects to perform a mixing zone study, the permittee shall submit a study plan for review and approval to the Department of Ecology. The study plan must adhere to guidance given in Ecology publication 92-109.

S7. HAZARDOUS SPILL PREVENTION AND CONTROL

A. No petroleum products, wet cement, lime, concrete, chemicals - including emulsifiers, dispersants or cleaning solvents used for tool or equipment cleaning, or other toxic or deleterious materials shall be used in or immediately adjacent to waters of the state, or be discharged into waters of the state.

B. Equipment that enters the state's waters shall be maintained to prevent any visible sheen from petroleum products from appearing on the water. Containment measures for the sheen will be deployed if a visible sheen is observed. If a sheen is observed, work shall cease and all leaking or dirty equipment shall be removed from the water and the source of the sheen shall be fixed prior to reentering the water.

C. All oil, fuel or chemical storage tanks or containers will be stored in a method which provides appropriate containment in the event of a spill thereby reducing impacts to surface water or groundwater of the state.

D. Fuel hoses, oil drums, oil or fuel transfer valves and fittings, etc., shall be checked regularly for drips or leaks, and shall be maintained and stored properly to prevent spills into state waters. Proper security shall be maintained to prevent vandalism.

E. Concentrated waste or spilled chemicals shall be transported off site for disposal at a facility approved by Ecology or the appropriate County Health Department. These materials shall not be discharged to any sewer without approval of the local sewer authority.

GENERAL CONDITIONS

G1. SIGNATORY REQUIREMENTS

All applications, reports, or information submitted to the Department shall be signed and certified.

A. All permit applications shall be signed by either a responsible corporate officer of at least the level of vice president of a corporation, a general partner of a partnership, or the proprietor of a sole proprietorship.

B. All reports required by this permit and other information requested by the Department shall be signed by a person described above or by a duly authorized representative of that person. A person is a duly authorized representative only if:

1. The authorization is made in writing by a person described above and submitted to the Department.
2. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility, such as the position of plant manager, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.)

C. Changes to authorization. If an authorization under paragraph B.2 above is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of paragraph B.2 above must be submitted to the Department prior to or together with any reports, information, or applications to be signed by an authorized representative.

1. Certification. Any person signing a document under this section shall make the following certification:

   I certify under penalty of law, that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

G2. RIGHT OF INSPECTION AND ENTRY

The Permittee shall allow an authorized representative of the Department, upon the presentation of credentials and such other documents as may be required by law:

A. To enter upon the premises where a discharge is located or where any records must be kept under the terms and conditions of this permit.
B. To have access to and copy - at reasonable times and at reasonable cost - any records required to be kept under the terms and conditions of this permit.
C. To inspect - at reasonable times - any facilities, equipment (including monitoring and control equipment), practices, methods, or operations regulated or required under this permit.
D. To sample or monitor - at reasonable times - any substances or parameters at any location for purposes of assuring permit compliance or as otherwise authorized by the Clean Water Act.

G3. PERMIT ACTIONS

This permit may be modified, revoked and reissued, or terminated either at the request of any interested person (including the permittee) or upon the Department's initiative. However, the permit may only be modified, revoked and reissued, or terminated for the reasons specified in 40 CFR 122.62, 122.64 or WAC 173-220-150 according to the procedures of 40 CFR 124.5.

A. The following are causes for terminating this permit during its term, or for denying a permit renewal application:
   1. Violation of any permit term or condition.
   2. Obtaining a permit by misrepresentation or failure to disclose all relevant facts.
   3. A material change in quantity or type of waste disposal.

4. A determination that the permitted activity endangers human health or the environment or contributes to water quality standards violations and can only be regulated to acceptable levels by permit modification or termination [40 CFR part 122.64(3)].
5. A change in any condition that requires either a temporary or permanent reduction or elimination of any discharge or sludge use or disposal practice controlled by the permit [40 CFR part 122.64(4)].
6. Nonpayment of fees assessed pursuant to RCW 90.48.465.
7. Failure or refusal of the permittee to allow entry as required in RCW 90.48.090.

B. The following are causes for modification but not revocation and reissuance except when the permittee requests or agrees:
   1. A material change in the condition of the waters of the state.
   2. New information not available at the time of permit issuance that would have justified the application of different permit conditions.
   3. Material and substantial alterations or additions to the permitted facility or activities which occurred after this permit issuance.
   4. Promulgation of new or amended standards or regulations having a direct bearing upon permit conditions, or requiring permit revision.
   5. The Permittee has requested a modification based on other rationale meeting the criteria of 40 CFR part 122.62.
   6. The Department has determined that good cause exists for modification of a compliance schedule, and the modification will not violate statutory deadlines.
   7. Incorporation of an approved local pretreatment program into a municipality's permit.

The following are causes for modification or alternatively revocation and reissuance:
1. Cause exists for termination for reasons listed in A1 through A7, of this section, and the Department determines that modification or revocation and reissuance is appropriate.
2. The Department has received notification of a proposed transfer of the permit. A permit may also be modified to reflect a transfer after the effective date of an automatic transfer (General Condition G8) but will not be revoked and reissued after the effective date of the transfer except upon the request of the new permittee.

G4. REPORTING PLANNED CHANGES

The Permittee shall, as soon as possible, but no later than sixty (60) days prior to the proposed changes, give notice to the Department of planned physical alterations or additions to the permitted facility, production increases, or process modification which will result in: 1) the permitted facility being determined to be a new source pursuant to 40 CFR 122.29(b); 2) a significant change in the nature or an increase in quantity of pollutants discharged; or 3) a significant change in the Permittee's sludge use or disposal practices. Following such notice, and the submittal of a new application or supplement to the existing application, along with required engineering plans and reports, this permit may be modified, or revoked and reissued pursuant to 40 CFR 122.62(a) to specify and limit any pollutants not previously limited. Until such modification is effective, any new or increased discharge in excess of permit limits or not specifically authorized by this permit constitutes a violation.

G5. PLAN REVIEW REQUIRED

Prior to constructing or modifying any wastewater control facilities, an engineering report and detailed plans and specifications shall be submitted to the Department for approval in accordance with Chapter 173-240 WAC. Engineering reports, plans, and specifications shall be submitted at least one hundred eighty (180) days prior to the planned start of construction unless a shorter time is approved by Ecology. Facilities shall be constructed and operated in accordance with the approved plans.

G6. COMPLIANCE WITH OTHER LAWS AND STATUTES

Nothing in this permit shall be construed as excusing the Permittee from compliance with any applicable federal, state, or local statutes, ordinances, or regulations.

G7. DUTY TO REAPPLY

The Permittee shall apply for permit renewal at least 180 days prior to the specified expiration date of this permit.

G8. TRANSFER OF THIS PERMIT

In the event of any change in control or ownership of facilities from which the authorized discharge emanate, the Permittee shall notify the succeeding owner or controller of the existence of this permit by letter, a copy of which shall be forwarded to the Department.

A. Transfers by Modification
   Except as provided in paragraph B below, this permit may be transferred by the Permittee to a new owner or operator only if this permit has been modified or revoked and reissued under 40 CFR 122.62(b)(2), or a minor modification made under 40 CFR 122.63(d), to identify the new Permittee and incorporate such other requirements as may be necessary under the Clean Water Act.
B. Automatic Transfers
   This permit may be automatically transferred to a new Permittee if:
   1. The Permittee notifies the Department at least 30 days in advance of the proposed transfer date.
   2. The notice includes a written agreement between the existing and new Permittee's containing a specific date transfer of permit responsibility, coverage, and liability between them.
   3. The Department does not notify the existing Permittee and the proposed new Permittee of its intent to modify or revoke and reissue this permit. A modification under the subparagraph may also be minor modification under 40 CFR 122.63. If this notice is not received, the transfer is effective on the date specified in the written agreement.

G9. REDUCED PRODUCTION FOR COMPLIANCE

The Permittee, in order to maintain compliance with its permit, shall control production and/or all discharges upon reduction, loss, failure, or bypass of the treatment facility until the facility is

restored or an alternative method of treatment is provided. This requirement applies in the situation where, among other things, the primary source of power of the treatment facility is reduced, lost, or fails.

G10. REMOVED SUBSTANCES

Collected screenings, grit, solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters shall not be resuspended or reintroduced to the final effluent stream for discharge to state waters.

G11. DUTY TO PROVIDE INFORMATION

The Permittee shall submit to the Department, within a reasonable time, all information which the Department may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit or to determine compliance with this permit. The Permittee shall also submit to the Department upon request, copies of records required to be kept by this permit.

G12. OTHER REQUIREMENTS OF 40 CFR

All other requirements of 40 CFR 122.41 and 122.42 are incorporated in this permit by reference.

G13. ADDITIONAL MONITORING

The Department may establish specific monitoring requirements in addition to those contained in this permit by administrative order or permit modification.

G14. PAYMENT OF FEES

The Permittee shall submit payment of fees associated with this permit as assessed by the Department.

G15. PENALTIES FOR VIOLATING PERMIT CONDITIONS

Any person who is found guilty of willfully violating the terms and conditions of this permit shall be deemed guilty of a crime, and upon conviction thereof shall be punished by a fine of up to ten thousand dollars ($10,000) and costs of prosecution, or by imprisonment in the discretion of the court. Each day upon which a willful violation occurs may be deemed a separate and additional violation.

Any person who violates the terms and conditions of a waste discharge permit shall incur, in addition to any other penalty as provided by law, a civil penalty in the amount of up to ten thousand dollars ($10,000) for every such violation. Each and every such violation shall be a separate and distinct offense, and in case of a continuing violation, every day's continuance shall be deemed to be a separate and distinct violation.

G16. UPSET

Definition – "Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limitations because of factors beyond the reasonable control of the Permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

An upset constitutes an affirmative defense to an action brought for noncompliance with such technology-based permit effluent limitations if the requirements of the following paragraph are met.

A Permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs or other relevant evidence that: 1) an upset occurred and that the Permittee can identify the cause(s) of the upset; 2) the permitted facility was being properly operated at the time of the upset; 3) the Permittee submitted notice of the upset as required in condition S3 and 4) the Permittee complied with any remedial measures required under S4 of this permit.

In any enforcement proceeding the Permittee seeking to establish the occurrence of an upset has the burden of proof.

G17. PROPERTY RIGHTS

This permit does not convey any property rights of any sort, or any exclusive privilege.

G18. DUTY TO COMPLY

The Permittee shall comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Clean Water Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or denial of a permit renewal application.

G19. TOXIC POLLUTANTS

The Permittee shall comply with effluent standards or prohibitions established under Section 307(a) of the Clean Water Act for toxic pollutants within the time provided in the regulations that establish those standards or prohibitions, even if this permit has not yet been modified to incorporate the requirement.

G20. PENALTIES FOR TAMPERING

The Clean Water Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained under this permit shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than two years per violation, or by both. If a conviction of a person is for a violation committed after a first conviction of such person under this Condition,

punishment shall be a fine of not more than $20,000 per day of violation, or by imprisonment of not more than four (4) years, or by both.

G21. REPORTING ANTICIPATED NON-COMPLIANCE

The Permittee shall give advance notice to the Department by submission of a new application or supplement thereto at least one hundred and eighty (180) days prior to commencement of such discharges, of any facility expansions, production increases, or other planned changes, such as process modifications, in the permitted facility or activity which may result in noncompliance with permit limits or conditions. Any maintenance of facilities, which might necessitate unavoidable interruption of operation and degradation of effluent quality, shall be scheduled during non-critical water quality periods and carried out in a manner approved by the Department.

G22. REPORTING OTHER INFORMATION

Where the Permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or in any report to the Department, it shall promptly submit such facts or information.

G23. COMPLIANCE SCHEDULES

Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this permit shall be submitted no later than fourteen (14) days following each schedule date

Programmatic Permit Guidance

Bridge Paint-Prep Washing and Blasting
General HPA GH-D9448-01, Appendix C
General NPDES WA-0039039, Section S1.C

This guidance will help you interpret and understand the roles and responsibilities for complying with programmatic permits and exemptions for **bridge paint-prep washing and blasting**. You must read the permits prior to conducting work. Only familiarity with the permits will ensure your activities maintain compliance. The permits and referenced documents are available for download at WSDOT's programmatic permit website http://www.wsdot.wa.gov/environment/Programmatics/default.htm.

Programmatic permits and exemptions

- General Hydraulic Project Approval GH-D9448-01, Appendix C
- General NPDES WA-0039039, Section S1.C

Work covered:

The GHPA and NPDES permits allow bridge painting, paint-prep cleaning and washing, and abrasive blasting. Debris and paint collection and wash-water filtration structures are required. Subject to restrictions described below, filtered wash-water may enter State Waters or be discharged via ground infiltration.

Work not covered:

The permits do not allow work below the Ordinary High Water Line (OHWL) (except for a temporary floating platform) or work that affects the bed of state waters. Discharges are not allowed to 303(d) listed rivers, lakes, or wetlands if listed for copper, zinc, or lead. A list of 303(d) waterbodies is available at http://www.ecy.wa.gov/programs/wq/303d.

When and how often work is allowed:

There are no freshwater timing restrictions; however, some restrictions (below) may limit work to seasons when streams experience high flows. If the bridge is located less than 50 feet above saltwater and the containment or filter structure will shade aquatic plants for longer than 72 hours, then the shading part of the work shall occur between October 1 and April 30.

Work restrictions:

Appendix C and S1.C specify restrictions and required practices that minimize the disturbance of vegetation and prevent pollutants from entering the water. **Notable restrictions** include the following:

- Paint-prep activities should not be scheduled before May.
- Wash-water cannot be discharged to water bodies listed as impaired for copper, zinc, or lead by Ecology.
- Wash-water cannot be discharged to streams with flows less than 55cfs in Eastern Washington (EW) and 89cfs in Western Washington (WW).
- Wash-water discharges are allowed to streams with flows over 4261cfs (EW) and 7931 (WW) if filtered through a #100 sieve tarp.
- Wash-water discharges are allowed to the ground or to streams with flows in between those listed above—if filtered through a #100 sieve tarp ***and*** the project participates in discharge monitoring studies being conducted by ESO
- Dry clean (scrape, sweep, or vacuum) before washing and sandblasting. This includes flaking paint. Residual grease must be removed with degreaser on absorbent-material. (Exercise discretion when cleaning areas where worker safety may be compromised. Areas of the bridge that cannot be safely dry cleaned should be flushed.).

Monitoring Requirements:

Monitoring and evaluation of the water discharged during washing is required, as described in Section S2 of the NPDES Waste Discharge Permit (WA-0039039). The permit requires that at least one bridge paint-prep project be monitored each year. It is recommended that the bridge selected for monitoring has a nearby gaging station so that flow estimates are easy to obtain, however, this is not a requirement. Detailed monitoring protocols are provided as Appendix A to this Permit Guidance. This monitoring should be performed by a consultant under subcontract to the prime contractor responsible for paint-prep operations. **Contact Gregor Myhr to identify whether monitoring is required.**

Permit questions and monitoring/report submittals

Please contact:
Gregor Myhr **(360) 705-7487**
Permit Program Manager
WSDOT, Environmental Services Office
PO Box 47331, Olympia WA 98504-7331

Reporting requirements:

Complete and accurate reporting of all work covered by this permit is a legal requirement.

Report Planned Projects to WSDOT ESO (NPDES requirement only)

On or before January 10**, Regional maintenance and design** offices shall submit a list of all bridges expected to be pressure washed and painted during the year to the Environmental Services Office (ESO). The report shall include the following:

- stream flows expected during bridge washing,
- planned mitigation measures (following section C3 of the NPDES permit)
- (if proposed) the location and description of soils suitable for infiltration.

ESO must submit a statewide list of planned bridge painting projects to Ecology SEA program by January 31 of each year. The list must be submitted at least 90 days prior to conducting paint–prep activities. As a consequence, **no paint-prep washing should be scheduled before May.**

Pre-project notification to WDFW & Ecology

Three Days or more before starting work—notify the WDFW Regional Habitat Program Manager (RHMP) and Ecology's Regional water quality staff by letter or fax. The RHMP contact list is available at the programmatic permit website (click on the *documents referenced in permits* quick link). Ecology contacts are listed below. Notification shall include:

- Agency Name, contact person, and telephone number
- Type of Activity
- Waterbody name
- Bridge location, including road number, milepost
- Starting date and estimated ending date for work

Reporting a completed project to ESO

Painting projects covered by these permits must submit a Programmatic Permit Reporting Form to ESO (form and directions available at the programmatic permit website). Reports of completed projects (meaning the paint has been applied) are due by January 10 of the following year.

Annual monitoring reports are also required and prepared separately as described in Appendix A. In general, these include a field form and chain of custody form prepared by the person responsible for sample collection. The monitoring file should also contain a copy of the Notification letter sent to Ecology and WDFW pertaining to the scheduled bridge washing.

WSDOT's End of Year Report to Ecology and WDFW

Appendix C and S3.B specify information ESO must submit to the WDFW and Ecology in the annual report. ESO will coordinate with regional environmental offices, the maintenance environmental office at HQ, and bridge preservation to submit annual project reports by January 31. An annual report will be submitted even if no work was done. ESO will convert the SR & MP to lat/long for the annual report

Emergency reporting

Distressed or dead fish and water quality problems must be reported to the regional WDFW and Ecology offices below.

Ecology Regional Contact Information:

Southwest Region P.O. Box 47775 Olympia, WA 98504-7775 Fax # 360-407-6305 Deborah Cornett - supervisor for water quality inspectors/construction dcor461@ecy.wa.gov. 360-407-7269 Margaret Hill - water quality inspector mhil461@ecy.wa.gov. 360-407-0246 Janet Boyd - water quality inspector jboy461@ecy.wa.gov. 360-407-0245 Betsy Dickes - water quality inspector bedi461@ecy.wa.gov. 360-407-6283 Rusty Post - water quality inspector (Vancouver field office) rpos461@ecy.wa.gov. 360-690-4787	**Northwest Region** 3190 160th Ave SE Bellevue, WA 9808-5452 Fax # 425-649-7098 Don Seeberger - Unit Supervisor for the Water Quality Inspectors/Construction dsee461@ecy.wa.gov. 425-649-4424 John Drabek - supervisor for the water quality inspectors/industrial unit Note - John's group works pretty closely with Don's group - some overlap so John is listed more of a backup but should be included in all e-mail notifications. jdra461@ecy.wa.gov. 425-649-7293
Central Region 15 West Yakima Ave Suite 200 Yakima, WA 98902-3452 Fax # 509-575-2809 Jeff Lewis - supervisor for water quality inspectors jlew461@ecy.wa.gov. 509-454-7207 Ray Latham - water quality inspector rlat461@ecy.wa.gov. 509-575-2807 Terry Whittmeier twit461@ecy.wa.gov. 509-574-3991	**Eastern Region** N 4601 Monroe Spokane, WA 99205-1295 Fax # 509-329-3570 Lenox Bramble (called Len) - supervisor for water quality permit writers lbra461@ecy.wa.gov. 509-329-3504 Mike Hepp - water quality inspector mhep461@ecy.wa.gov. 509-329-3536

Department of Fish and Wildlife Contact Information:

Region 1 – Spokane: 509-456-4082	Region 4 – Mill Creek: 425-775-1311
Region 2 - Ephrata: 509-754-4624	Region 5 – Vancouver: 360-906-6700
Region 3 – Yakima: 509-575-2740	Region 6 – Montesano: 360-249-4628

WSDOT, Regional Maintenance Environmental Coordinators:

NCR—Joe Williams: 509-667-3054	SCR—Mark Reynolds 509-577-1755
SWR—Candace. Jochim: 360-905-2173	ER —Erv Koller: 509-324-6133
NWR—Mark Cornwall: 206-440-4523	OR —Ken Schlatter: 360-570-6707

2/9/2005

Programmatic Permit Guidance

Bridge Maintenance Washing and Cleaning
General HPA GH-D9448-01, Appendix B
General NPDES WA-0039039, Section S1.A

This guidance will help you interpret and understand the roles and responsibilities for complying with programmatic permits and exemptions for **maintenance bridge washing and cleaning**. You must read the permits prior to conducting work. Only familiarity with the permits will ensure your activities maintain compliance. The permits and other referenced documents are available for download at WSDOT's programmatic permit website http://www.wsdot.wa.gov/environment/Programmatics/default.htm.

Programmatic permits and exemptions

- General Hydraulic Project Approval GH-D9448-01, Appendix B
- General NPDES WA-0039039, Section S1.A

Work covered:

The GHPA and NPDES permits allow routine bridge cleaning and washing with low pressure water (relative to paint-prep washing). Wash water can be discharged to state waters without a filter if dry cleaning is done before washing.

Work not covered:

The GHPA and NPDES permits do not allow high-pressure paint-prep washing (covered in appendix C), work below the Ordinary High Water Line (OHWL), or work that affects the bed of State Waters.

When and how often work is allowed:

The bed of the water body must be covered with water (under the part of the structure to be washed). Also, work is limited to the following time periods: November 1 to May 31 (West of the Cascades) and December 1 to June 30 (East of the Cascades). There are no restrictions as to how often work can be conducted, so long as the 3-day pre-project notification requirement is met. However, maintenance washing is generally scheduled in advance and occurs no more than once per year.

Work restrictions:

Appendix B and S1.A specify restrictions and required practices that minimize pollutants entering the water and the disturbance of vegetation. **Notable requirements** include the following:

- Dry clean (scrape, sweep, or vacuum) before washing. This includes flaking paint. Residual grease must be removed with degreaser on absorbent-material. (Exercise discretion when cleaning areas where worker safety may be compromised. Areas of the bridge that cannot be safely dry cleaned should be flushed.)
- Use the minimum pressure that will clean the bridge and prevent paint chips from entering state waters. That is, avoid flaking paint and lower the pressure if needed to prevent the removal of bonded paint. The equipment that WSDOT typically uses, such as hoses attached to water trucks, mains and hydrants, do not carry pressures capable of removing bonded paint.
- Plug bridge drains before washing.
- Use clean wash water with no detergents or other additives.

Monitoring Requirements:

Monitoring and evaluation of the water discharged during washing is required, as described in Section S2 of the NPDES Waste Discharge Permit (WA-0039039). The permit requires that at least one bridge wash project be monitored each year. It is recommended that the bridge selected for monitoring has a nearby gaging station so that flow estimates are easy to obtain, however, this is not a requirement. Detailed monitoring protocols are provided as Appendix A to this Permit Guidance. This monitoring should be performed by a consultant under subcontract to the prime contractor responsible for paint-prep operations. **Contact Gregor Myhr to identify whether monitoring is required.**

Permit questions and monitoring/report submittals

Please contact:
Gregor Myhr **(360) 705-7487**
Permit Program Manager
WSDOT, Environmental Services Office
PO Box 47331, Olympia WA 98504-7331

Reporting requirements:

Complete and accurate reporting of all work covered by this permit is a legal requirement.

Pre-project notification to WDFW & Ecology

The WDFW Regional Habitat Program Manager (RHPM) and Ecology Regional WQ program must be notified at least three days before starting work, by letter or fax. The RHPM contact list is available at the programmatic permit website (click on the *documents referenced in permits* quick link).
Notification shall include:

- Agency Name, contact person, and telephone number
- Type of Activity
- Waterbody Name
- Bridge location, including road number, milepost
- Starting date and estimated ending date for work

Reporting a completed project to ESO

Maintenance crews fill out the ESA compliance forms on the PDA or the computer. Contact your Regional Maintenance Environmental Coordinator (see list next page) for assistance. When reporting, maintenance staff can recommend improvements to BMPs and mitigation: This is the best way to rid our toolbox of BMPs that do not work and add BMPs that work better.

Construction projects covered by these permits must submit a Programmatic Permit Reporting Form to ESO (form and directions available at the programmatic permit website). Reports of completed projects (meaning the paint has been applied) are due by January 10 of the following year. Maintenance staff should use the form to identify BMPs that do not work and new BMPs that work well.

Annual monitoring reports are also required and prepared separately as described in Appendix A. In general, these include a field form and chain of custody form prepared by the person responsible for sample collection. The monitoring file should also contain a copy of the Notification letter sent to Ecology and WDFW pertaining to the scheduled bridge washing.

WSDOT's End of Year Report to Ecology and WDFW

Appendix B and S3.B specify information ESO must submit to the WDFW and Ecology in the annual report. ESO will coordinate with regional environmental offices, the maintenance environmental office at HQ, and bridge preservation to submit annual project reports by January 31. An annual report will be submitted even if no work was done. ESO will convert the SR & MP to lat/long for the annual report.

Emergency reporting

Distressed or dead fish and water quality problems must be reported to the RMEC and regional WDFW and Ecology offices below.

Ecology Regional Contact Information:

Southwest Region P.O. Box 47775 Olympia, WA 98504-7775 Fax # 360-407-6305 Deborah Cornett - supervisor for water quality inspectors/construction dcor461@ecy.wa.gov. 360-407-7269 Margaret Hill - water quality inspector mhil461@ecy.wa.gov. 360-407-0246 Janet Boyd - water quality inspector jboy461@ecy.wa.gov. 360-407-0245 Betsy Dickes - water quality inspector bedi461@ecy.wa.gov. 360-407-6283 Rusty Post - water quality inspector (Vancouver field office) rpos461@ecy.wa.gov. 360-690-4787	**Northwest Region** 3190 160th Ave SE Bellevue, WA 9808-5452 Fax # 425-649-7098 Don Seeberger - Unit Supervisor for the Water Quality Inspectors/Construction dsee461@ecy.wa.gov. 425-649-4424 John Drabek - supervisor for the water quality inspectors/industrial unit Note - John's group works pretty closely with Don's group - some overlap so John is listed more of a backup but should be included in all e-mail notifications. jdra461@ecy.wa.gov. 425-649-7293
Central Region 15 West Yakima Ave Suite 200 Yakima, WA 98902-3452 Fax # 509-575-2809 Jeff Lewis - supervisor for water quality inspectors jlew461@ecy.wa.gov. 509-454-7207 Ray Latham - water quality inspector rlat461@ecy.wa.gov. 509-575-2807 Terry Whittmeier twit461@ecy.wa.gov. 509-574-3991	**Eastern Region** N 4601 Monroe Spokane, WA 99205-1295 Fax # 509-329-3570 Lenox Bramble (called Len) - supervisor for water quality permit writers lbra461@ecy.wa.gov. 509-329-3504 Mike Hepp - water quality inspector mhep461@ecy.wa.gov. 509-329-3536

Department of Fish and Wildlife Contact Information:

Region 1 – Spokane: 509-456-4082	Region 4 – Mill Creek: 425-775-1311
Region 2 - Ephrata: 509-754-4624	Region 5 – Vancouver: 360-906-6700
Region 3 – Yakima: 509-575-2740	Region 6 – Montesano: 360-249-4628

WSDOT, Regional Maintenance Environmental Coordinators:

NCR—Joe Williams: 509-667-3054	SCR—Mark Reynolds 509-577-1755
SWR—Candace. Jochim: 360-905-2173	ER —Erv Koller: 509-324-6133
NWR—Mark Cornwall: 206-440-4523	OR —Ken Schlatter: 360-570-6707

PROGRAMMATIC AGREEMENT BETWEEN WASHINGTON DEPARTMENT OF TRANSPORTATION, WASHINGTON DEPARTMENT OF ECOLOGY AND WASHINGTON DEPARTMENT OF FISH AND WILDLIFE FOR BRIDGE AND FERRY TERMINAL MAINTENANCE AND PRESERVATION ACTIVITIES

CONTENTS:

A. BRIDGE AND FERRY TERMINAL DECK AND DRAIN CLEANING.
B. BRIDGE CLEANING AND WASHING.
C. BRIDGE PAINTING, INCLUDING PREPARATORY CLEANING, WASHING, AND ABRASIVE BLASTING.
D. BRIDGE GENERAL MAINTENANCE AND REPAIR.
E. BRIDGE AND FERRY TERMINAL DECK OVERLAY REPLACEMENT.
F. FERRY TERMINAL CLEANING, WASHING, AND MARINE GROWTH REMOVAL.
G. FERRY TERMINAL PAINTING, INCLUDING PREPARATORY CLEANING, WASHING, ABRASIVE BLASTING, AND MARINE GROWTH REMOVAL.
H. FERRY TERMINAL GENERAL MAINTENANCE AND REPAIR.

*Note: These conditions are FINAL, except that we are waiting for completion of impact analysis and response from Ecology anticipated to be due October 6th that will contain final conditions that will apply to where the approved technology can be used based on in-stream flow rates or dilution factors. These conditions will only apply to sections B, C, F, and G of this Agreement.

AGENCY SIGNATURE BLOCK

_____

A. **BRIDGE AND FERRY TERMINAL DECK AND DRAIN CLEANING**: This work typically occurs annually or more frequently for bridge and ferry terminal safety and appearance and includes sweeping and/or vacuuming the deck, sidewalks gutters, and drains. Cleaned debris is collected and contained and placed at an approved disposal site. The only wash water that may enter state waters is direct drain flushing water after dry cleaning methods have been used in the drains. No work shall occur below the ordinary high water line (OHWL) or shall affect the bed of state waters.

1. HAZARDOUS SPILL AND EROSION CONTROL: Hazardous substance or material spill and soil erosion prevention and control shall comply with the Water Quality Implementing Agreement (WQIA) between WSDOT and Ecology.

2. FISH KILL/WATER QUALITY PROBLEM NOTIFICATION: If at any time, as a result of project activities, fish are observed in distress, a fish kill occurs, or a water quality problem occurs, immediate notification shall be made to the regional offices of WDFW and Ecology in the attached telephone lists of regional offices.

3. Measures shall be used to prevent damage to the vegetation in the riparian (streamside or shoreline) area located within 200 feet perpendicular to the water and adjacent to the structure. Within the riparian area existing parking lots and open managed fields and lots may be used for staging work.

4. No work or equipment use shall occur below the ordinary high water line (OHWL) or shall affect the bed of state waters.

5. Deck shall first be cleaned using dry methods and equipment (scraping, sweeping, vacuuming) that will prevent debris and substances from entering state waters. Examples of debris and substances include, but are not restricted to:

    a. bird nests and associated fecal material
    b. dirt, moss, sediments, and rust
    c. old paint chips and residue
    d. petroleum products
    e. cement chips
    f. construction materials
    g. chemicals or any other toxic or deleterious substances

6. If cleaned debris, substances, and/or deck wash water could enter state waters through deck drains, where practicable the drains shall be temporarily blocked to route water to the landward end(s) of the structure and onto vegetative areas.

7. Cleaned debris and substances from this project shall be collected and then contained and deposited above the limits of flood water or extreme high tide in a disposal site that has the appropriate regulatory approval. No debris and substances shall be placed in road drainages, wetlands, riparian (streamside or shoreline) areas, or on adjacent land where they may erode into state waters.

8. Washing shall be done with clean water. No detergents or other cleaning agents shall be used.

9. After dry cleaning methods have been completed debris accumulations remaining in the drains may be flushed with clean water.

10. No petroleum products, hydraulic fluids, chemicals, or any other polluting substances shall be allowed to enter state waters.

B. **BRIDGE CLEANING AND WASHING**: This work typically occurs annually or less frequently, is not involved with preparation for structure painting, and includes bridge cleaning and washing of the superstructure required to prevent metal and material deterioration. This work does not require a water filter structure. This work includes first dry cleaning using scraping, sweeping, and vacuuming methods and equipment. Cleaned debris is collected and contained and placed in an approved disposal site. Washing of the superstructure is done after dry cleaning with use of various types of washing equipment. The wash water may enter state waters. No work shall occur below the ordinary high water line (OHWL) or shall affect the bed of state waters.

1. TIMING LIMITATIONS: Work shall only occur during the following times and water conditions, to increase dilution of a potential concentration of sedimentation and associated pollutants in state waters:

   a. West of the Cascade Mountain Crest: **November 1 to May 31**.
      East of the Cascade Mountain Crest: **December 1 to June 30.**

   b. Bridge washing work that will result in wash water entering state waters shall be restricted to when the bed of the water body under the part of the structure to be washed is covered with water.

2. NOTIFICATION: The local Regional Habitat Program Manager (RHPM) in the attached list of WDFW regional offices shall be notified (letter or fax) at least three (3) working days prior to start of work. Notification shall include:

   a. Agency name, contact person, and telephone number
   b. Water body name
   c. Bridge location, including road number, milepost, latitude, and longitude
   d. Starting date and estimated ending date for work

3. ANNUAL REPORTING: WSDOT shall submit to the WDFW Habitat Program, address 600 Capitol Way N. Olympia, WA 98501, a calendar year annual report of Bridge Cleaning and Washing work by January 31 of the following year. An annual report is also required if no work was conducted. The annual report shall include:

   a. General: Reporting agency, contact person, address, telephone number, date of report, time period.
   b. Summary: Total number of individual projects by region and statewide.
   c. Problem(s) encountered: Provision violation, notification, corrective action, impacts to fish life and water quality from problem. If the Environmental Compliance Assurance Procedure (ECAP) was used, what activity triggered the procedure. *[these*

may be highlighted and specified in this section or included in the full list of projects completed below]

d. Recommendations for improvement to BMPs and mitigation *[optional]*
e. List of individual projects completed: By region including water body name, bridge name, road number and milepost, latitude and longitude, date of work.

4. HAZARDOUS SPILL AND EROSION CONTROL: Hazardous substance or material spill and soil erosion prevention and control shall comply with the Water Quality Implementing Agreement (WQIA) between WSDOT and Ecology.

5. FISH KILL/WATER QUALITY PROBLEM NOTIFICATION: If at any time, as a result of project activities, fish are observed in distress, a fish kill occurs, or a water quality problem occurs, immediate notification shall be made to the regional offices of WDFW and Ecology in the attached telephone lists of regional offices.

6. Measures shall be used to prevent damage to the vegetation in the riparian (streamside or shoreline) area located within 200 feet perpendicular to the water and adjacent to the structure. Within the riparian area existing parking lots and open managed fields and lots may be used for staging work.

7. No work or equipment use shall occur below the ordinary high water line (OHWL) or shall affect the bed of state waters.

8. Bridge shall first be cleaned using dry methods and equipment (scraping, sweeping, vacuuming) that will prevent debris and substances from entering state waters, except residual grease may be removed by hand methods and degreaser on absorbent material, provided none of this material shall enter state waters. Examples of debris and substances include, but are not restricted to:

   a. bird nests and fecal material
   b. dirt, moss, sediments, and rust
   c. old paint chips and residue
   d. petroleum products
   e. cement chips
   f. construction materials
   g. chemicals or any other toxic or deleterious substances

9. If cleaned debris, substances, and/or wash water could enter state waters through deck drains, where practicable the drains shall be temporarily blocked to route water to the landward end(s) of the structure and onto vegetative areas.

10. Cleaned debris and substances from this project shall be collected and then contained and deposited above the limits of flood water or extreme high tide in a disposal site that has

the appropriate regulatory approval. No debris and substances shall be placed in road drainages, wetlands, riparian (streamside or shoreline) areas, or on adjacent land where they may be eroded into state waters.

11. Washing shall be done with clean water. No detergents or other cleaning agents shall be used.

12. Washing shall occur with the minimum water pressure necessary to accomplish the work to prevent existing paint from being removed and entering state waters.

13. After dry cleaning methods have been completed debris accumulations remaining in the drains may be flushed with clean water.

14. No petroleum products, hydraulic fluids, chemicals, or any other polluting substances shall be allowed to enter state waters.

C. **BRIDGE PAINTING, INCLUDING PREPARATORY CLEANING, WASHING, AND ABRASIVE BLASTING**: This painting work typically occurs every 15-25 years and includes preparatory dry cleaning the superstructure to be painted using scraping, sweeping, and vacuuming methods and equipment. A debris and paint collection containment and water filter structure is required. Cleaned debris is collected and contained and placed at an approved disposal site. After dry leaning, washing of the superstructure to be painted is done with high pressure equipment followed by selective areas abrasive blasting. The filtered wash water may enter state waters. No work shall occur below the ordinary high water line (OHWL) or shall affect the bed of state waters, except it may include use of a temporary floating work platform.

1. TIMING LIMITATIONS:

   a. Saltwater: If the bridge is less than fifty (50) feet in elevation above the water and the project includes a containment or filter structure or a temporary floating work platform that would result in temporary new area shading of eelgrass, kelp, and/or other intertidal wetland vascular plants longer than 72 hours, the shading part of the work shall only occur from **October 1 to April 30** of the following year, to prevent shading impacts to such saltwater vegetation habitat.

2. NOTIFICATION: The local Regional Habitat Program Manager (RHPM) in the attached list of WDFW regional offices shall be notified (letter or fax) at least three (3) working days prior to start of work. Notification shall include:

   a. Agency name, contact person, and telephone number
   b. Water body name
   c. Bridge location, including road number, milepost, latitude, and longitude
   b. Starting date and estimated ending date for work

3. ANNUAL REPORTING: WSDOT shall submit to the WDFW Habitat Program, address 600 Capitol Way N. Olympia, WA 98501, a calendar year annual report of Bridge Painting including Preparatory Cleaning, Washing, and Abrasive Blasting work by January 31 of the following year. An annual report is also required if no work was conducted. The annual report shall include:

   a. <u>General</u>: Reporting agency, contact person, address, telephone number, date of report, time period.
   b. <u>Summary</u>: Total number of individual projects by region and statewide.
   c. <u>Problem(s) encountered</u>: Provision violation, notification, corrective action, impacts to fish life and water quality. If the Environmental Compliance Assurance Procedure (ECAP) was used, what activity triggered the procedure. *[these may be highlighted*

and specified in this section or included in the full list of projects completed below]

d. Recommendations for improvement to BMPs and mitigation *[optional]*

e. List of individual projects completed: By region including water body name, bridge name, road number and milepost, latitude and longitude, date of work.

4. HAZARDOUS SPILL AND EROSION CONTROL: Hazardous substance or material spill and soil erosion prevention and control shall comply with the Water Quality Implementing Agreement (WQIA) between WSDOT and Ecology.

5. FISH KILL/WATER QUALITY PROBLEM NOTIFICATION: If at any time, as a result of project activities, fish are observed in distress, a fish kill occurs, or a water quality problem occurs, immediate notification shall be made to the regional offices of WDFW and Ecology in the attached telephone lists of regional offices.

6. Measures shall be used to prevent damage to the vegetation in the riparian (streamside or shoreline) area located within 200 feet perpendicular to the water and adjacent to the structure. Within the riparian area existing parking lots and open managed fields and lots may be used for staging work.

7. No work or equipment use shall occur below the ordinary high water line (OHWL) or shall affect the bed of state waters, except the use of a temporary floating work platform.

8. No disturbance to the stream banks or shoreline shall occur when placing or removing a temporary floating work platform.

9. Any temporary floating work platform shall not ground on the bed of state waters.

10. No temporary floating work platform anchoring shall occur in freshwater that would disturb fish spawning areas or in saltwater that would disturb eelgrass, kelp, and/or other intertidal wetland vascular plants.

11. Bridge shall first be cleaned using dry methods and equipment (scraping, sweeping, vacuuming) that will prevent debris and substances from entering state waters, except residual grease may be removed by hand methods and degreaser on absorbent material, provided none of this material shall enter state waters. Examples of debris and substances include, but are not restricted to:

    a. bird nests and fecal material
    b. dirt, moss, sediments, and rust
    c. old paint chips and residue
    d. blasting medium
    e. petroleum products
    f. cement chips
    g. construction materials

h. chemicals or any other toxic or deleterious substances

12. If cleaned debris, substances, and/or wash water could enter state waters through deck drains, where practicable the drains shall be temporarily blocked to route water to the landward end(s) of the structure and onto vegetative areas.
13. Wash water and debris resulting from pressure washing, including but not restricted to dirt and old paint chips, shall be filtered through a filter structure capable of collecting all such debris.

14. Work that would result in debris and substances entering state waters, including but not restricted to dirt, abrasive blasting medium, old paint chips, and new paint, shall include a containment structure capable of collecting all such debris and substances.

15. Debris and substances collected in the containment or filter structure shall be removed from the structure at least daily, whenever accumulations may place the structure at risk, and before its movement or removal.

16. Work shall not occur when weather conditions would place the containment or filter structure at risk and/or result in loss of containment or filtering of debris and substances.

17. Any containment or filter structure shall be routinely inspected and repaired as necessary to ensure its function.

18. Cleaned debris and substances from this project shall be collected and then contained and deposited above the limits of flood water or extreme high tide in a disposal site that has the appropriate regulatory approval. No debris and substances shall be placed in road drainages, wetlands, riparian (streamside and shoreline) areas, or on adjacent land where they may be eroded into state waters.

19. Washing shall be done with clean water. No detergents or other cleaning agents shall be used.

20. After dry cleaning methods have been completed debris accumulations remaining in the drains may be flushed with clean water.

21. No cleaning of any painting or other equipment or mixing or storing of paint and other polluting materials and substances shall be done over the water or in an area where a spill would result in these materials and substances entering state waters.

22. No petroleum products, hydraulic fluids, chemicals, or any other polluting substances shall be allowed to enter state waters.

D. **BRIDGE GENERAL MAINTENANCE AND REPAIR**: This work occurs as necessary to maintain the bridge function and includes maintenance, repair, or replacement of structure components above state waters in their existing configuration. This work may include cap replacement or stringer addition or replacement. This work does not include new construction, replacement or expansion of the existing structure within state waters or the flood plain; work that could result in bridge structural failure; release of grindings or toxic materials to state waters; work below the ordinary high water line (OHWL); or work that affects the bed of state waters; except it may include use of a temporary floating work platform.

1. TIMING LIMITATIONS:

   a. Saltwater: If the structure is less than fifty (50) feet in elevation above the water and the project includes a containment or filter structure or a temporary floating work platform that would result in temporary new area shading of eelgrass, kelp, and/or other intertidal wetland vascular plants longer than 72 hours, the shading part of the work shall only occur from **October 1 to April 30** of the following year, to prevent shading impacts to such saltwater vegetation habitat.

2. ANNUAL REPORTING: WSDOT shall submit to the WDFW Habitat Program, address 600 Capitol Way N. Olympia, WA 98501, a calendar year annual report of Bridge General Maintenance and Repair work; including work outside the rails, under the bridge, structural maintenance and repair, cap replacement, stringer addition or replacement, and use of a temporary floating work platform; by January 31 of the following year. An annual report is also required if no work was conducted. The annual report shall include:

   a. General: Reporting agency, contact person, address, telephone number, date of report, time period.
   b. Summary: Total number of individual projects by region and statewide.
   c. Problem(s) encountered: Provision violation, notification, corrective action, impacts to fish life and water quality. If the Environmental Compliance Assurance Procedure (ECAP) was used, what activity triggered the procedure. *[these may be highlighted and specified in this section or included in the full list of projects completed below]*
   d. Recommendations for improvement to BMPs and mitigation *[optional]*
   e. List of individual projects completed: By region including water body name, bridge name, road number and milepost, latitude and longitude, date of work.

3. HAZARDOUS SPILL AND EROSION CONTROL: Hazardous substance or material spill and soil erosion prevention and control shall comply with the Water Quality Implementing Agreement (WQIA) between WSDOT and Ecology.

4. FISH KILL/WATER QUALITY PROBLEM NOTIFICATION: If at any time, as a result of project activities, fish are observed in distress, a fish kill occurs, or a water quality problem occurs, immediate notification shall be made to the regional offices of WDFW and Ecology in the attached telephone lists of regional offices.

5. Measures shall be used to prevent damage to the vegetation in the riparian (streamside or shoreline) area located within 200 feet perpendicular to the water and adjacent to the structure. Within the riparian area existing parking lots and open managed fields and lots may be used for staging work.

6. No work or equipment use shall occur below the ordinary high water line (OHWL) or shall affect the bed of state waters, except the use of a temporary floating work platform.

7. No disturbance to the stream banks or shoreline shall occur when placing or removing a temporary floating work platform.

8. Any temporary floating work platform shall not ground on the bed of state waters.

9. No temporary floating work platform anchoring shall occur in freshwater that would disturb fish spawning areas or in saltwater that would disturb eelgrass, kelp, and/or other intertidal wetland vascular plants.

10. Work that would result in debris and substances entering state waters shall include a containment structure capable of collecting all such debris and substances.

11. Debris and substances collected in the containment structure shall be removed from the structure at least daily, whenever accumulations may place the structure at risk, and before its movement or removal.

12. Cleaned debris and substances from this project shall be collected and then contained and deposited above the limits of flood water or extreme high tide in a disposal site that has the appropriate regulatory approval. No debris and substances shall be placed in road drainages, wetlands, riparian (streamside or shoreline) areas, or on adjacent land where they may be eroded into state waters.

13. Any containment structure shall be routinely inspected and repaired as necessary to ensure its function.

14. No cleaning of any equipment or mixing or storing of any polluting materials and substances shall be done over the water or in an area where a spill would result in these materials and substances entering state waters.

15. No petroleum products, hydraulic fluids, chemicals, or any other polluting substances shall be allowed to enter state waters.

E. **BRIDGE AND FERRY TERMINAL DECK OVERLAY REPLACEMENT**: This work includes removal and replacement of existing concrete or asphalt overlay of the deck road surface, gutters, and sidewalks only where a structurally sound subsurface exists that will prevent old or new overlay material from entering state waters. A debris, material, and substance collection containment structure is required only if any of these materials may enter state waters. This work shall not include debris, materials, or substances entering state waters; bridge or ferry terminal enlargement; replacement of stringers and/or other structural supports; work below the ordinary high water line (OHWL); or work that affects the bed of state waters.

1. NOTIFICATION: The local Regional Habitat Program Manager (RHPM) in the attached list of WDFW regional offices shall be notified (letter or fax) at least three (3) working days prior to start of work. Notification shall include:

   a. Agency name, contact person, and telephone number
   b. Water body name
   c. Bridge location, including road number, milepost, latitude, and longitude; or ferry terminal location
   d. Starting date and estimated ending date for work.

2. ANNUAL REPORTING: WSDOT shall submit to the WDFW Habitat Program, address 600 Capitol Way N. Olympia, WA 98501, a calendar year annual report of Bridge and Ferry Terminal Deck Overlay Replacement work by January 31 of the following year. An annual report is also required if no work was conducted. The annual report shall include:

   a. General: Reporting agency, contact person, address, telephone number, date of report, time period.
   d. Summary: Total number of individual projects by region and statewide.
   e. Problem(s) encountered: Provision violation, notification, corrective action, impacts to fish life and water quality. If the Environmental Compliance Assurance Procedure (ECAP) was used, what activity triggered the procedure. *[these may be highlighted and specified in this section or included in the full list of projects completed below]*
   d. Recommendations for improvement to BMPs and mitigation *[optional]*
   e. List of individual projects completed: By region including water body name, bridge or ferry terminal name, road number and milepost, latitude and longitude, date of work..

3. HAZARDOUS SPILL AND EROSION CONTROL: Hazardous substance or material spill and soil erosion prevention and control shall comply with the Water Quality

Implementing Agreement (WQIA) between WSDOT and Ecology.

4. FISH KILL/WATER QUALITY PROBLEM NOTIFICATION: If at any time, as a result of project activities, fish are observed in distress, a fish kill occurs, or a water quality problem occurs, immediate notification shall be made to the regional offices of WDFW and Ecology in the attached telephone lists of regional offices.

5. Measures shall be used to prevent damage to the vegetation in the riparian (streamside or shoreline) area located within 200 feet perpendicular to the water and adjacent to the structure. Within the riparian area existing parking lots and open managed fields and lots may be used for staging work.

6. No work or equipment use shall occur below the ordinary high water line (OHWL) or shall affect the bed of state waters.

7. An existing structurally sound impervious subsurface shall be required to prevent old deck material and new surfacing material from entering state waters.

8. During physical or hydraulic removal of the old surface, the water and all removed debris and substances shall be fully contained to prevent them from entering state waters.

9. Bridge drains shall be blocked during old surface removal and new surface installation, to prevent water, debris, and substances from entering state waters.

10. Debris and substances collected in the containment structure shall be removed from the structure at least daily, whenever accumulations may place the structure at risk, and before its movement or removal.

11. Cleaned debris and substances from this project shall be collected and then contained and deposited above the limits of flood water or extreme high tide in a disposal site that has the appropriate regulatory approval. No debris and substances shall be placed in road drainages, wetlands, riparian (streamside or shoreline) areas, or on adjacent land where they may be eroded into state waters.

12. Any containment structure shall be routinely inspected and repaired as necessary to ensure its function.

13. No cleaning of any equipment or mixing or storing of any polluting materials and substances shall be done over the water or in an area where a spill would result in these materials and substances entering state waters.

14. New overlay material shall not be allowed to enter state waters.

15. No petroleum products, hydraulic fluids, chemicals, or any other polluting substances shall be allowed to enter state waters.

F. **FERRY TERMINAL CLEANING, WASHING, AND MARINE GROWTH REMOVAL**: This work includes external ferry terminal general cleaning and washing of the superstructure and marine growth removal from the in-water parts of the structure required to prevent material deterioration. This work typically occurs annually or less frequently and is not involved with preparation for structure painting. This work does not require a water filter structure. This work includes dry cleaning the superstructure using scraping, sweeping, and vacuuming methods and equipment. Cleaned debris is collected and contained and placed at an approved disposal site. Washing of the superstructure is done after cleaning with use of various types of washing equipment. The wash water may enter state waters. No work shall occur below the ordinary high water line (OHWL) or shall affect the bed of state waters, except it may include use of a temporary floating work platform and marine growth removal.

1. TIMING LIMITATIONS:

   a. WASH WATER DILUTION: Ferry terminal washing work shall be restricted to when the depth of water under the part of the structure to be washed is **greater than five (5) feet at its shallowest part**, to increase dilution of a potential concentration of sedimentation and associated pollutants in state waters.

   b. SALTWATER VEGETATION PROTECTION: If the project would result in temporary new shading of eelgrass, kelp, and/or other intertidal wetland vascular plants longer than 72 hours, the work that produces the shadow shall only occur from **October 1 through April 30** of the following year, to prevent shading impacts to such saltwater vegetation habitat.

   c. JUVENILE SALMONID MIGRATION PROTECTION: If a temporary floating work platform is used shoreward of minus 10 feet (tidal reference MLLW=0.0 feet) and/or closer than 25 feet from the water's edge at any water level, the use of a temporary floating work platform in this area shall only occur from **July 1 through February 15** of the following year, for the protection of outmigrating juvenile salmonids.

2. NOTIFICATION FOR FLOATING WORK PLATFORM USE: If a temporary floating work platform with greater than 20 feet wide is used, the local Regional Habitat Program Manager (RHPM) in the attached list of WDFW regional offices shall be notified (letter or fax) at least three (3) working days prior to start of work. Notification shall include:

   a. Agency name, contact person, and telephone number
   b. Water body name
   c. Ferry terminal location

d. Starting date and estimated ending date for work

3. HAZARDOUS SPILL AND EROSION CONTROL: Hazardous substance or material spill and soil erosion prevention and control shall comply with the Water Quality Implementing Agreement (WQIA) between WSDOT and Ecology.

4. FISH KILL/WATER QUALITY PROBLEM NOTIFICATION: If at any time, as a result of project activities, fish are observed in distress, a fish kill occurs, or a water quality problem occurs, immediate notification shall be made to the regional offices of WDFW and Ecology in the attached telephone lists of regional offices.

5. Measures shall be used to prevent damage to the vegetation in the riparian (streamside or shoreline) area located within 200 feet perpendicular to the water and adjacent to the structure. Within the riparian area existing parking lots and open managed fields and lots may be used for staging work.

6. No work or equipment use shall occur below the ordinary high water line (OHWL)) or shall affect the bed of state waters, except the use of a temporary floating work platform and marine growth removal.

7. No disturbance to the shoreline shall occur when placing or removing a temporary floating work platform.

8. No temporary floating work platform anchoring or grounding shall occur in saltwater that would disturb eelgrass, kelp, and/or other intertidal wetland vascular plants.

9. Ferry terminal shall first be cleaned using dry methods and equipment (scraping, sweeping, vacuuming) that will prevent debris and substances from entering state waters, except residual grease may be removed by hand methods and degreaser on absorbent material, provided none of this material shall enter state waters. Examples of debris and substances include, but are not restricted to:

   a. bird nests and associated fecal material
   b. dirt, moss, sediments, and rust
   c. old paint chips and residue
   d. petroleum products
   e. cement chips
   f. construction materials
   g. chemicals or any other toxic or deleterious substances

10. If cleaned debris, substances, and/or wash water could enter state waters through deck drains, where practicable the drains shall be temporarily blocked to route water to the landward end of the ferry terminal and onto vegetative areas.

11. Marine growth may be removed from the ferry terminal, provided for existing pilings and other wood structures treated with creosote and preservative chemicals, methods shall be used that will include nets, tarps, or other appropriate equipment to prevent such removed growth from falling on the sea bed as much as possible. Any removed growth that falls on the sea bed shall be collected from the sea bed as much as possible, if feasible.
12. Marine growth removal from creosote or any other treated wood shall be restricted to the use of methods and tools that will minimize removal of the creosote or treated wood fibers.

13. Cleaned debris, marine growth, and substances from this project shall be collected and then contained and deposited above the limits of extreme high tide in a disposal site that has the appropriate regulatory approval. No debris, marine growth, and substances shall be placed in road drainages, wetlands, riparian (shoreline) areas, or on adjacent land where they may be eroded into state waters.

14. Washing shall be done with clean water. No detergents or other cleaning agents shall be used.

15. Washing shall occur with the minimum water pressure to prevent existing paint from being removed and entering state waters.

16. After dry cleaning methods have been completed debris accumulations remaining in the drains may be flushed with clean water.

17. No petroleum products, hydraulic fluids, chemicals, or any other polluting substances shall be allowed to enter state waters.

G. **FERRY TERMINAL PAINTING, INCLUDING PREPARATORY CLEANING, WASHING, ABRASIVE BLASTING, AND MARINE GROWTH REMOVAL**: This painting work typically occurs every 15-25 years and includes dry cleaning and washing the external superstructure and marine growth removal from the in- water parts of the structure to be painted using scraping, sweeping, and vacuuming methods and equipment. A debris and paint collection containment and water filter structure is required. Cleaned debris is collected and contained and placed at an approved disposal site. After dry leaning, washing of the superstructure to be painted is done with high pressure equipment followed by selective areas abrasive blasting. The filtered wash water may enter state waters. No work shall occur below the ordinary high water line (OHWL) or shall affect the bed of state waters, except it may include use of a temporary floating work platform and marine growth removal.

1. TIMING LIMITATIONS:

   a. WASH WATER DILUTION: Ferry terminal washing work shall be restricted to when the depth of water under the part of the structure to be washed is **greater than five (5) feet at its shallowest part**, to increase dilution of a potential concentration of sedimentation and associated pollutants in state waters.

   b. SALTWATER VEGETATION PROTECTION: If the project would result in temporary new shading of eelgrass, kelp, and/or other intertidal wetland vascular plants longer than 72 hours, the work that produces the shadow shall only occur from **October 1 through April 30** of the following year, to prevent shading impacts to such saltwater vegetation habitat.

   c. JUVENILE SALMONID MIGRATION PROTECTION: If a temporary floating work platform is used shoreward of minus 10 feet (tidal reference MLLW=0.0 feet) and/or closer than 25 feet from the water's edge at any water level, the use of a temporary floating work platform in this area shall only occur from **July 1 through February 15** of the following year, for the protection of outmigrating juvenile salmonids.

2. NOTIFICATION: The local Regional Habitat Program Manager (RHPM) in the attached list of WDFW regional offices shall be notified (letter or fax) at least three (3) working days prior to start of work. Notification shall include:

   a. Agency name, contact person, and telephone number
   b. Water body name
   c. Ferry terminal location
   d. Starting date and estimated ending date for work

3. ANNUAL REPORTING: WSDOT shall submit to the WDFW Habitat Program, address 600 Capitol Way N. Olympia, WA 98501, a calendar year annual report of Ferry Terminal Painting including Preparatory Cleaning, Washing, and Abrasive Blasting work by January 31 of the following year. An annual report is also required if no work was conducted. The annual report shall include:

   a. General: Reporting agency, contact person, address, telephone number, date of report, time period.
   b. Summary: Total number of individual projects by region and statewide.
   a. Problem(s) encountered: Provision violation, notification, corrective action, impacts to fish life and water quality. If the Environmental Compliance Assurance Procedure (ECAP) was used, what activity triggered the procedure. *[these may be highlighted and specified in this section or included in the full list of projects completed below]*
   d. Recommendations for improvement to BMPs and mitigation *[optional]*
   e. List of individual projects completed: By region including water body name, ferry terminal name, latitude and longitude, date of work.

4. HAZARDOUS SPILL AND EROSION CONTROL: Hazardous substance or material spill and soil erosion prevention and control shall comply with the Water Quality Implementing Agreement (WQIA) between WSDOT and Ecology.

5. FISH KILL/WATER QUALITY PROBLEM NOTIFICATION: If at any time, as a result of project activities, fish are observed in distress, a fish kill occurs, or a water quality problem occurs, immediate notification shall be made to the regional offices of WDFW and Ecology in the attached telephone lists of regional offices.

6. Measures shall be used to prevent damage to the vegetation in the riparian (streamside or shoreline) area located within 200 feet perpendicular to the water and adjacent to the structure. Within the riparian area existing parking lots and open managed fields and lots may be used for staging work.

7. No work or equipment use shall occur below the ordinary high water line (OHWL) or shall affect the bed of state waters, except the use of a temporary floating work platform and marine growth removal.

8. No disturbance to the shoreline shall occur when placing or removing a temporary floating work platform.

9. No temporary floating work platform anchoring or grounding shall occur in saltwater that would disturb eelgrass, kelp, and/or other intertidal wetland vascular plants.

10. Ferry terminal shall first be cleaned using dry methods and equipment (scraping, sweeping, vacuuming) that will prevent debris and substances from entering state waters,

except residual grease may be removed by hand methods and degreaser on absorbent material, provided none of this material shall enter state waters. Examples of debris and substances include, but are not restricted to:

a. bird nests and associated fecal material
b. dirt, moss, sediments, and rust
c. old paint chips and residue
d. petroleum products
e. cement chips
f. construction materials
g. chemicals or any other toxic or deleterious substances

11. If cleaned debris, substances, and/or wash water could enter state waters through deck drains, where practicable the drains shall be temporarily blocked to route water to the landward end of the ferry terminal and onto vegetative areas.

12. Work that would result in debris and substances entering state waters, including but not restricted to dirt, abrasive blasting medium, old paint chips, and new paint, shall include a containment structure capable of collecting all such debris and substances.

13. Wash water and debris resulting from pressure washing, including but not restricted to dirt and old paint chips, shall be filtered through a filter structure capable of collecting all such debris.

14. Debris and substances collected in the containment or filter structure shall be removed from the structure at least daily, whenever accumulations may place the structure at risk, and before its movement or removal.

15. Work shall not occur when weather conditions would place the containment or filter structure at risk and/or result in loss of containment or filtering of debris and substances.

16. Any containment or filter structure shall be routinely inspected and repaired as necessary to ensure its function.

17. Marine growth may be removed from the ferry terminal, provided for existing pilings and other wood structures treated with creosote and preservative chemicals, methods shall be used that will include nets, tarps, or other appropriate equipment to prevent such removed growth from falling on the sea bed as much as possible. Any removed growth that falls on the sea bed shall be collected from the sea bed as much as possible, if feasible.

18. Marine growth removal from creosote or any other treated wood shall be restricted to the use of hand tools and methods that will minimize removal of the creosote or treated wood fibers.

19. Cleaned debris, marine growth, and substances from this project shall be collected and then contained and deposited above the limits of extreme high tide in a disposal site that has the appropriate regulatory approval. No debris, marine growth, and substances shall be placed in road drainages, wetlands, riparian (shoreline) areas, or on adjacent land where they may be eroded into state waters.
20. Washing shall be done with clean water. No detergents or other cleaning agents shall be used.

21. After dry cleaning methods have been completed debris accumulations remaining in the drains may be flushed with clean water.

22. No cleaning of any painting or other equipment or mixing or storing of paint and other polluting materials and substances shall be done over the water or in an area where a spill would result in these materials and substances entering state waters.

23. No petroleum products, hydraulic fluids, chemicals, or any other polluting substances shall be allowed to enter state waters.

H. **FERRY TERMINAL GENERAL MAINTENANCE AND REPAIR**: This work occurs as needed and includes ferry terminal general maintenance and repair of external superstructures and other structures associated with operation of the facility in their existing location and configuration. This work usually occurs over water but may include in-water or intertidal sea bed work including diving, marine growth removal, structural bracing replacement, or use of a temporary floating work platform (barge, derrick, boat). Specific examples of work include, but are not restricted to, repair and replacement of wingwall rub timbers and polyethylene fender panels; wood, steel, and polyethylene dolphin panels and fenders; cross bracing; hanger bars; transfer spans; bolting and lashing associated with dolphins, wingwalls, and towers; anchor chain repair and replacement; counterweights and cables; cathodic protection anodes; and structures above the dock. A collection containment structure is required if any polluting debris, material, or substance may enter state waters. This work shall not include any penetration of the sea bed by excavation, boring, or pile driving; addition to or enlargement of any structure; work that could result in ferry terminal structural failure; and polluting debris, materials, or substance entering state waters.

1. TIMING LIMITATIONS:

   a. SALTWATER VEGETATION PROTECTION: If the project would result in temporary new shading of eelgrass, kelp, and/or other intertidal wetland vascular plants longer than 72 hours, the work that produces the shadow shall only occur from **October 1 through April 30** of the following year, to prevent shading impacts to such saltwater vegetation habitat.

   b. JUVENILE SALMONID MIGRATION PROTECTION: If a temporary floating work platform is used shoreward of minus 10 feet (tidal reference MLLW=0.0 feet) and/or closer than 50 feet from the water's edge at any water level, the use of a temporary floating work platform in this area shall only occur from **July 1 through February 15** of the following year, for the protection of outmigrating juvenile salmonids.

2. NOTIFICATION FOR FLOATING WORK PLATFORM USE: If a temporary floating work platform with greater than 20 feet wide is used, the local Regional Habitat Program Manager (RHPM) in the attached list of WDFW regional offices shall be notified (letter or fax) at least three (3) working days prior to start of work. Notification shall include:

   a. Agency name, contact person, and telephone number
   b. Water body name
   c. Ferry terminal location
   d. Starting date and estimated ending date for work

3. ANNUAL REPORTING: WSDOT shall submit to the WDFW Habitat Program, address 600 Capitol Way N. Olympia, WA 98501, a calendar year annual report of Ferry Terminal General Maintenance and Repair work that occurs below Mean Higher High Water (MHHW) and any use of a temporary floating work platform greater than 20 feet wide by January 31 of the following year. An annual report is also required if no work was conducted. The annual report shall include:

   a. General: Reporting agency, contact person, address, telephone number, date
   b. of report, time period.
   c. Summary: Total number of individual projects by WSDOT region and statewide.
   d. Problem(s) encountered: Provision violation, notification, corrective action, impacts to fish life and water quality. If the Environmental Compliance Assurance Procedure (ECAP) was used, what activity triggered the procedure. *[these may be highlighted and specified in this section or included in the full list of projects completed below]*
   e. Recommendations for improvement to BMPs and mitigation *[optional]*
   f. List of individual projects completed: By region including water body name, ferry terminal name, latitude and longitude, date of work.

4. HAZARDOUS SPILL AND EROSION CONTROL: Hazardous substance or material spill and soil erosion prevention and control shall comply with the Water Quality Implementing Agreement (WQIA) between WSDOT and Ecology.

5. FISH KILL NOTIFICATION: If at any time, as a result of project activities, fish are observed in distress or a fish kill occurs, operations shall cease and immediate notification shall be made to the regional offices of WDFW and Ecology in the attached telephone lists of regional offices. Work shall not resume until notice to proceed is given by WDFW. Additional approval may be required from Ecology.

6. Measures shall be used to prevent damage to the vegetation in the riparian (shoreline) area located within 200 feet perpendicular to the water and adjacent to the structure. Within the riparian area existing parking lots and open managed fields and lots may be used for staging work.

7. Geared mechanisms (wheels, tracks) of equipment shall not operate in the intertidal area.

8. This work shall not include any penetration of the sea bed by excavation, boring, or pile driving.

9. A temporary floating work platform may be used, provided no damage to the shoreline shall occur when placing or removing a temporary floating work platform.

10. No grounding of a temporary floating work platform greater than 20 feet wide shall occur.

11. No anchoring of a temporary floating work platform anchoring or grounding shall occur in saltwater that would disturb eelgrass, kelp, and/or other intertidal wetland vascular plants.

12. Work that would result in debris or substances entering state waters, including but not restricted to treated wood sawdust and cuttings, shall include a containment structure capable of collecting all such debris or substances.

13. If a containment structure cannot be used because of restricted or difficult location or type of structure, a containment boom shall be placed around the work area to capture debris and cuttings.

14. Cleaned debris or substances from any containment or boom structure shall be collected and then contained and deposited above the limits of extreme high tide in a disposal site that has the appropriate regulatory approval. No debris or substances shall be placed in road drainages, wetlands, riparian (shoreline) areas, or on adjacent land where they may be eroded into state waters.

15. Debris or substances collected in the containment or boom structure shall be removed from the structure at least daily, whenever accumulations may place the structure at risk, and before its movement or removal.

16. Any containment or boom structure shall be routinely inspected and repaired as necessary to ensure its function.

17. Marine growth may be removed from the ferry terminal, provided for existing pilings or other wood structures treated with creosote or preservative chemicals, containment methods shall be used that will include nets, tarps, or other appropriate equipment to prevent such removed growth from falling on the sea bed as much as possible. Any removed growth that falls on the sea bed shall be collected from the sea bed as much as possible, if feasible.

18. Marine growth removal from creosote or any other treated wood shall be restricted to the use of hydraulic suctioning or hand tools and methods that will minimize removal of the creosote or treated wood fibers.

19. No cleaning of any equipment or mixing or storing of any polluting materials or substances shall be done over the water or in an area where a spill would result in these materials and substances entering state waters.

20. The use of wood treated with creosote or pentachlorophenol is not authorized.

21. All treated wood to be used for these projects shall meet or exceed the most current standards established in, “Best Management Practices for the Use of Treated Wood in Aquatic Environments” developed by the Western Wood Preservers Institute. Certification that the wood material was produced according to these BMPs shall be presented upon request by WDFW or Ecology.

22. No petroleum products, hydraulic fluids, chemicals, or any other polluting substances shall be allowed to enter state waters.

WDFW CONTACT NUMBERS:

Region 1 - Spokane	(509) 456-4082
Region 2 – Ephrata	(509) 754-4624
Region 3 – Yakima	(509) 575-2740
Region 4 – Mill Creek	(425) 775-1311
Region 5 – Vancouver	(360) 906-6700
Region 6 – Montesano	(360) 2494628
After hours/weekend statewide	(360) 902-2537

ECOLOGY CONTACT NUMBERS

Central Region – Yakima	(509) 575-2490
Northwest Region – Bellevue	(425) 649-7000
Eastern Region – Spokane	(509) 456-2926
Southwest Region – Lacey	(360) 407-6300
After hours/weekend – use above numbers also.	
Office of Permit Assistance - Lacey	(360) 407-7037
	(800) 917-0043

APPENDIX D

WSDOT Fish Exclusion Protocols and Standards

Work below the Ordinary High-Water Mark (or Mean Higher High-Water Mark) shall, in general, be conducted in isolation from flowing waters. Exceptions to this general rule or performance measure include: 1) implementation of the work area isolation and fish capture and removal protocols described in this document; 2) placement or removal of small quantities of material (e.g., wood or rock), or installation of structural best management practices (e.g., turbidity curtain), under site conditions where potential exposures and effects to fish life are minimized without isolation from flowing waters[1]; 3) work conducted under a declared emergency or under emergency conditions; or, 4) work conducted where flow conditions prevent safe implementation of work area isolation and fish capture and removal protocols.

Implementation of the work area isolation and fish capture and removal protocols shall be planned and directed by a WSDOT biologist, or qualified biologist under contract to WSDOT, possessing all necessary knowledge, training, and experience (the directing biologist). If electrofishing will or may be used as a means of fish capture, the directing biologist shall have a minimum of 100 hours electrofishing experience in the field using similar equipment, and any individuals operating electrofishing equipment shall have a minimum of 40 hours electrofishing experience under direct supervision. All individuals participating in fish capture and removal operations shall have the training, knowledge, skills, and ability to ensure safe handling of fish, and to ensure the safety of staff conducting the operations.

The directing biologist shall work with Maintenance, Construction, and/or Environmental staff (as appropriate) to plan the staging and sequence for work area isolation, fish capture and removal, and dewatering. This plan should consider the size and channel characteristics of the area to be isolated, the method(s) of dewatering (e.g., diversion with bypass flume or culvert; diversion with sandbag, sheet pile or similar cofferdam; etc.), and what sequence of activities will provide the best conditions for safe capture and removal of fish. Where the area to be isolated is small, depths are shallow, and conditions are conducive to fish capture, it may be possible to isolate the work area and remove all fish life prior to dewatering or flow diversion. Where the area to be isolated is large, depths are not shallow, where flow volumes or velocities are high, and/or conditions are not conducive to easy fish capture, it may be necessary to commence with dewatering or flow diversion staged in conjunction with fish capture and removal. The directing biologist shall use his/her best professional judgment in deciding what sequence of activities is likely to minimize exposure of fish to conditions causing stress or injury

[1] WSDOT shall make this determination with consultation or input from the regulatory agencies with jurisdiction, including the Washington State Department of Fish and Wildlife (WDFW), U.S. Fish and Wildlife Service (FWS), and NOAA-National Marine Fisheries Service (NMFS) as appropriate; also, this exception shall not permit work that requires in-water excavation or that presents a risk of increased turbidity beyond the immediate work area or for a duration of more than 15 minutes.

(including stranding, exposure to extremes of temperature or reduced dissolved oxygen, risk of injury resulting from electrofishing, etc.).

The directing biologist shall plan work area isolation, fish capture and removal, and dewatering with consideration for the following: habitat connectivity and fish habitat requirements; the duration and extent of planned in-water work; anticipated flow and temperature conditions over the duration of planned in-water work; and, the risk of exposure to turbidity or other unfavorable conditions during construction. If the area to be isolated includes only a portion of the wetted channel width (e.g., large or deep rivers where diversion from the entirety of the wetted channel is difficult or impossible), or if the bypass flume or culvert will effectively maintain connectivity and fish passage for the duration of construction activities, it may be less important whether fish are herded (and/or captured and released) upstream or downstream of the isolated work area. However, if the area to be isolated includes the entire wetted channel width, and especially if conditions make it unlikely that connectivity (i.e., upstream/ downstream fish passage) can be effectively maintained for the duration of construction activities, then the directing biologist should carefully consider whether to herd fish (and/or capture and release fish) upstream or downstream of the isolated work area.

If conditions upstream of the isolated work area will or may become unfavorable during construction, then fish should not be herded or released to an upstream location; this situation is probably most common where the waterbody in question is small, where seasonal flows are substantially diminished, and conditions of elevated temperature and/or reduced dissolved oxygen are foreseeable. However, the directing biologist shall also consider whether planned in-water work presents a significant risk of downstream turbidity and sedimentation; fish herded or released to a downstream location may be exposed to these conditions.

If large numbers of fish are to be herded (and/or captured and released), and in order to avoid overcrowding or concentrating fish in areas where their habitat needs cannot be met, it may be appropriate to relocate fish both upstream and downstream of the isolated work area. At locations where habitat connectivity or quality is poor, including along reaches upstream and/or downstream of the isolated work area, the directing biologist should carefully consider whether relocated fish can meet their minimum habitat requirements for the duration of planned in-water work. On rare occasions it may be appropriate to relocate fish at a greater distance upstream and/or downstream (e.g., thousands of feet or miles), so as to ensure fish are not concentrated in areas where their habitat needs cannot be met, or where they may be exposed to unfavorable conditions during construction. On those rare occasions where relocation to a greater distance is deemed necessary, the WSDOT shall provide notice to the agencies with jurisdiction in advance of the operations.

Plans for staging work area isolation, fish capture and removal, and dewatering must comply with WSDOT safety requirements. Safe implementation is a high priority. The directing biologist shall design and adjust the plan as necessary to ensure the safety of all individuals implementing the plan. Under some conditions it may be appropriate to

conduct work without isolation from flowing waters, without placement of block nets, fish capture or removal; for a fuller discussion of this topic see page 1.

In order to comply with WSDOT safety requirements, work in or around water outside of daylight hours is not generally permissible. If, under unusual circumstances, the directing biologist identifies work that will or may be necessary outside of daylight hours, he/she shall coordinate and gain approval for this work with appropriate managers (including the WSDOT safety officer and/or supervisors with authority).

Work Area Isolation

The directing biologist shall determine appropriate locations for the placement of block nets, based on site characteristics and a consideration of the type and extent of planned in-water work. Sites that exhibit reduced flow volume or velocity, uniformity of depth, and good accessibility are preferred; sites with heavy vegetation, large cobble or boulders, undercut banks, deep pools, etc. should be avoided due to the difficulty of securing and/or maintaining nets. Sites with a narrow channel cross-section ("constriction") should be avoided if foreseeable flow conditions might overwhelm or dislodge the block nets, posts, or anchors.

Except when planning and intending to herd fish upstream, an upstream block net shall be placed first. With a block net secured to prevent movement of fish into the work area from upstream, a second block net should be used as a seine to herd fish in a downstream direction. Where the area to be isolated includes a culvert(s), deep pools, undercut banks, or other cover attractive to fish (e.g., thick overhanging vegetation, rootwads, logjams, etc.) it may be appropriate to isolate a portion or portions of the work area, rather than attempting to herd fish from the entirety of the work area in a single downstream pass. Fish capture and removal will be most successful if an effort is made to strategically focus and concentrate fish in areas where they can be easily seined and netted. Care shall be taken not to concentrate fish where they are exposed to sources of stress, or to leave them concentrated in such areas for a long duration (e.g., more than 30 minutes).

Depending upon site characteristics, and the planned staging and sequence for work area isolation and dewatering, it may or may not be necessary to place a downstream block net. Typically, however, site characteristics and/or the duration of planned in-water work will necessitate placement of a net(s) to prevent movement of fish into the work area from downstream. If groundwater seepage or site drainage has a tendency to re-wet the area, if the area to be isolated is low-gradient or subject to a backwatering influence, or if the area to be isolated is large and considerable effort will be expended in capturing and removing fish life, a downstream block net should be placed. If foreseeable flow conditions over the duration of planned in-water work might enable fish to re-enter the work area from downstream, a downstream block net should be placed.

In most instances where gradual dewatering or flow diversion is staged in conjunction with fish capture and removal, it is appropriate to delay installation of the downstream block net(s) until after fish have been given sufficient time to move downstream by their

own choosing. If flows are reduced gradually over the course of several hours, or the length of an entire workday, some (perhaps many) fish will make volitional movements downstream beyond the area to be isolated. Gradual dewatering can be an effective means by which to reduce the risk of fish stress or injury. Gradual dewatering and the encouragement of volitional movement are particularly important where the area to be isolated is large and may hold many fish. However, where the area to be isolated includes a culvert(s), deep pools, undercut banks, or other cover attractive to fish, some (perhaps many) fish will not choose to move downstream regardless of how gradually flows are reduced. The directing biologist should use his/her best professional judgment in deciding what sequence of activities is likely to minimize fish stress or injury (including stranding).

Where the area to be isolated is small, depths are shallow, and conditions are conducive to fish capture, it may be possible to remove all fish life prior to dewatering, or to implement plans for dewatering staged with fish capture over a relatively short timeframe (e.g., 1-2 hours). Where the area to be isolated is large, depths are not shallow, where flow volumes or velocities are high, and/or conditions are not conducive to easy fish capture, dewatering or flow diversion should be staged in conjunction with fish capture and removal over a longer timeframe (e.g., 3-6 hours). The largest areas and/or most difficult site conditions may warrant or require that plans for dewatering and fish capture proceed over the length of an entire workday, or multiple workdays. Where this is the case, fish shall be given sufficient time and a means to move downstream by their own choosing so as to reduce the total number of fish exposed to sources of stress and injury (including fish handling).

The directing biologist shall select suitable block nets. Type of material, length, and depth may vary based on site conditions. It may be necessary and appropriate to contact other WSDOT Regions or offices with access to nets (or other materials) suitable for placement under unique or unusual circumstances. Typically block nets will be composed of 9.5 millimeter stretched nylon mesh and should be installed at an angle to the direction of flow (i.e., not directly perpendicular to flow) so as to reduce the risk of impinging fish. Anchor bags filled (or half-filled) with clean, washed gravel are preferred over sandbags, especially for nets and anchors that will or may remain in-place for a long duration (i.e., more than two weeks). Any use or movement of native substrates or other materials found on-site should be incidental and shall not appreciably affect channel bed or bank conditions.

Block nets shall remain in-place until work is complete and conditions are suitable for the reintroduction of fish[2]. Block nets require frequent inspection and debris removal. A

[2] If plans for work area isolation and fish capture and removal include the installation of temporary cofferdams, and once the directing biologist has confirmed fish life have been successfully excluded from the entire area enclosed by the cofferdam(s), it may be appropriate to remove block nets and allow fish to re-enter the previously isolated work area; this approach is particularly relevant and appropriate where many weeks or months of construction are planned for completion within temporary cofferdams (i.e., isolated from flowing waters).

qualified biologist, or other field staff trained in safe fish handling, shall be assigned the responsibility of inspecting the nets and safely capturing and relocating any impinged fish. The frequency of these inspections shall be determined on a case-by-case basis. However, block nets shall, at a minimum, be inspected for impinged fish (especially juvenile fish) at least three times daily for the first 48 hours after installation (approximate), and for the first 24 hours after significant rainfall (or change in flow volume or velocity). In the event fish are found impinged on the net(s), or if weather or flow conditions change significantly, the directing biologist shall re-consider and adjust the frequency of net inspections so as to minimize the risk of impinging and injuring fish.

Field staff shall be assigned the responsibility of frequently checking and maintaining the nets for accumulated debris, general stability, and proper function. The frequency of these inspections shall be determined on a case-by-case basis, dependent upon the site, seasonal, and weather conditions. Block nets must be secured along both banks and the channel bottom to prevent failure as a result of debris accumulation, high flows, and/or flanking. Some locations may require additional block net support (e.g., galvanized hardware cloth, affixed metal fence posts, etc.).

Fish Capture and Removal

If dewatering and/or flow diversion are deemed necessary[1], this work (including related fish capture and removal operations) shall comply with any provisions contained in the Hydraulic Project Approval (HPA), or applicable General HPA, issued by the WDFW. If the FWS and/or NMFS have provided relevant Terms and Conditions from a Biological Opinion addressing the work (or action), this work shall also comply with those Terms and Conditions.

If pumps are used to temporarily bypass water or to dewater residual pools or cofferdams, pump intakes shall be screened to prevent aquatic life from entering the intake. Fish screens or guards shall comply with Washington State law (RCW 77.57.010 and 77.57.070), with guidelines prescribed by the NMFS[3], and any more stringent requirements contained in the HPA or General HPA issued by the WDFW. If pumps are to be used on a more permanent basis, as the primary or secondary method for diverting flow around the isolated work area, plans for dewatering shall address contingencies (i.e., extremes of flow or weather). These plans shall include ready access to a larger or additional "back-up" pump with screened intake. If the directing biologist has confirmed that all fish life has been successfully excluded from the area, if there is no risk of entraining fish, and adequate plans are in-place to address contingencies (including a routine schedule for inspection), then pumps may be operated without a screened intake.

[3] National Marine Fisheries Service. 1997. Fish screening criteria for anadromous salmonids. NMFS Southwest Region, January 1997, 12p. << http://swr.nmfs.noaa.gov/hcd/fishscrn.pdf >>.

Fish Capture and Removal Methods:

Methods for safe capture and removal of fish from the isolated work area are described below. These methods are given in order of preference. At most locations, a combination of methods will be necessary. In order to avoid and minimize the risk of injury to fish, attempts to seine and/or net fish shall always precede the use of electrofishing equipment. Visual observation techniques (e.g. snorkeling, surveying with polarized glasses or Plexiglas bottomed buckets, etc.) may be used to assess the effectiveness of these methods, to identify locations where fish are concentrating, or otherwise adjust methods for greater effectiveness.

If the planned fish capture and removal operations have not been addressed through consultation (or programmatic consultation), if seining and netting are impracticable (i.e., electrofishing is deemed the only viable means of fish capture), and fish listed under the ESA will or may be present, the directing biologist shall provide notice to the FWS and/or NMFS (as appropriate). This notice shall be provided in advance of the operations, and shall include an explanation of the unique site conditions or circumstances. Work conducted under a declared emergency (or emergency conditions) shall follow established ESA notification protocols.

Where fish listed under the ESA will or may be present, the directing biologist shall ensure that fish capture and removal operations adhere to the following minimum performance measures or expectations:

1) Only dip nets and seines composed of soft (non-abrasive) nylon material shall be used.

2) The operations shall not resort to the use of electrofishing equipment unless and until other, less injurious methods have been effective in removing most or all of the adult and sub-adult fish (i.e., fish in excess of 300 millimeters); the operations shall conduct a minimum of three complete passes without capture using seines and/or nets.

3) The operations shall confirm success of fish capture and removal before completely dewatering or commencing with other work within the isolated work area; the operations shall conduct a minimum of two complete passes without capture using electrofishing equipment.

4) Fish listed under the ESA shall not be held in containers for more than 10 minutes, unless those containers are dark-colored, lidded, and fitted with a portable aerator.

• **Seining** shall be the preferred method for fish capture. Other methods shall be used when seining is not possible, or when/after attempts at seining have proven ineffective. Seines, once pursed, shall remain partially in the water while fish are removed with dip nets. Seines with a "bag" minimize handling stress and are preferred. Seines with a bag

are also preferred where obstructions make access to the water (or deployment/ retrieval of the seine) difficult.

In general, seining will be more effective if fish, especially juvenile fish, are moved (or "flushed") out from under cover. Methods which may increase effectiveness and/or efficiency include conducting seining operations at dawn or dusk (i.e., during low-light conditions), in conjunction with snorkeling, and/or flushing of the cover. In flowing waters, and especially where flow volume or velocity is high or moderately-high, seines that employ a heavy lead line and variable mesh size are preferred. Small mesh sizes are more effective across the full range of fish size (and age class), but also increase resistance and can make deployment/ retrieval more difficult in flowing waters. Seines which use a small mesh size in the bag (or body), and a larger, less resistant mesh size in the wings may under some conditions be most effective and efficient.

• **Baited Minnow Traps** are typically used before and in conjunction with seining. Traps may be left in the isolated work area overnight. Traps shall be inspected at least four times daily to remove captured fish and thereby minimize predation within the trap. Traps should be checked more frequently if temperatures are in excess of 15 degrees C. Predation within the trap may be an unacceptable risk when/ where minnow traps are left in-place over night; large sculpin and other predators that feed on juvenile fish are typically much more active at night. The directing biologist shall consider the need and plan for work outside daylight hours (i.e., inspection and removal) before leaving minnow traps in-place over night.

• **Dip Nets** shall be used in conjunction with seining. This method is particularly effective when employed during gradual dewatering or flow diversion. To be most effective, and to minimize stress and risk of injury to fish (including stranding), the directing biologist shall coordinate fish capture operations with plans for dewatering or flow diversion. Plans for dewatering and/or flow diversion shall proceed at a measured pace (within constraints), to encourage the volitional downstream movement of fish, and reduce the risk of stranding. Plans for dewatering and/or flow diversion shall not proceed unless there are sufficient staff and materials on-site to capture and safely remove fish in a timely manner. Generally this will require a minimum of two persons (three if electrofishing), but the directing biologist may find that some sites (especially large or complicated sites) warrant or require a more intensive effort (i.e., additional staffing).

Once netted, fish shall remain partially in water until transferred to a bucket, cooler, or holding tank. Dip nets which retain a volume of water ("sanctuary nets") are preferred. However, sanctuary nets may be ineffective where flow volume or velocity is high or moderately-high (i.e., increased resistance lessens ability to net and capture fish). In addition, where water depths are very shallow and/or fish are concentrated in very small receding pools or coarse substrate, "aquarium" nets may be a better, more effective choice. Use of dip nets in conjunction with snorkeling, flushing of the cover, or around the hours of dawn or dusk (i.e., during low-light conditions), can be effective for capturing fish sheltered below cover.

• **Connecting Rod Snakes** may be used to flush fish out of stream crossing structures (i.e., culverts). Connecting rod snakes are composed of wood sections approximately three feet in length. Like other cover attractive to fish, culverts (especially long culverts), can present a challenge to fish capture and removal operations. The directing biologist should plan a strategy for focusing and concentrating fish in areas where they can be easily seined and netted, and should take active steps to prevent fish from evading capture. When first implementing plans for work area isolation, fish capture and removal, and dewatering, it may be appropriate to place block nets immediately upstream and/or downstream of culverts so as to minimize the number of fish that might seek cover within the culvert(s). Once most or all of the fish have been removed from other parts of the work area, the block net placed downstream of the culvert(s) should be removed to encourage volitional downstream movement of fish.

• **Electrofishing** shall be performed only when other methods of fish capture and removal have proven impracticable or ineffective at removing all fish. The directing biologist shall ensure that attempts to seine and/or net fish always precede the use of electrofishing equipment. Larger fish (i.e., adult and sub-adult fish with comparatively longer spine lengths) are more susceptible to electrofishing injury than smaller fish. To minimize the risk of injury (and the number of fish potentially injured), the directing biologist shall confirm that other methods have been effective in removing most or all of the adult and sub-adult fish before resorting to the use of electrofishing equipment; see the related performance measure appearing on page 6. As a general rule or performance measure, electrofishing should not be conducted under conditions that offer poor visibility (i.e., visibility of less than 0.5 meter).

The following performance measures shall apply to the use of electrofishing equipment as a means of fish capture and removal:

1. If the planned fish capture and removal operations have not been addressed through consultation (or programmatic consultation), and fish listed under the ESA will or may be present, WSDOT shall provide notice to the FWS and/or NMFS prior to the initiation of electrofishing attempts. Upon request, the WSDOT shall permit the FWS, NMFS, and/or their designated representative to observe fish capture and removal operations. Work conducted under a declared emergency (or emergency conditions) shall follow established ESA notification protocols.

2. Electrofishing shall only be conducted when a biologist with at least 100 hours of electrofishing experience is on-site to conduct or direct all related activities. The directing biologist shall be familiar with the principles of electrofishing, including the effects of voltage, pulse width and pulse rate on fish, and associated risk of injury or mortality. The directing biologist shall have knowledge regarding galvanotaxis, narcosis and tetany, their relationships to injury/mortality rates, and shall have the ability to recognize these responses when exhibited by fish.

3. The directing biologist shall ensure that electrofishing attempts use the minimum voltage, pulse width, and rate settings necessary to achieve the desired response

(galvanotaxis). Water conductivity shall be measured in the field prior to each electrofishing attempt to determine appropriate settings. Electrofishing methods and equipment shall comply with guidelines outlined by the NMFS[4].

4. The initial and maximum settings identified below shall serve as guidelines when electrofishing in waters that may support ESA-listed fish. Only DC or pulsed DC current shall be used. [Note: some newer, late-model electrofishing equipment includes a "set-up" or initialization function; the directing biologist shall have the discretion to use this function as a means to identify proper initial settings.]

Guidelines for initial and maximum settings for backpack electrofishing.[5]

	Initial Settings	Conductivity (µS/cm)	Maximum Settings
Voltage	100 V	≤ 300 > 300	800 V 400 V
Pulse Width	500 µs		5 ms
Pulse Rate	15 Hz		60 Hz [*In general*, exceeding 40 Hz will injure more fish.]

Each attempt shall begin with low settings for pulse width and pulse rate. If fish present in the area being electrofished do not exhibit a response, the settings shall be gradually increased until the appropriate response is achieved (galvanotaxis). The lowest effective settings for pulse width, pulse rate and voltage shall be used to minimize risks to both personnel and fish. Safe implementation is a high priority. The directing biologist shall ensure the safety of all individuals assisting with electrofishing attempts; this includes planning for and providing all necessary safety equipment and materials (e.g., insulated waders and gloves, first aid/cpr kit, a current safety plan with emergency contacts and phone numbers, etc.). Only individuals that are trained and familiar with the use of electrofishing equipment shall provide direct assistance during electrofishing attempts.

5. Electrofishing shall not be conducted where spawning adults or redds with incubating eggs may be exposed to the electrical current. As a general rule or performance measure, waters that support anadromous salmon should not be electrofished from October 15 through May 15, and resident waters from November 1 through May 15. If located within waters that support bull trout, especially waters located within a local bull trout population (i.e., that support spawning and rearing), seasonal limitations on the use of electrofishing equipment may be more restrictive; if you have questions, contact the

[4] National Marine Fisheries Service. 2000. Guidelines for electrofishing waters containing salmonids listed under the Endangered Species Act. NMFS Northwest Region, June 2000, 5p. << http://www.nwr.noaa.gov/ESA-Salmon-Regulations-Permits/4d-Rules/upload/electro2000.pdf >>.

[5] Adapted from NMFS (June 2000) and WDFW Electrofishing Guidelines for Stream Typing (May 2001).

FWS. If any, more restrictive work windows have been identified through consultation, those windows shall apply. The directing biologist shall ensure that electrofishing attempts are made only during appropriate times of year, and not where spawning adults or redds with incubating eggs may be exposed to the electrical current.

6. An individual shall be stationed at the downstream block net(s) during electrofishing attempts to recover stunned fish in the event they are flushed downstream and/or impinged against the block net(s).

7. The operator shall use caution so as to prevent fish from coming into direct contact with the anode. Under most conditions, the zone of potential fish injury extends approximately 0.5 meter from the anode. Netting shall not be attached to the anode, as this practice presents an increased risk of direct contact and injury. Extra care shall be taken near in-water structures or undercut banks, in shallow waters, or where fish densities are high. Under these conditions fish are more likely to come into close or direct contact with the anode and/or voltage gradients may be intensified. Voltage and other settings shall be readjusted to accommodate changing conditions in the field, including channel depth. When electrofishing near undercut banks, overhanging vegetation, large cobble or boulders, or where structures provide cover, fish that avoid capture may be exposed to the electrical current repeatedly. Repeated or prolonged exposures to the electrical current present a higher risk of injury, and therefore galvanotaxis should be used to draw fish out of cover.

8. Electrofishing shall be conducted in a manner that minimizes harm to fish. Once an appropriate fish response (galvanotaxis) is achieved, the isolated work area shall be worked systematically. The number of passes shall be kept to a minimum, but is dependent upon the numbers of fish and site characteristics and shall be at the discretion of the directing biologist. Electrofishing shall not be conducted unless there are sufficient staff and materials on-site, to both minimize the number of passes required and to locate, net, recover, and release fish in a timely manner. Generally this will require a minimum of three persons, but the directing biologist may find that some sites (especially large or complicated sites) warrant or require a more intensive effort (i.e., additional staffing). Care shall be taken to remove fish from the electrical field immediately and to avoid exposing the same fish repeatedly. Fish shall not be held in dip nets while electrofishing is in progress (i.e., while continuing to capture additional fish). [Note: where flow velocity or turbulence is high or moderately-high (e.g., within riffles) it may be difficult to see and net fish; these fish may evade capture (resulting in repeated exposure), or may become impinged on the downstream block net(s); a "frame" net, or small and portable block net approximately 3 feet in width, can be effective under these conditions when held downstream in close proximity to the anode.]

9. The condition of captured fish shall be carefully observed and documented. Dark bands on the body and/or extended recovery times are signs of stress or injury. When such signs are noted, settings for the electrofishing unit may require readjustment. The directing biologist shall also review and consider changes to the manner in which the electrofishing attempt is proceeding. If adjustments to the electrofishing attempt do not

lessen the frequency (or severity) of observed stress, the directing biologist shall have the authority to postpone fish capture and removal operations[6]. Each fish shall be capable of remaining upright and actively swimming prior to release (see Fish Handling, Holding and Release).

10. Electrofishing shall not be conducted when turbidity reduces visibility to less than 0.5 meter, when water conductivity exceeds 350 μS/cm, or when water temperature is above 18°C or below 4°C.

Fish Handling, Holding and Release:

• Fish handling shall be kept to the minimum necessary to remove fish from the isolated work area. Fish capture and removal operations shall be planned and conducted so as to minimize the amount and duration of handling. The operations shall maintain captured fish in water to the maximum extent possible during seining/netting, handling, and transfer for release.

• The directing biologist shall document and maintain accurate records of the operations, including: fish species, number, age/size class estimate, condition at release, and release location. Fish shall not be sampled or anesthetized, unless for valid purposes consistent with the WSDOT's Section 10 scientific collection permits.

• Individuals handling fish shall ensure that their hands are free of harmful and/or deleterious products, including but not limited to sunscreen, lotion, and insect repellent.

• The operations shall ensure that water quality conditions are adequate in the buckets, coolers, or holding tanks used to hold and transfer captured fish. The operations shall use aerators to provide for clean, cold, well-oxygenated water, and/or shall stage capture, temporary holding, and release to minimize the risks associated with prolonged holding. The directing biologist shall ensure that conditions in the holding containers are monitored frequently and operations adjusted appropriately to minimize fish stress. If fish listed under the ESA will or may be held for more than a few minutes prior to release, the directing biologist should consider using dark-colored, lidded containers only. Fish listed under the ESA shall not be held in containers for more than 10 minutes, unless those containers are dark-colored, lidded, and fitted with a portable aerator; small coolers meeting this description are preferred over buckets.

• The operations shall provide a healthy environment for captured fish, including low densities in holding containers to avoid effects of overcrowding. Large fish shall be kept

[6] If the FWS and/or NMFS have provided an Incidental Take Statement from a Biological Opinion addressing the work (or action), the directing biologist shall ensure limits on take have not been exceeded; if the limits on take are exceeded, or if take is approaching these limits, the directing biologist shall postpone fish capture and removal operations and immediately notify the federal agency (or agencies) with jurisdiction.

separate from smaller fish to avoid predation. The operations shall use water-to-water transfers whenever possible.

• The release site(s) shall be determined by the directing biologist. The directing biologist should consider both site characteristics (e.g., flow, temperature, available refuge and cover, etc.) and the types of fish captured (e.g., out-migrating smolt, kelt, prespawn migrating adult, etc.) when selecting a release site(s). More than one site may be designated to provide for varying needs, and to separate prey-sized fish from larger fish. The directing biologist shall consider habitat connectivity and fish habitat requirements, seasonal flow and temperature conditions, and the duration and extent of planned in-water work when selecting a fish release site(s). If conditions upstream of the isolated work area will or may become unfavorable during construction, then fish should not be released to an upstream location. However, the directing biologist should also consider whether planned in-water work presents a significant risk of downstream turbidity and sedimentation; fish released to a downstream location may be exposed to these conditions. Site conditions may warrant releasing fish both upstream and downstream, or relocating fish at a greater distance (e.g., thousands of feet or miles), so as to ensure fish are not concentrated in areas where their habitat needs cannot be met. For a fuller discussion of this topic see page 2.

• The directing biologist shall ensure that each fish is capable of remaining upright and has the ability to actively swim upon release.

• Any ESA-listed fish incidentally killed as a result of fish capture and removal operations shall be preserved and delivered to the appropriate authority upon request (see Documentation).

• If the limits on take of ESA-listed species are exceeded (harm or harassment), or if incidental take is approaching and may exceed specified limits, the directing biologist shall postpone fish capture and removal operations and immediately notify the federal agency (or agencies) with jurisdiction. If dewatering or flow diversion is incomplete and still in-progress, WSDOT shall take remedial actions directed at maintaining sufficient quantity and quality of flow and lessening sources of fish stress and/or injury. If conditions contributing to fish stress and/or injury may worsen before the federal agency with jurisdiction can be contacted, WSDOT should attempt to move fish to a suitable location near the capture site while keeping fish in water and reducing stress as much as possible.

Reintroduction of Flow and Fish to the Isolated Work Area

If conducting work in isolation from flowing waters has required placement of a block net(s), fish capture and removal, and temporary dewatering, the directing biologist shall ensure that the block net(s) remain in-place until work is complete and conditions are suitable for the reintroduction of fish[2]. Flows shall be gradually reintroduced to the isolated work area, so as to prevent channel bed or bank instability, excessive scour, or turbidity and sedimentation. The directing biologist shall inspect the work area and

downstream reach to ensure no fish are stranded or in distress during reintroduction of flows. If conditions causing or contributing to fish stress and/or injury are observed, WSDOT shall take remedial actions directed at lessening these sources of stress. This may include a more gradual reintroduction of flow, so as to reduce resulting turbidity and sedimentation.

All temporary structures and materials (e.g., block nets, posts, and anchors; bypass flume or culvert; sandbag, sheet pile or similar cofferdam; etc) shall be removed at the completion of work. The directing biologist shall document in qualitative terms the final condition of the isolated work area (including temporary bypass). The directing biologist shall identify and document any obvious signs of channel bed or bank instability resulting from the work, and shall report these conditions to the appropriate Maintenance, Construction, and/or Environmental staff for remedy. WSDOT shall document any additional actions taken to correct channel instability, and the final condition of the isolated work area (including temporary bypass).

To avoid and minimize the risk of introducing or spreading nuisance or invasive species, aquatic parasites, or disease, the directing biologist shall ensure that all equipment and materials are cleaned and dried before transporting them for use at another site or waterbody.

Documentation

• All work area isolation, and fish capture and handling shall be documented in a log book with the following information: project location, date, methods, personnel, water temperature, conductivity, visibility, electrofishing equipment settings, and other comments.

• All fish captured or handled shall be documented: species, number of each species, age/ size class estimate, condition at release, and location of release.

• If at any time, fish are observed in distress, a fish kill occurs, or water quality problems develop (including equipment leaks or spills), WSDOT shall provide immediate notification to the WDFW consistent with any provisions contained in the HPA (or applicable General HPA). Notification shall consist of a phone call or voice mail message directed to the Area Habitat Biologist identified on the HPA and/or the Washington Military Department Emergency Management Division at (800) 258-5990, as appropriate.

• Any ESA-listed fish incidentally killed as a result of fish capture and removal operations shall be documented with notification provided to the appropriate authority (FWS and/or NMFS) within two working days. Initial notifications may consist of a phone call or voice mail message. Initial notifications shall be directed to the following: (FWS) the nearest FWS Law Enforcement Office, and the Washington Fish and Wildlife Office at (360) 753-9440; (NMFS) the NMFS Office of Law Enforcement at (800) 853-1964, and the Washington State Habitat Office at (360) 753-9530. Any dead specimens

shall be kept whole and preserved on-ice or frozen until WSDOT receives a response and further directions from the appropriate authority; if WSDOT receives no response within 5 working days, the directing biologist shall have the discretion to dispose of specimens. Initial notifications shall be followed by a second notification in writing. All notifications shall provide at a minimum the following: date, time, WSDOT point-of-contact (the directing biologist and/or supervisor), project name (and FWS and/or NMFS tracking number if available), precise location of any incidentally killed or injured and unrecovered fish, number of specimens and species, and cause of death or unrecoverable injury. If the limits on incidental take are exceeded (harm or harassment), the written notification shall also include an explanation of the circumstances causing or contributing to observed levels of take.

• The final condition of the isolated work area (including temporary bypass) shall be documented in qualitative terms, including any obvious signs of channel bed or bank instability resulting from the work. WSDOT shall document any additional actions taken to correct channel instability, and the final condition of the isolated work area (including temporary bypass).

APPENDIX E

Appendix E: Exempt activities as listed in section 3-2.2 of the Highway Runoff Manual M 31-16.01, June 2008.

- Pothole and square cut patching
- Overlaying existing bituminous surface treatment (BST or "chip seal"), asphalt concrete pavement (ACP), or Portland cement concrete pavement (PCCP) with BAST, ACP, or PCCP without expanding the area of coverage.
- Reshaping/regrading drainage systems
- Crack sealing
- Resurfacing with in-kind material without expanding the road prism
- Vegetation maintenance
- Upgrading by resurfacing Washington State Department of Transportation (WSDOT) facilities from BST to ACP or PCCP without expanding the area of coverage[55]

55 This exemption is only applicable to WSDOT projects, whereas, the "gravel-to-BST" exemption in Ecology's stormwater management manual is available to local governments. For local governments, upgrades that involve resurfacing from BST to ACP or PCCP are considered new impervious surfaces and are not categorically exempt.

APPENDIX F

Appendix F. 1-07.15(1) Spill Prevention, Control and Countermeasures Plan

The Contractor shall prepare a project specific spill prevention, control and countermeasures (SPCC) plan to be used for the duration of the project. The plan shall be submitted to the Engineer prior to the commencement of any on site construction activities. The Contractor shall maintain a copy of the plan at the work site, including any necessary updates as the work progresses. If hazardous materials are encountered during construction, the Contractor shall do everything possible to control and contain the material until appropriate measures can be taken. Hazardous material, as referred to within this specification, is defined in RCW 70.105.010 under "Hazardous Substances". Occupational safety and health requirements that may pertain to SPCC planning are contained in but not limited to WAC 296-824 and WAC 296-843.

The SPCC plan shall address the following project-specific information:

1. SPCC Plan Elements

A. Site Information

Identify general site information useful in construction planning, recognizing potential sources of spills, and identifying personnel responsible for managing and implementing the plan.

B. Project Site Description

Identify staging, storage, maintenance, and refueling areas and their relationship to drainage pathways, waterways, and other sensitive areas. Specifically address:

· the Contractor's equipment maintenance, refueling, and cleaning activities.
· the Contractor's on site storage areas for hazardous materials.

C. Spill Prevention and Containment

For each of the locations identified in B, above, specifically address:

1. Spill prevention and containment measures to be used at each location.
2. The method of collecting and treating, or disposing of runoff from each location.
3. The method of diverting project runoff from each location.

D. Spill Response

Outline spill response procedures including assessment of the hazard, securing spill response and personal protective equipment, containing and eliminating the spill source, and mitigation, removal and disposal of the material.

E. Standby, On-Site, Material and Equipment

The plan shall identify the equipment and materials the Contractor will maintain on site to carry out the preventive and responsive measures for the items listed.

F. Reporting

The plan shall list all federal, state and local agency telephone numbers the Contractor must notify in the event of a spill.

G. Program Management

Identify site security measures, inspection procedures and personnel training procedures as they relate to spill prevention, containment, response, management and cleanup.

H. Preexisting Contamination

If preexisting contamination in the project area is described elsewhere in the plans or specifications, the SPCC plan shall indicate measures the Contractor will take to conduct work without allowing release or further spreading of the materials.

I. Work Below the Ordinary High Water Line

Identify equipment that will be used below the ordinary high water line. Outline daily inspection and cleanup procedures that ensure equipment is free of all external petroleum-based products. Identify refueling procedures for equipment that cannot be moved from below the ordinary high water line.

2. Attachments

A. Site plan showing the locations identified in (1. B. and 1. C.) noted previously.

B. Spill and Incident Report Forms, if any, that the Contractor will be using.

Implementation Requirements

The Contractor shall implement prevention and containment measures identified in the SPCC plan prior to performing any of the following:

1. Placing materials or equipment in staging or storage areas
2. Equipment refueling
3. Equipment washing
4. Stockpiling contaminated materials

Payment

The lump sum contract price for the “SPCC Plan” shall be full pay for:

1. All costs associated with creating the SPCC plan.
2. All costs associated with providing and maintaining on site standby materials and equipment described in the SPCC plan.
3. All costs associated with implementing the prevention and containment measures identified in the approved SPCC plan.

As to other costs associated with spills, the contractor may request payment as provided for in the Contract. No payment shall be made if the spill was caused by or resulted from the Contractor’s operations, negligence or omissions.

APPENDIX G

Appendix G –Analysis of Risk to Bull Trout Populations from WSDOT Programmatic Effects

Overview

To assess overall risk to bull trout from potential effects of activities covered by the WSDOT Programmatic, a risk analysis integrating both spatial and non-spatial information was conducted. In this way we could evaluate where the effects could occur in relation to bull trout core areas and local populations within the WSDOT PBO coverage areas, and what level of risk those potential effects presented to bull trout and their habitat given baseline conditions. This is a multi-scale analysis, focusing on the local population scale (i.e., smallest group of fish that is known to represent an interacting reproductive unit) and on the core area scale (i.e., the combination of one or more local populations and their associated foraging, migration, and overwintering (FMO) habitat. Core areas require both habitat and bull trout to function, and the number (replication) and characteristics of local populations inhabiting a core area provide a relative indication of the core area's likelihood to persist. Local populations represent the bull trout spawning and early juvenile rearing habitat for a core area and are generally depicted as area polygons (typically a subwatershed), while FMO habitat is typically all other habitat used by bull trout within the core area polygon. There is also FMO habitat lying outside of the core area polygon. However, this analysis does not include an evaluation of risk to FMO habitat outside of core areas. All references to FMO in this analysis relate only to that found within a core area.

This risk analysis can be summarized into five basic steps:

1) Determine and evaluate exposure risk of core area (local population and FMO habitat).

2) Evaluate baseline habitat risk of exposed core areas.

3) Evaluate baseline population risk (i.e., at local population scale and core area scale) of exposed core areas.

4) Integrate all three risk evaluations to reach conclusion about the overall potential risk of exposure to WSDOT Programmatic actions within core areas.

5) Integrate the anticipated effects of the WSDOT Programmatic actions to determine likely risk to the core areas.

A spatial analysis using GIS (Appendix A) was conducted on all bull trout core areas and core habitat in areas affected by the proposed programmatic to identify the following information:

1) The location of roads where proposed WSDOT programmatic activities may occur in relation to bull trout habitat and populations within core areas; and

2) The percentage of total length of bull trout stream habitat within 300 feet of WSDOT state and interstate roads and number of WSDOT road crossings within these core areas' local populations (i.e., spawning and rearing habitat) and FMO habitat to help estimate and compare relative levels of "exposure risk" (i.e., low, medium, high) from WSDOT programmatic activities.

3) The potential degree of effect from existing roads[56] to bull trout local populations and FMO habitats using key transportation features (i.e., road crossings and road density) (Appendix B) that are a primary source of some of the ongoing adverse effects to bull trout and their habitat.

4) The presence and underlying risk of existing stressors (e.g., habitat limiting factors, 303d impairments) to bull trout habitat within local populations and FMO habitat containing WSDOT state and interstate roads to determine the "baseline habitat risk" (i.e., low, medium, high) to bull trout. As part of this determination, we integrated non-spatial information (i.e., adult spawner abundance and trend in abundance) (Appendix A) about the current condition of bull trout habitat within core areas and local populations. This ranking helps us understand the context of the potential effects from the WSDOT programmatic activities on baseline bull trout habitat conditions.

As part of the risk analysis, the non-spatial population status parameters of the local populations were evaluated to determine the "baseline population risk" ranking (i.e., low, medium, high) (Appendix A). The analysis also evaluated similar population status parameters at the core area scale. This ranking helps one understand the resiliency of a local population and of a core area.

Exposure risk was used to focus the risk analysis only on those bull trout core areas within the action area that may be exposed to WSDOT programmatic activities that may result in significant affects due to their proximity (within 300 ft) of bull trout habitat. The risk analysis then integrated the two remaining risk categories (i.e., baseline habitat risk and baseline population risk) (Appendix A) to estimate an overall relative risk to specific local populations and their core areas. From this analysis, it could be determined which local populations may be at risk, and of those, which were at highest risk from the effects from WSDOT programmatic activities. To summarize the overall risk at a core area level, the exposure risk and baseline habitat risk rankings of the corresponding FMO habitat were integrated with that core area's baseline population risk ranking. These two scales of analysis are then combined to determine the core areas at greatest potential risk from proposed WSDOT actions under the programmatic.

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56 Roads not included are those identified as railroads, railroad grades, and trails on GIS layer.

Assumptions

The following major assumptions were used in this bull trout risk analysis:

1) Programmatic activities that occur on roads located more than 300 feet away from a bull trout stream are not expected to have significant effects to bull trout or their habitat. This assumption anticipates that all applicable best management practices will be adequately implemented and that any vegetation removal (including trees) does not provide significant habitat value (including large woody debris, shade, or nutrients) as it is greater than two site potential trees from the waterbody.

2) Some roads within 300 feet of streams (both fish and non-fish bearing) are not included in our analysis because they were not in proximity to streams designated as "key recovery habitat57" for bull trout. However, these tributaries can translate effects downstream to those stream reaches identified as key recovery habitat for bull trout. Therefore, this analysis may underestimate the risk of some WSDOT programmatic activities to some bull trout local populations and core areas.

3) Where multiple WSDOT road crossings where identified within a local population, we assume construction will not occur on more than one crossing within an individual local population per year

4) Marine areas used by some bull trout populations are assumed to be affected to a lesser extent than freshwater habitats (e.g., effects from sediment in the marine nearshore are not anticipated to effect bull trout to the same degree as sediment that may affect bull trout in spawning and rearing areas).

5) The effects of global climate change may have an effect on aquatic resources during the life of the WSDOT programmatic. Anticipated changes due to global climate change within the area of the WSDOT programmatic include increased stream temperatures that may limit bull trout distribution and reduce spawning and rearing areas. Although the manifestations of global climate change on bull trout within streams affected by WSDOT programmatic activities are reasonable to anticipate, the magnitude or effects of this change cannot be specifically predicted at this time. Therefore, this analysis may underestimate the long-term risk of some WSDOT programmatic activities to bull trout local populations and core areas.

57 Key recovery habitat is defined as habitat necessary for recovery of bull trout as identified by the Bull Trout Recovery/Management Unit Teams. It is those streams and lakes identified within the draft recovery plan, known to be occupied and likely to be occupied, that were deemed necessary for the recovery of bull trout.

Where additional assumptions were used, but were specific to a particular part of the analysis, they were stated and discussed in those specific sections of the document.

It should be noted that there is one core area in western Washington that is transboundary in nature that was included in our analysis. The Upper Skagit core area spans Washington and British Columbia, with seven local populations lying largely within Washington, one transboundary with Canada (i.e., Lightning Creek), and the remaining five lying only within British Columbia. We included the portions of habitat within British Columbia where necessary to complete our analysis (i.e., evaluation of baseline habitat risk and baseline population risk), since these habitats are functionally part of the respective core area.

Analysis of Exposure Risk

Using a spatial analysis of WSDOT roads in relationship to bull trout habitat, we were able to identify which of the core areas (n = 16) within or partially within Washington had relatively high levels of exposure, that is $\geq$ 5 percent of total stream length within 300 feet of WSDOT roads within "spawning and rearing" and/or "foraging, migration, and overwintering (FMO)" habitats. We also identified core areas that had relatively high levels of exposure from WSDOT state and interstate road crossings. "High levels" was defined as greater than two crossings within "spawning and rearing" habitat and greater than five crossings "foraging, migration, and overwintering (FMO)" habitat. Activities related to road crossings can have significant impacts to bull trout habitat, such as streambank armoring, bridge abutment armoring, and riparian removal. We considered road crossings to have greater potential impacts within local populations due to the sensitivity and limited amount of habitats used for spawning and rearing versus those for foraging, migration, and overwintering. Therefore, we believed using different road crossing criteria thresholds for local populations and FMO habitats was appropriate.

Local Population Exposure

Local populations with less than 5 percent total stream length (i.e., spawning and rearing habitat) within 300 feet of WSDOT roads were visually assessed to determine if the roads were adjacent or crossed critical spawning reaches, that may have been overlooked by the coarse percentage and coarse crossings analysis. Because of the importance and sensitivity of spawning habitat, this additional level of evaluation was considered warranted. These determinations were made by visually reviewing the GIS map and determining the location of WSDOT roads covered by the programmatic.

Four core areas were identified as containing greater than 5 percent spawning and rearing streams within 300 feet of WSDOT roads (Appendix A. *Supporting Materials for Risk Analysis: 1. Bull Trout Exposure Risk Analysis*). The core areas with greater than 5 percent spawning and rearing stream meters within 300 feet of WSDOT roads are listed below in descending order of percentage.

1) Snohomish/Skykomish
2) Nooksack
3) Lewis River
4) Upper Skagit

Within these four core areas (which include a total of 6 local populations), 3 local populations were determined to contain between 10 and 30 percent total spawning and rearing stream habitat within 300 feet of WSDOT roads covered by the programmatic (Table 1). No additional core areas had been overlooked by the coarse percentage or crossings analysis. None of the local populations that had less than 5 percent spawning and rearing stream miles within 300 feet of WSDOT roads were visually determined to have segments directly adjacent to or crossing critical spawning reaches.

Table 1. Exposure risk rankings based on percentage of stream habitat within 300 feet of WSDOT roads (criteria 1) and number of WSDOT road crossings (criteria 2) for local populations and FMO habitats within the 7 core areas determined to have some level of exposure risk.

Core Area	**Local Population**	**FMO**	**Exposure Risk**	
			Criteria 1	**Criteria 2**
Columbia River Population Segment				
Lewis	Cougar Creek		H	L
		Lewis FMO	L	L
Coastal-Puget Sound Population Segment				
Nooksack	Glacier Creek		L	L
	Upper NF Nooksack River		H	H
	Middle NF Nooksack River		M	M
	Lower NF Nooksack River		M	H
		Nooksack FMO	L	H
Lower Skagit	Goodell Creek		L	L
	Bacon Creek		L	L
		Lower Skagit FMO	M	H
Upper Skagit	Ruby Creek		H	L
		Upper Skagit FMO	H	L
Stillaguamish	NF Stillaguamish River		L	M
		Stillaguamish FMO	L	H
Snohomish-Skykokmish	SF Skykomish River		M	L
		Snohomish/Skykomish	L	H

Core Area	Local Population	FMO	Exposure Risk	
			Criteria 1	Criteria 2
		FMO		
Puyallup	Upper White River		M	L
	Greenwater River		L	L
	Carbon River		L	L
		Puyallup FMO	M	M
Foraging, Migration, and Overwintering Habitats (with no local population exposure				
Klickitat		Klickitat FMO	H	L
White Salmon		White Salmon FMO	H	L
Elwha		Elwha FMO	M	M
Dungeness		Dungeness FMO	L	L
Hoh		Hoh FMO	L	M
Queets		Queets FMO	L	L
Quinault		Quinault FMO	L	L

FMO Habitat Exposure

Five core areas, in addition to the White Salmon core habitat, were identified as containing greater than 5 percent FMO stream habitat within 300 feet of WSDOT roads (Appendix A. *Supporting Materials for Risk Analysis: 1. Bull Trout Exposure Risk Analysis*). It should be noted that for some core areas, the amount of FMO stream habitat may be naturally limited, so although the percentage of stream habitat within 300 feet of WSDOT roads may appear large, the actual amount (number of meters) may be lower than a core area having less than 5 percent FMO stream habitat within 300 feet of WSDOT roads. For this risk analysis, we believe percentage of stream habitat within 300 feet of WSDOT roads is the appropriate metric to evaluate. It is reasonable to assume the overall influence of WSDOT programmatic activities on the character/condition of available FMO habitat within an individual core area is generally based on the percent of the FMO stream habitat that is within 300 feet of WSDOT roads.

Core areas containing greater than 5 percent FMO stream habitat within 300 feet of WSDOT roads are listed below in descending order of percentage:

1) Klickitat
2) Upper Skagit
3) White Salmon[58]
4) Elwha
5) Puyallup
6) Lower Skagit

58 White Salmon is technically core habitat, meaning it currently has no core population/local populations.

Core areas containing local populations with impaired habitat and/or population baselines will generally be less resilient to adverse effects to their FMO habitat. The rationale for this premise is that a depressed migratory bull trout population must sufficiently endure effects at two locations, their spawning and rearing habitat (i.e., local populations) and their FMO habitat (regardless if those effects are considered less than what might occur within spawning and rearing habitat).

It should be noted that evaluating only the percent of bull trout FMO stream habitat directly affected may underestimate the actual overall affect to bull trout from activities within 300 feet of any stream (fish- and non-fish bearing) within these FMO areas (i.e., the greater area of watershed or hydrologic network within which the actual FMO stream habitat is located).

Those core areas that had less than 5 percent FMO stream habitat within 300 feet of WSDOT roads and no spawning and rearing stream habitat within 300 feet of WSDOT roads (i.e., no direct exposure) were removed from further analysis. These included the Quinault, Queets, Hoh, Dungeness, Chester Morse Lake, and Chilliwack core areas.

It should be noted that freshwater and marine FMO habitats "outside" of core areas (e.g., Chehalis River, Kalaloch Creek, Lake Washington, Puget Sound) were not explicitly incorporated into this risk analysis due to the nature of these habitats and the limited information on their relationship to specific core areas. These habitats are solely used by the anadromous life history form, once they migrate outside of their natal core area. Bull trout from multiple core areas may use these habitats, making it extremely difficult to evaluate the overall effect to individual core areas or local populations. It is recognized that these FMO habitats outside of core areas are an important component of the overall habitat network for anadromous populations of bull trout to complete their life history. However, given the limited information on specific relationships to core areas, all that can be stated is that some unknown amount of additional risk will likely be incurred for at least some unknown number of core areas, where these FMO stream and marine habitats have moderate to high exposure to activities within 300 feet of WSDOT roads.

Summary or Exposure Risk

Exposure risk was estimated for two categories of exposure within a core area's local populations (i.e., spawning and rearing habitats) and FMO areas: 1) the quantity of bull trout stream habitat within 300 feet of WSDOT roads, and 2) the number of WSDOT road stream crossings. These determinations addressed the amount of bull trout stream habitat potentially exposed to the effects of WSDOT programmatic activities. It also helped weight the importance of the location of those WSDOT programmatic activities in relationship to spawning and rearing or FMO habitats. In those cases where the specific location of spawning sites were unknown within the local population, the draft Bull Trout Recovery Plan or a bull trout biologist familiar with the area were consulted to identify/approximate the potential spawning locations.

The spatial analysis of local populations partially or completely within western Washington (n= 72), determined that 59 local populations contained no stream habitat within 300 feet of WSDOT roads (i.e., no direct risk). Six of the remaining 13 local populations had a small percentage (< 5 percent) of stream habitat within 300 feet of WSDOT roads, and seven local populations contained 5 percent or more stream habitat within 300 feet of a WSDOT road.

Exposure risk for local populations and FMO habitats are summarized for the relevant core areas in Table 1. Exposure risk for FMO habitats outside of core areas is summarized in Table 2. For detailed assessment of exposure risk to local populations and FMO habitats see Appendix A (*Supporting Materials for Risk Analysis: 1. Bull Trout Exposure Risk Analysis*).

Table 2. Exposure risk rankings based on percentage of stream habitat within 300 feet of WSDOT roads (criteria 1) and number of WSDOT road crossings (criteria 2) for FMO habitats outside of core areas determined to have some level of exposure risk.

Management Unit	**FMO**	**Exposure Risk**	
		Criteria 1	**Criteria 2**
Columbia River Population Segment			
Lower Columbia	Lower Columbia River FMO	H	H
Coastal-Puget Sound Population Segment			
Puget Sound	Samish River FMO	L	M
	Lake Washington FMO	L	M
	Lower Green River FMO	L	M
	Lower Nisqually River FMO	L	L
Olympic Peninsula	Bell Creek FMO	M	L
	Morris, Ennis, Siebert Creeks FMO	L	L
	Kalaloch Creek FMO	L	L
	Moclips River, Copalis River, Joe Creek FMO	L	L
	Humptulips River FMO	L	L
	Wishkah River FMO	L	L
	Satsop River FMO	L	L
	Wynoochee River FMO	L	L
	Chehalis River FMO	L	L
	Skokomish FMO	L	M

The exposure risk for local populations and FMO habitat was ranked based on the following two sets of criteria:

Criteria 1 (percent of stream adjacent road):

> *Low Risk*: Less than 5 percent stream habitat is within 300 feet of WSDOT roads.

Moderate Risk: Greater than 5 percent and less than 10 percent stream habitat within 300 feet of WSDOT roads.

High Risk: Greater than 10 percent stream habitat within 300 feet of WSDOT roads.

Criteria 2 (number of road crossings):

Local population:

Low Risk: No more than 2 WSDOT crossings within the local population.

Moderate Risk: Between 2 and 5 WSDOT crossings within the local population.

High Risk: 5 or more WSDOT crossings within the local population.

FMO habitat:

Low Risk: No more than 5 WSDOT crossings within FMO habitat.

Moderate Risk: Greater than 5 and less than 10 WSDOT crossings within FMO habitat.

High Risk: 10 or more WSDOT crossings within FMO habitat.

Risk rankings for the two criteria were generally consistent. This was not unexpected since one might anticipate increasing percentage of stream habitat within 300 feet of a WSDOT road would somewhat correlate with the total number of WSDOT road crossings. This generally held true, however, there were several exceptions. For local populations, the percentage of stream habitat within 300 ft of WSDOT roads typically expressed the greatest exposure risk of the two criteria. For FMO habitats, typically the reverse was true. This would suggest using criteria 1 is the most conservative approach for evaluating local population risk.

It should be noted that although some FMO habitat may be ranked at high exposure risk under criteria 1, this does not equate with the same level of risk to local populations (i.e., spawning and rearing habitat). WSDOT programmatic activities are not expected to affect FMO habitat to the same degree as spawning and rearing habitat when within 300 feet of a WSDOT road. Bull trout FMO habitats are 1) typically larger bodies of water, 2) generally contain streams with warmer water temperatures, and 3) typically used seasonally by bull trout life stages that have less sensitive or restrictive habitat requirements. Therefore, the effects of WSDOT programmatic activities on FMO streams will typically have a comparatively lesser impact to bull trout.

Only two (Lower Columbia River and Bell Creek FMOs) out of 14 FMO habitats outside of core areas had moderate to high exposure based on criteria 1, while only four FMO habitats had moderate to high exposure based on criteria 2 (Table 2). Only the Lower Columbia River FMO, had a moderate or high ranking for both criteria. When multiple FMO habitats outside of core areas within a particular Management Unit are at moderate to high exposure, that particular Management Unit may be considered at greater overall risk. However, because we determined most of the FMO habitats outside of core areas had limited exposure, and the remaining two core areas with at least moderate exposure risk are within two different Management Units, we don't believe it is necessary to address them further in this analysis. The impacts from WSDOT programmatic activities to these two particular FMO habitats are not anticipated to significantly change the overall risk ratings for any of their associated core areas in their respective Management Units.

Analysis of Baseline Habitat Risk

Given the variability of habitat conditions across local populations it was deemed warranted to individually assess and rank each local population and their core area's corresponding FMO habitat. FMO habitats with some level of exposure, but having no local populations with exposure risk, were also ranked because there was still potential risk to the core area. Baseline habitat risk was estimated (ranked) using spatial analysis of road density, number of road crossings on bull trout streams, 303d listings, and additional qualitative information on local population and FMO habitat condition. These rankings rate the condition of existing habitats within local populations and their corresponding FMO habitat. Spatial and non-spatial information was assessed through the bull trout "Matrix of Pathways and Indicators" (Matrix) (USFWS 1998) to arrive at the baseline habitat risk ranking. Risk categories (i.e., low, medium, high) were essentially equated to the Matrix categories (i.e., functioning appropriately, functioning at risk, functioning at unacceptable risk). The draft Bull Trout Recovery Plan (USFWS 2002 and 2004), Washington State limiting factors analyses, and/or a bull trout biologist familiar with the area were consulted in assessing the baseline habitat risk for local populations. Baseline habitat risk for local populations and FMO habitats is summarized in Table 3 below. See Appendix A (*Supporting Materials for Risk Analysis: 2. Bull Trout Baseline Habitat Risk Analysis*) for complete analysis of baseline habitat risk.

Table 3. Baseline habitat risk ranking for local populations with exposure risk, and for their corresponding FMO habitats. Also includes core areas with FMO exposure risk, but no local population exposure risk.

Core Area	**Local Population**	**Baseline Habitat Risk**
Columbia River Population Segment		
Lewis	Cougar Creek	L
	Lewis FMO	L
Klickitat	Klicktat FMO	H
White Salmon	White Salmon FMO	L
Coastal-Puget Sound Population Segment		

Core Area	Local Population	Baseline Habitat Risk
Nooksack	Glacier Creek	L
	Upper NF Nooksack River	M
	Middle NF Nooksack River	M
	Lower NF Nooksack River	M
	Nooksack FMO	M
Lower Skagit	Goodell Creek	L
	Bacon Creek	L
	Lower Skagit FMO	M
Upper Skagit	Ruby Creek	L
	Upper Skagit FMO	L
Stillaguamish	NF Stillaguamish River	M
	Stillaguamish FMO	M
Snohomish-Skykokmish	SF Skykomish River	M
	Snohomish/Skykomish FMO	M
Puyallup	Upper White River	L
	Greenwater River	H
	Carbon River	L
	Puyallup FMO	H
Elwha	Elwha FMO	M
Skokomish	Skokomish FMO	H

The baseline habitat risk analysis determined that only one of the 13 local populations had high (H) baseline habitat risk, while five had a moderate (M) risk. Three of the local populations with moderate or high exposure risk based on criteria 1 (n = 7) had low (L) baseline habitat risk, one in the Columbia River population segment and two within the Coastal-Puget Sound population segment. The remaining four local populations, all within the Coastal-Puget Sound population segment, were determined to have moderate (M) baseline habitat risk.

Although FMO habitat is critical for supporting migratory life history forms of bull trout, it is less sensitive to potential effects from WSDOT programmatic activities. In determining overall core area risk, FMO baseline habitat risk is more important in cases where core areas have local populations at moderate to high overall potential risk (see Summary of Overall Potential Risk section below). We judged that FMO baseline habitat risk becomes a much more relevant factor in these cases, since it is an indicator of what additional pressures are being placed upon a population already at a level of increased risk. By integrating baseline habitat risk for FMO habitat in these cases, it provides a more holistic and reliable risk condition of a core area with a local population(s) at moderate to high overall risk.

Analysis of Baseline Population Risk

Local Population Scale

Baseline population risk was estimated using the number of adult spawners and trend status within a local population. This determination addressed the current condition of population status parameters within local populations, which are an indicator of the potential sensitivity of a local population to impacts from WSDOT programmatic activities within 300 feet of stream habitat. In those cases where population parameters were unknown, we ranked these as moderate risk by default. A moderate or intermediate risk ranking seemed reasonable to assume in these cases, although this could mischaracterize the true status of an unknown local population as either better or worse. Population data from the draft bull trout recovery plans (USFWS 2002, 2004) in conjunction with updated information from the core area templates (USFWS 2005) were used in ranking local populations.

Baseline population risk for local populations was ranked using the following criteria, which was based on the bull trout population guidance and information from Rieman and Allendorf (2001). Baseline population risk for local populations is summarized in Table 4.

> *Low Risk*: Average, annual spawner abundance in the local population is greater than 100, and is stable or increasing (5-10 years data).
>
> *Moderate Risk*: Average, annual spawner abundance in the local population is greater than 100, and population trend is declining; or average, annual spawner abundance in the local population is between between 50 and 100 and is stable or increasing; or population parameters are currently unknown.
>
> *High Risk*: Average, annual spawner abundance in the local population is between between 50 and 100 and is declining; or average, annual spawner abundance in the local population is less than 50; or migratory form is or nearly absent.

Table 4. Baseline population risk rankings for local populations with exposure risk.

Core Area	**Local Population**	**Baseline Population Risk**
Columbia River Population Segment		
Lewis	Cougar Creek	H
Coastal-Puget Sound Population Segment		
Nooksack	Glacier Creek	L
	Upper NF Nooksack River	M
	Middle NF Nooksack River	M
	Lower NF Nooksack River	M

Core Area	Local Population	Baseline Population Risk
Lower Skagit	Goodell Creek	H
	Bacon Creek	L
Upper Skagit	Ruby Creek	L
Stillaguamish	NF Stillaguamish River	L
Snohomish/Skykomish	SF Skykomish River	M
Puyallup	Upper White River	M
	Greenwater River	M
	Carbon River	M

Core Area Scale

Different parameter values are used to assess baseline population condition or risk at the core area scale. The ranking criteria reflect this, and are generally based on values described in the current bull trout literature and draft recovery plans (USFWS 2002 and 2004). Analysis of baseline population risk at this scale also includes assessment of an additional parameter, the number of local populations. Because we did not necessarily evaluate all local populations (i.e., only those with moderate to high exposure risk) within a core area in the earlier parts of our analysis, we could not simply "sum up" the baseline population risk rankings for local populations and equate that with the baseline population risk ranking for the core area, nor would that have been necessarily appropriate. Population data from the draft bull trout recovery plans (USFWS 2002 and 2004) in conjunction with updated information from the core area templates (USFWS 2005) were used in ranking core areas.

Baseline population risk for affected core areas was ranked using the following criteria which was based on the bull trout population guidance and information from Rieman and McIntyre (1993), and Rieman and Allendorf (2001). Baseline population risk for core areas with local populations with moderate to high exposure risk is summarized in Table 5.

> *Low Risk*: Average, annual spawner abundance in the core area is estimated to be greater than 1000 and is stable or increasing (5-10 years data), and core area contains more than 5 local populations.
>
> *Moderate Risk*: Average, annual spawner abundance in the core area is estimated to be greater than 1000 and is stable or increasing (5-10 years data), and core area contains less than 5 local populations; or average, annual spawner abundance in the core area is estimated to be at least 500 and is stable or increasing (5-10 years data); or population parameters are currently unknown.
>
> *High Risk*: Average, annual spawner abundance in the core area is estimated to be between 500 and 1000 and is declining and has less than 5

local populations; or average, annual spawner abundance in the core area is less than 500.

Table 5. Baseline population risk rankings for core areas with a least one local population at moderate to high exposure risk.

Core Area	**Baseline Population Risk**
Columbia River Population Segment	
Lewis	M
Klickitat	H
Coastal-Puget Sound Population Segment	
Nooksack	M
Lower Skagit	L
Upper Skagit	L
Stillaguamish	M
Snohomish/Skykomish	M
Puyallup	M
Elwha	M

Summary of Overall Potential Risk

Overall potential risk is presented at two scales, the local population and core area. Although the ranking results can be used independently to assess relative risk at the two scales, they should also be examined together to more fully assess the ultimate risk to a particular core area from WSDOT programmatic activities.

Local Population Scale

Overall potential risk for local populations was ranked using a simple scoring system in the following matrix. A “high” ranking received a value of 3 points, a “moderate” ranking a value of 2 points, and a “low” ranking a value of 1 point (i.e. H=3, M=2, L=1). For each local population, its three resulting ranking values were summed together and then divided by three to determine its final score and its overall potential risk category. We assumed that both habitat and population risk rankings were equally weighted or equally important to bull trout, and therefore, only a finite number of combinations are possible. These combinations are displayed in Table 6.

Table 6. Potential individual risk combinations and resultant overall risk ranking for a local population (i.e., spawning and rearing habitat).

Exposure Risk		**Risk 1**		**Risk 2**		**Overall Potential Risk**	
Ranking	Pt value	Ranking	Pt value	Ranking	Pt value	Ranking	Score
H	3	H	3	H	3	H	3.0
H	3	H	3	M	2	MH	2.7
H	3	H	3	L	1	M	2.3
H	3	M	2	M	2	M	2.3
H	3	L	1	M	2	M	2.0
H	3	L	1	L	1	ML	1.7
M	2	L	1	L	1	L	1.3
L	1	L	1	L	1	L	1.0
L	1	L	1	M	2	L	1.3
L	1	M	2	L	1	L	1.3
M	2	L	1	M	2	ML	1.7
L	1	M	2	M	2	ML	1.7
L	1	H	3	M	2	M	2.0
L	1	M	2	H	3	M	2.0
M	2	M	2	M	2	M	2.0
M	2	H	3	L	1	M	2.0
M	2	H	3	M	2	M	2.3
M	2	H	3	H	3	MH	2.7

The overall potential risk rankings for local populations with a moderate to high exposure risk are summarized below in Table 7. Out of the 13 local populations analyzed to this point, none were scored in the high (H) or moderate-high (MH) risk categories. Six local populations were scored in the moderate (M), or next highest risk category. Two of these local populations where ranked as having a high (H) exposure risk, three a moderate (M) exposure risk, and one a low (L) exposure risk. Five of the six local populations were located in the Coastal-Puget Sound population segment, with the remaining one in the Columbia River population segment. The remaining seven local populations ranked, were scored in the moderate-low (ML) or low (L) risk categories.

Table 7. Overall potential risk rankings for local populations with moderate to high exposure risk. Rankings are in descending order, with high (H) exposure risk local populations listed first in each final ranking (rank 4) category.

		Exposure Risk		**Habitat Risk**		**Population Risk**		**Overall Potential Risk**	
Core Area	**Local Population**	**rank 1**	**score 1**	**rank 2**	**score 2**	**rank 3**	**score 3**	**rank 4**	**score 4**
Lewis	Cougar Creek	H	3	L	1	H	3	M	2.3
Nooksack	Upper NF Nooksack	H	3	M	2	M	2	M	2.3
Nooksack	Middle NF Nooksack	M	2	M	2	M	2	M	2.0
Nooksack	Lower NF Nooksack	M	2	M	2	M	2	M	2.0
Puyallup	Greenwater River	L	1	H	3	M	2	M	2.0
Snohomish/Skykomish	SF Skykomish River	M	2	M	2	M	2	M	2.0
Lower Skagit	Goodell Creek	L	1	L	1	H	3	ML	1.7
Puyallup	Upper White River	M	2	L	1	M	2	ML	1.7
Upper Skagit	Ruby Creek	H	3	L	1	L	1	ML	1.7
Puyallup	Carbon River	L	1	L	1	M	2	L	1.3
Stillaguamish	NF Stillaguamish	L	1	M	2	L	1	L	1.3
Lower Skagit	Bacon Creek	L	1	L	1	L	1	L	1.0
Nooksack	Glacier Creek	L	1	L	1	L	1	L	1.0

An additional "habitat" factor not explicitly integrated into the Matrix analysis and therefore not integrated into the overall baseline habitat risk results was the presence of brook trout (Appendix A *Supporting Materials for Risk Analysis: 2. Bull Trout Baseline Habitat Risk Analysis*). The analysis results for this additional factor can be overlayed with the results of the overall potential risk rankings to provide an even more comprehensive picture of relative risk for individual local populations. Two (Upper NF Nooksack River and Greenwater River) of the six local populations that scored a moderate (M) overall potential risk, also have a moderate risk ranking associated with the presence of brook trout, while the remaining four local populations (Cougar Creek, Middle NF Nooksack River, Lower NF Nooksack River, and SF Skykomish River) have a low risk ranking associated with the presence of brook trout.

Core Area Scale

To estimate the overall potential risk for the core area containing local population(s) with moderate to high exposure risk, we integrated the baseline habitat risk ranking for corresponding FMOs (Table 3) with the baseline population risk for core areas (Table 5). We also integrated FMO exposure risk into this final ranking. However, since the exposure risk can be variable between local populations and FMO habitat within a core area, the results of this combined ranking should be evaluated with some degree of caution. In addition, baseline habitat conditions may also vary significantly between local populations and FMO habitat within a core area, so bias may lean toward the FMO baseline habitat conditions in the core area ranking. However, the fact that only those core areas with local populations with moderate to high exposure risk were evaluated, and that FMO habitat is typically an equal or greater portion of a core area's landscape when compared to its local populations, tends to minimize any bias.

The overall potential risk rankings for the core areas with local populations with a moderate to high exposure risk are summarized in Table 8. No core areas were determined to be at high (H) or moderate-high (MH) overall potential risk. The Puyallup and Snohomish-Skykomish core areas were determined to be at a moderate (M) overall potential risk, or the next highest risk category. The remaining three core areas had a moderate-low (ML) or low (L) overall potential risk ranking.

Table 8. Overall potential risk rankings for core areas with at least one local population at moderate to high exposure risk.

	FMO Exposure Risk		**FMO Habitat Risk**		**Core Area Population Risk**		**Overall Potential Risk**	
Core Area	**rank 1**	**score 1**	**rank 2**	**score 2**	**rank 3**	**score 3**	**rank 4**	**score 4**
Puyallup	M	2	H	3	M	2	M	2.3
Snohomish/ Skykomish	M	2	M	2	M	2	M	2.0
Nooksack	L	1	M	2	M	2	ML	1.7
Upper Skagit	H	3	L	1	L	1	ML	1.7
Lewis	L	1	L	1	M	2	L	1.3

Integrating the results of the core area and local population overall potential risk rankings would indicate that none of the core areas are at major levels of risk from WSDOT programmatic activities. However, the Snohomish-Skykomish core area appears to be at the highest risk of all core areas exposed to WSDOT programmatic activities, followed by the Puyallup core area. Overall, the Lewis River core area was not at a high risk, even though one of its only three local populations, Cougar Creek, is at a moderate (M) overall potential risk. Although the Nooksack core area had a moderate-low (ML) overall potential risk, three of its ten local populations were rated at a moderate (M) overall potential risk to the effects of WSDOT programmatic activities.

Overall Risk for Core Areas Not Included in Overall Potential Risk Ranking

In the analysis of exposure risk, FMO habitats within two core areas and one core habitat were identified as having moderate to high exposure (i.e., containing greater than 5 percent FMO stream habitat within 300 feet of WSDOT roads), but no exposure risk to their corresponding local populations (Table 1). These areas were located within the Klickitat and Elwha core areas, and White Salmon core habitat. These core area populations can still have risk from WSDOT programmatic activities, especially for those core areas currently in a significantly impaired condition.

To evaluate the risk to the two core areas containing these FMO habitats, their exposure to WSDOT programmatic activities, baseline habitat condition, and core area baseline population condition were evaluated. The overall potential risk to these two core areas from the effects of WSDOT programmatic activities is considered to be generally less compared to the core areas ranked above in Table 8 due to the lack of exposure to their associated local populations. Because none of their local populations are directly affected, the primary risk to these two core populations is from potential impacts to/in their FMO habitats. As stated earlier, these habitats are generally less sensitive to the effects from WSDOT programmatic activities. This does not mean that adverse effects from WSDOT programmatic activities will not occur to habitat in these FMO areas or that adverse effects will not occur to bull trout within these areas, but rather the adverse effects to a core population's more sensitive spawning and rearing habitats and more sensitive life stages will largely be avoided.

The overall potential risk rankings for these two core areas having local populations with no exposure risk are summarized in Table 9. Only the Klickitat core area was determined to be at a high (H) overall potential risk. The Elwha core area and White Salmon core habitat, were determined to be only at a moderate (M) overall potential risk. The Klickitat core area risk ranking is driven by the poor baseline habitat conditions and depressed population status. The Klickitat core area primarily consists of a resident population of bull trout with apparently only a few remnant fluvial migrants.

Table 9. Overall potential risk rankings for core areas with FMO habitats with moderate to high exposure, with local populations with low or no exposure risk.

	FMO Exposure Risk		**FMO Habitat Risk**		**Core Area Population Risk**		**Overall Potential Risk**	
Core Area	**rank 1**	**score 1**	**rank 2**	**score 2**	**rank 3**	**score 3**	**rank 4**	**score 4**
Klickitat	H	3	H	3	H	3	H	3.0
White Salmon	H	3	L	1	n/a59	n/a	M	2.0
Elwha	M	2	M	2	M	2	M	2.0

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59 No population rank because it is just core habitat. Overall risk is based only on score 1 and 2.

APPENDIX A. Supporting Materials for Risk Analysis for WSDOT Western Washington Programmatic, 2005:

1. Bull Trout Exposure Risk Analysis

Table 1. Geographic Information System analysis summary of WSDOT state highways/interstate highways within 300 feet of, or crossing bull trout key habitat within action area. Summarized by local population and FMO habitat for each exposed core area.

Management Unit	Core Area (subunit)/FMO Outside of Core Area	Local Population	FMO	Key Habitat within Action Area (meters)	Key Habitat within 300 ft of State/Interstate Highway within Action Area (meters)	% of Key Habitat within 300 ft	# of Stream Crossings over Key Habitat
PUGET SOUND	Nooksack	Total		452,064	9848	2.18	28
		Upper NF Nooksack River		17,478	1976	11.31	5
		Middle NF Nooksack River		10,628	677	6.37	3
		Glacier Creek		18,660	214	1.15	1
		Lower NF Nooksack River		22,140	2044	9.23	5
			Nooksack	224,019	4938	2.20	14
	Lower Skagit	Total		952,957	25,933	2.72	23
		Bacon Creek		19,773	*193*	0.98	1
		Goodell Creek		17,058	*162*	0.95	1
			Lower Skagit	568,502	25,579	4.50	21
	Upper Skagit	Total		291,101	23,480	8.07	2
		Ruby Creek		28,226	8,186	29.00	1
			Upper Skagit	137656	12,520	9.10	1

Management Unit	Core Area (subunit)/FMO Outside of Core Area	Local Population	FMO	Key Habitat within Action Area (meters)	Key Habitat within 300 ft of State/Interstate Highway within Action Area (meters)	% of Key Habitat within 300 ft	# of Stream Crossings over Key Habitat
	Stillaguamish	Total		392,207	5,209	1.33	16
			Stillaguamish	246,669	4,365	1.77%	12
		NF Stillaguamish River		57,056	845	1.48	4
	Snohomish/ Skykomish	Total		530,795	15,484	2.92	25
		SF Skykomish River		76870	4,615	6.00	2
			Snohomish/ Skykomish	421,485	10,868	2.58	23
	Puyallup	Total		524,885	19,259	3.67	12
		Greenwater River		31,862	223	0.70	1
		Upper White River		83,060	3,871	4.66	1
		Carbon River		52,546	329	0.63	1
			Puyallup	237,242	14,836	6.25	9
	Lower Nisqually FMO		Lower Nisqually	72,973	382	0.52	2
	Lake Washington FMO		Lake Washington	160554	7602	4.73	6
	Samish FMO		Samish	53476	1884	3.52	6

Management Unit	Core Area (subunit)/FMO Outside of Core Area	Local Population	FMO	Key Habitat within Action Area (meters)	Key Habitat within 300 ft of State/Interstate Highway within Action Area (meters)	% of Key Habitat within 300 ft	# of Stream Crossings over Key Habitat
	Puget Sound FMO		Puget Sound	911437	12595	1.38	1
	Lower Green FMO		Lower Green	101,821	4,387	4.31	7
OLYMPIC	Chehalis FMO		Chehalis	78,529	1,833	2.33	2
	Wynoochee FMO		Wynoochee	81,929	226	0.28	1
	Wishkah FMO		Wishkah	91,314	351	0.38	1
	Satsop FMO		Satsop	92,580	210	0.23	1
	Humptulips FMO		Humptulips	166,664	1,147	0.69%	4
	Moclips, Copalis, Joe Creek FMO		Moclips, Copalis, Joe Creek FMO	43,233	1,195	2.76	3
	Quinault		Quinault	183,083	393	0.21	2
	Kalaloch FMO		Kalaloch	10,223	400	3.91	1
	Hoh		Hoh	156,416	2,525	1.61	7
	Elwha		Elwha	54,231	4,504	8.31	6
	Skokomish		Skokomish	188,907	1,164	0.6	6
	Hood Canal FMO		Hood Canal	172,038	54693	31.79	1
	Grays Harbor FMO		Grays Harbor	186601	4204	2.25	2

Management Unit	Core Area (subunit)/FMO Outside of Core Area	Local Population	FMO	Key Habitat within Action Area (meters)	Key Habitat within 300 ft of State/Interstate Highway within Action Area (meters)	% of Key Habitat within 300 ft	# of Stream Crossings over Key Habitat
	Queets		Queets	224,947	582	0.26	2
	Dungeness	Total		79454	235	0.30	1
			Dungeness	34940	235	0.67	1
	Strait of Juan de Fuca FMO		Strait of Juan de Fuca FMO	210169	3209	1.53	0
	Bell FMO		Bell FMO	6108	376	6.16	1
	Morris Creek, Ennis, Siebert FMO		Morris Creek, Ennis, Siebert FMO	26210	688	2.62	3
COLUMBIA RIVER	White Salmon[1]	Total	White Salmon	30046	2592	8.63	
	Lewis	Total		261,035	7,974	3.05	5
		Cougar Creek		6,663	1166	17.50	1
			Lewis	214,415	6808	3.18	4
	Klickitat	Total		135,694	20,674	15.24	9
			Klickitat	103,299	20,674	20.01	2
	Lower Columbia River FMO		Lower Columbia River FMO	341,294	93,729	27.46	17

[1] White Salmon is a Core Habitat; no known spawning occurs within this watershed.

2. Baseline Habitat Risk Analysis

Spatial and non-spatial information was assessed through the bull trout "Matrix of Pathways and Indicators" (Matrix) (USFWS 1998) to arrive at the baseline habitat risk ranking. Risk categories (i.e., low, medium, high) were essentially equated to the Matrix categories (i.e., functioning appropriately, functioning at risk, functioning at unacceptable risk). The draft Bull Trout Recovery Plan (USFWS 2002 and 2004), Washington State limiting factors analyses, subbasin plans, other biological opinions, and/or a bull trout biologist familiar with the area were consulted in assessing the baseline habitat risk for local populations. For the Coastal-Puget Sound population segment's local populations, the "watershed conditions" category was rated by integrating road density and road crossing information (Table 2), while road density as well as other available information was used to rate the watershed conditions for local populations within the Columbia River population segment (Table 3).

To calculate the overall baseline habitat risk ranking an average of the six habitat pathways in the Matrix was used. It should be noted that this approach may underestimate the actual overall risk ranking. For example, if either flow/hydrology or habitat access is determined to be high risk (i.e., functioning at unacceptable risk), the condition or ranking of the remaining pathways may in reality have only a minor significance to the overall habitat risk ranking. More simply stated, if bull trout access to habitat is significantly impaired or base flows of a stream are extremely low, the pathways of water quality, habitat elements, and/or channel condition are all secondary in significance in this particular case. However, in many cases pathways work synergistically or are ultimately related in some way. To minimize subjectivity and potential rating errors or biases in weighting any particular pathway, "averaging" was ultimately deemed the most appropriate approach for calculating the baseline habitat risk analysis.

The "brook trout presence" category was added to the matrix to indicate what additional level of risk might be faced by bull trout populations, especially where baseline habitat conditions are in a significantly degraded or impaired condition (i.e., rated at high risk). The level of effect from brook trout on bull trout is sight specific and variable depending on a number of factors (e.g., baseline habitat condition, amount of available habitat, bull trout access to refugia, brook trout densities, water temperature). In addition, the presence of brook trout primarily has population effects to bull trout (e.g., hybridization, competition) as opposed to strictly habitat effects. Therefore, we did not integrate it directly into our overall baseline habitat risk ranking. Because brook trout appear to have a competitive advantage over bull trout in degraded habitats, the brook trout presence ranking is most significant for those local populations determined to have a high (H) overall baseline habitat risk.

Table 2. Baseline habitat risk ranking matrix by local population and FMO habitat for the Coastal-Puget Sound population segment and the Lower Columbia Management Unit of the Columbia River population segment.

Core Area	Local Population	FMO	Water Quality	Habitat Access	Habitat Elements	Channel Condition	Flow/ Hydrology	Watershed Conditions	Brook Trout Presence	Risk Ranking
Lewis	Cougar Creek		L	L	M	M	L	L	L	**L**
		Lewis	L	M	L	L	L	M	n/a	**L**
Lower Skagit	Goodell Creek		L	M	L	L	L	L	L	**L**
	Bacon Creek		L	L	L	L	L	L	L	**L**
		Lower Skagit	M	L	M	H	M	H	n/a	**M**
Nooksack	Glacier Creek		L	M	L	M	L	L	L	**L**
	Middle NF Nooksack River		H	L	M	H	H	M	L	**M**
	Upper NF Nooksack River		L	M	M	M	L	M	M	**M**
	Lower NF Nooksack River		M	L	M	M	H	H	L	**M**
		Nooksack	H	M	M	M	H	M	n/a	**M**
Puyallup	Upper Puyallup-Mowich		L	M	H	M	H	H	M	**H**
	Greenwater River		H	M	H	H	L	H	M	**H**
	Carbon River		L	L	L	L	L	L	H	**L**
	Upper White River		L	L	M	M	L	M	H	**L**
		Puyallup	M	M	H	H	M	H	n/a	**H**

Core Area	Local Population	FMO	Water Quality	Habitat Access	Habitat Elements	Channel Condition	Flow/ Hydrology	Watershed Conditions	Brook Trout Presence	Risk Ranking
Skokomish		Skokomish	M	M	H	H	H	H	n/a	**H**
Snohomish/ Skykomish	SF Skykomish River		M	L	H	M	M	H	M	**M**
		Snohomish/ Skykomish	M	L	M	M	L	H	n/a	**M**
Stillaguamish	NF Stillaguamish River		M	L	M	M	L	M	M	**M**
		Stillaguamish	M	L	M	L	L	M	n/a	**M**
Upper Skagit	Ruby Creek		L	L	L	M	L	L	L	**L**
		Upper Skagit	L	L	L	L	L	L	n/a	**L**
Dungeness		Dungeness	M	L	H	H	M	M	n/a	**M**
Elwha		Elwha	M	H	H	H	L	M	n/a	**M**
Hoh		Hoh	M	L	M	M	M	H	n/a	**M**
Klickitat		Klickitat	H	H	H	H	H	H	n/a	**H**
Queets		Queets	H	L	M	M	H	H	n/a	**M**
Quinault		Quinault	M	L	M	M	M	M	n/a	**M**
White Salmon		White Salmon	L	H	M	L	L	L	n/a	**L**

Table 3. Matrix for ranking "watershed conditions" for the Coastal-Puget Sound population segment. Crossing categories [1] for Road Type = 10 were based on best professional judgment after reviewing the range of the number of crossings among local populations. It should be noted that the resolution of our road crossing data set used in this analysis could not distinguish between crossing types (i.e., bridges versus culverts), nor did we distinguish crossing location (i.e., over fishbearing versus non-fishbearing stream) (see Appendix B *Supporting GIS Analyses for Bull Trout Risk Analysis: Road Density and Stream Crossing Summaries by Local Population and Core Area*). Therefore, we believe our crossing categories represent an adequate compromise given the resolution of the data used, even though we acknowledge that there may be some over or underestimate of the impact from crossings given the uncertainties of crossing types and locations. It should also be noted that the watershed condition ranking was often not affected by the road crossing ranking (i.e., it was consistent with the road density ranking), and in those cases where it was different, it could only shift the ranking by one level.

Core Area	Local Population	FMO	Road Density[1]	Road Crossings[2]	Watershed Conditions
Lewis	Cougar Creek		H	L	M
		Lewis	H	n/a	M[3]
Lower Skagit	Goodell Creek		L	L	L
	Bacon Creek		L	L	L
		Lower Skagit	H	n/a	H
Nooksack	Glacier Creek		M	L	L
	Middle NF Nooksack River		H	L	M
	Upper NF Nooksack River		M	L	M
	Lower NF Nooksack River		H	M	H
		Nooksack	M	n/a	M
Puyallup	Upper Puyallup-Mowich		M	H	H
	Greenwater River		H	M	H
	Carbon River		M	M	M
	Upper White River		M	L	M
		Puyallup	H	n/a	H
Snohomish/ Skykomish	SF Skykomish River		M	H	H

Core Area	Local Population	FMO	Road Density[1]	Road Crossings[2]	Watershed Conditions
		Snohomish/ Skykomish	H	n/a	H
Stillaguamish	NF Stillaguamish River		M	M	M
		Stillaguamish	H	n/a	H
Upper Skagit	Ruby Creek		L	L	L
		Upper Skagit	L	n/a	L
Dungeness		Dungeness	M	n/a	H
Elwha		Elwha	M	n/a	M
Hoh		Hoh	H	n/a	H
Klickitat		Klickitat	H	n/a	H
Queets		Queets	H	n/a	H
Quinault		Quinault	M	n/a	M
White Salmon[4]		White Salmon	L	n/a	L
n/a		*Satsop*	H	n/a	H
n/a		*Wynoochee*	H	n/a	H
n/a		*Wishkah*	H	n/a	H
n/a		*Bell*	H	n/a	H
n/a		*Lower Nisqually*	H	n/a	H
n/a		*Kalaloch*	H	n/a	H
n/a		*Morris Creek, Ennis, Siebert*	H	n/a	H
n/a		*Humptulip*	H	n/a	H
n/a		*Moclips, Copalis, Joe Creek*	H	n/a	H
n/a		*Chehalis*	H	n/a	H
n/a		*Samish*	H	n/a	H
n/a		*Lower Green*	M	n/a	M
n/a		*Lake Washington*	H	n/a	M[3]
n/a		*Lower Columbia River*	n/a	n/a	n/a
n/a		***Strait of Juan de Fuca FMO***	n/a	n/a	n/a

Core Area	Local Population	FMO	Road Density[1]	Road Crossings[2]	Watershed Conditions
n/a		***Grays Harbor***	n/a	n/a	n/a
n/a		***Puget Sound***	n/a	n/a	n/a
n/a		***Hood Canal***	n/a	n/a	n/a

1. Relationships to MPI road density ratings: Functioning Appropriately = L; Functioning at Risk = M; Functioning at Unacceptable Risk = H

2. 600 crossings = H; 300 to 600 crossing = M; <300 crossings = L for Type 10 (roads); Note that crossing data was only used for local population ratings.

3. These areas were rated "moderate" because the majority of FMO habitat in these areas is represented by lakes and not streams, therefore, road density overestimates the level of potential impact in this case.

4. This area is technically core habitat, since the area currently does not contain a bull trout population. However, it is anticipated that reintroduction through passive or active means will take place in the future to achieve recovery goals.

APPENDIX B.

Supporting GIS Analyses for Bull Trout Risk Analysis – baseline conditions includes all roads:

Road Density and Stream Crossing Summaries by Local Population and Core Area

Item: Transportation in Local Populations & Forest Practices Lands

Clip WaTrans2005 with Local Populations

Identify clipped WaTrans2005 with Fplands in Local populations

Frequency by road type & local population to get total road miles in LP

sources: WDNR Transportation 2005 & US FWS FPLands 2005

Road Density by Local Population (Totals and Forest Practices lands)

Local Population Type: L= Local Population; P= Potential Local Population

Road Type: 10 = Road; 20 = Trail; 30 = Railroad; 31 = Railroad Grade; 99 = unspecified transportation route

ID #	Distinct Population Segment	Management Unit	Core Area	Local Population Name	Local Population Type	Total Acres in Local Population	Total Miles of Road (10 and 99) in Local Population	Road Density in Local Population
101	Columbia River	Middle Columbia	Yakima River	Upper Yakima River	L	38889.07	329.76	5.43
15	Coastal-Puget Sound	Puget Sound	Chester Morse	Rack Creek	L	1408.47	10.62	4.83
83	Columbia River	Lower Columbia	Lewis River	Pine Creek	L	15169.43	113.74	4.80
106	Columbia River	Northeast Washington	Pend Oreille River	Mill Creek PLP	P	12428.43	88.93	4.58
54	Coastal-Puget Sound	Puget Sound	Puyallup River	Greenwater River	L	32507.86	228.87	4.51
45	Coastal-Puget Sound	Puget Sound	Nooksack River	Lower North Fork Nooksack River	L	21767.30	143.73	4.23
47	Coastal-Puget Sound	Puget Sound	Nooksack River	Middle North Fork Nooksack River	L	9009.61	59.38	4.22
129	Columbia River	Upper Columbia	Entiat River	Mad River	L	58391.07	377.47	4.14

ID #	Distinct Population Segment	Management Unit	Core Area	Local Population Name	Local Population Type	Total Acres in Local Population	Total Miles of Road (10 and 99) in Local Population	Road Density in Local Population
118	Columbia River	Snake River Basin in Washington	Tucannon River	Little Tucannon River	P	4805.09	29.72	3.96
10	Coastal-Puget Sound	Olympic Peninsula	Skokomish River	Brown Creek PLP	P	5102.35	31.55	3.96
46	Coastal-Puget Sound	Puget Sound	Nooksack River	Lower South Fork Nooksack River	L	76879.68	461.89	3.85
13	Coastal-Puget Sound	Puget Sound	Chester Morse	Boulder Creek	L	14687.61	84.44	3.68
82	Columbia River	Lower Columbia	Lewis River	Cougar Creek	L	10613.84	58.29	3.51
93	Columbia River	Middle Columbia	Yakima River	Gold Creek (2)	L	36233.16	194.47	3.43
44	Coastal-Puget Sound	Puget Sound	Nooksack River	Lower Middle Fork Nooksack River	L	17495.01	92.98	3.40
113	Columbia River	Snake River Basin in Washington	Asotin Creek	Charley Creek	L	14455.79	76.71	3.40
12	Coastal-Puget Sound	Olympic Peninsula	Skokomish River	South Fork Skokomish River	L	24608.02	127.77	3.32
1	Coastal-Puget Sound	Olympic Peninsula	Dungeness River	Dungeness River	L	22734.08	114.32	3.22
14	Coastal-Puget Sound	Puget Sound	Chester Morse	Cedar River	L	27475.69	135.76	3.16
86	Columbia River	Middle Columbia	Yakima River	Ahtamum Creek	L	69364.12	318.26	2.94
128	Columbia River	Upper Columbia	Entiat River	Entiat River	L	80643.06	356.74	2.83
53	Coastal-Puget Sound	Puget Sound	Puyallup River	Clearwater River PLP	P	24734.11	108.31	2.80
127	Columbia River	Umatilla-Walla Walla	Walla Walla River	Wolf Fork Touchet River	L	6558.20	28.42	2.77
100	Columbia River	Middle Columbia	Yakima River	Taneum Creek PLP	P	39979.99	170.95	2.74
110	Columbia River	Northeast Washington	Pend Oreille River	Small Creek PLP	P	17210.81	73.43	2.73
104	Columbia River	Northeast Washington	Pend Oreille River	Indian Creek PLP (2)	P	3440.60	14.64	2.72
16	Coastal-Puget Sound	Puget Sound	Chester Morse	Shotgun Creek PLP	P	514.89	2.12	2.64
120	Columbia River	Snake River Basin in Washington	Tucannon River	Meadow Creek	L	4516.25	17.33	2.46
95	Columbia River	Middle Columbia	Yakima River	Kachess River	L	33061.02	126.78	2.45
112	Columbia River	Northeast Washington	Pend Oreille River	Tacoma Creek PLP	P	15856.05	60.01	2.42
126	Columbia River	Umatilla-Walla Walla	Walla Walla River	South Fork Touchet River	L	12482.40	46.44	2.38

ID #	Distinct Population Segment	Management Unit	Core Area	Local Population Name	Local Population Type	Total Acres in Local Population	Total Miles of Road (10 and 99) in Local Population	Road Density in Local Population
43	Coastal-Puget Sound	Puget Sound	Nooksack River	Lower Canyon Creek	L	19767.05	70.82	2.29
143	Columbia River	Upper Columbia	Wenatchee River	Nason Creek	L	70070.28	247.89	2.26
105	Columbia River	Northeast Washington	Pend Oreille River	Le Clerc Creek	L	48414.55	165.40	2.19
57	Coastal-Puget Sound	Puget Sound	Puyallup River	West Fork White River	L	41992.12	138.00	2.10
111	Columbia River	Northeast Washington	Pend Oreille River	Sullivan Creek PLP	P	45651.13	149.31	2.09
55	Coastal-Puget Sound	Puget Sound	Puyallup River	Upper Puyallup & Mowich Rivers	L	58489.24	190.85	2.09
99	Columbia River	Middle Columbia	Yakima River	SFk Tieton River	L	57301.55	182.04	2.03
65	Coastal-Puget Sound	Puget Sound	Stillaguamish River	Upper Deer Creek	L	22598.96	68.87	1.95
84	Columbia River	Lower Columbia	Lewis River	Rush Creek	L	16874.31	51.39	1.95
63	Coastal-Puget Sound	Puget Sound	Stillaguamish River	North Fork Stillaguamish River	L	61304.74	185.29	1.93
114	Columbia River	Snake River Basin in Washington	Asotin Creek	NFk Asotin River	L	66578.86	201.03	1.93
62	Coastal-Puget Sound	Puget Sound	Stillaguamish River	Canyon Creek	L	28851.69	87.11	1.93
133	Columbia River	Upper Columbia	Methow River	Goat Creek	L	23025.89	68.73	1.91
125	Columbia River	Umatilla-Walla Walla	Walla Walla River	North Fork Touchet River	L	38456.00	114.63	1.91
103	Columbia River	Northeast Washington	Pend Oreille River	Harvey Creek PLP	P	25507.50	75.85	1.90
102	Columbia River	Northeast Washington	Pend Oreille River	Cedar Creek PLP	P	11655.24	34.66	1.90
77	Columbia River	Clark Fork	Priest Lake	Kalispell Creek	L	14959.23	44.05	1.88
119	Columbia River	Snake River Basin in Washington	Tucannon River	Little Turkey Creek	L	1504.46	4.22	1.79
42	Coastal-Puget Sound	Puget Sound	Nooksack River	Glacier Creek	L	20319.65	56.38	1.78
48	Coastal-Puget Sound	Puget Sound	Nooksack River	Upper Middle Fork Nooksack River	L	46066.26	126.57	1.76
115	Columbia River	Snake River Basin in Washington	Asotin Creek	Wormell Gulch PLP	P	48628.47	132.69	1.75
37	Coastal-Puget Sound	Puget Sound	Lower Skagit River	Sulphur Creek (Lake Shannon) PLP	P	6442.89	17.24	1.71

ID #	Distinct Population Segment	Management Unit	Core Area	Local Population Name	Local Population Type	Total Acres in Local Population	Total Miles of Road (10 and 99) in Local Population	Road Density in Local Population
116	Columbia River	Snake River Basin in Washington	Tucannon River	Cummings Creek	L	12748.85	33.82	1.70
85	Columbia River	Lower Columbia	Lewis River	Upper Lewis River PLP	P	73798.80	192.02	1.67
91	Columbia River	Middle Columbia	Yakima River	Crow Creek	L	54514.93	141.69	1.66
51	Coastal-Puget Sound	Puget Sound	Nooksack River	Wanlick Creek	L	6275.61	15.74	1.61
49	Coastal-Puget Sound	Puget Sound	Nooksack River	Upper North Fork Nooksack River	L	29408.71	68.35	1.49
140	Columbia River	Upper Columbia	Wenatchee River	Chiwawa River	L	120808.79	268.80	1.42
52	Coastal-Puget Sound	Puget Sound	Puyallup River	Carbon River	L	51796.44	114.97	1.42
60	Coastal-Puget Sound	Puget Sound	Snohomish /Skykomish River	South Fork Skykomish River	L	175861.86	382.60	1.39
107	Columbia River	Northeast Washington	Pend Oreille River	Ruby Creek PLP (2)	P	19809.99	42.79	1.38
56	Coastal-Puget Sound	Puget Sound	Puyallup River	Upper White River	L	96129.28	206.94	1.38
97	Columbia River	Middle Columbia	Yakima River	NFk Tieton River	L	73144.00	157.31	1.38
130	Columbia River	Upper Columbia	Methow River	Blue Buck Creek PLP	L	5428.88	11.57	1.36
90	Columbia River	Middle Columbia	Yakima River	Cle Elum River	L	141656.06	294.35	1.33
4	Coastal-Puget Sound	Olympic Peninsula	Elwha River	Little River PLP	P	14641.73	29.39	1.28
96	Columbia River	Middle Columbia	Yakima River	NFk Teanaway River	L	60801.19	118.33	1.25
109	Columbia River	Northeast Washington	Pend Oreille River	Slate Creek PLP	P	20544.95	38.78	1.21
64	Coastal-Puget Sound	Puget Sound	Stillaguamish River	South Fork Stillaguamish River	L	46507.89	87.72	1.21
38	Coastal-Puget Sound	Puget Sound	Lower Skagit River	Tenas Creek	L	6705.65	12.30	1.17
142	Columbia River	Upper Columbia	Wenatchee River	Little Wenatchee River	L	64812.94	117.01	1.16
98	Columbia River	Middle Columbia	Yakima River	Rattlesnake Creek	L	69698.53	121.33	1.11
117	Columbia River	Snake River Basin in Washington	Tucannon River	Hixon Creek	P	1988.43	3.42	1.10
76	Columbia River	Clark Fork	Priest Lake	Granite Creek	L	40527.23	66.71	1.05
35	Coastal-Puget Sound	Puget Sound	Lower Skagit River	Straight Creek	L	7213.25	11.40	1.01

ID #	Distinct Population Segment	Management Unit	Core Area	Local Population Name	Local Population Type	Total Acres in Local Population	Total Miles of Road (10 and 99) in Local Population	Road Density in Local Population
88	Columbia River	Middle Columbia	Yakima River	Box Cayon Creek	L	7965.64	12.25	0.98
75	Columbia River	Clark Fork	Priest Lake	Gold Creek	L	15365.97	23.32	0.97
30	Coastal-Puget Sound	Puget Sound	Lower Skagit River	Lower Whitechuck River	L	29936.26	45.06	0.96
28	Coastal-Puget Sound	Puget Sound	Lower Skagit River	Illabot Creek	L	27581.41	38.94	0.90
134	Columbia River	Upper Columbia	Methow River	Gold Creek (3)	L	38918.32	54.01	0.89
108	Columbia River	Northeast Washington	Pend Oreille River	SFk Tacoma Creek PLP	P	10372.74	14.34	0.88
136	Columbia River	Upper Columbia	Methow River	Twisp River	L	132273.51	182.55	0.88
131	Columbia River	Upper Columbia	Methow River	Chewack River	L	208423.95	271.95	0.84
139	Columbia River	Upper Columbia	Wenatchee River	Chiwaukum Creek	L	31070.35	39.44	0.81
59	Coastal-Puget Sound	Puget Sound	Snohomish /Skykomish River	Salmon Creek	L	5304.38	6.73	0.81
145	Columbia River	Upper Columbia	Wenatchee River	White River	L	117473.15	140.27	0.76
80	Columbia River	Grande Ronde	Grande Ronde River	North Fork Wenaha River	L	11291.62	12.96	0.73
6	Coastal-Puget Sound	Olympic Peninsula	Hoh River	South Fork Hoh River	L	34122.97	38.56	0.72
123	Columbia River	Snake River Basin in Washington	Tucannon River	Turkey Creek	L	2873.84	3.22	0.72
22	Coastal-Puget Sound	Puget Sound	Lower Skagit River	Baker Lake	L	137800.28	134.11	0.62
122	Columbia River	Snake River Basin in Washington	Tucannon River	Tucannon River	L	28756.94	27.90	0.62
89	Columbia River	Middle Columbia	Yakima River	Bumping River	L	57839.08	53.95	0.60
21	Coastal-Puget Sound	Puget Sound	Lower Skagit River	Bacon Creek	L	32669.50	28.94	0.57
26	Coastal-Puget Sound	Puget Sound	Lower Skagit River	Forks of Sauk River	L	68178.45	58.43	0.55
50	Coastal-Puget Sound	Puget Sound	Nooksack River	Upper South Fork Nooksack River	L	13347.86	11.15	0.53
58	Coastal-Puget Sound	Puget Sound	Snohomish /Skykomish River	North Fork Skykomish River	L	52931.97	43.96	0.53

ID #	Distinct Population Segment	Management Unit	Core Area	Local Population Name	Local Population Type	Total Acres in Local Population	Total Miles of Road (10 and 99) in Local Population	Road Density in Local Population
81	Columbia River	Lower Columbia	Klickitat River	West Fork Klickitat River	L	58437.09	47.94	0.53
39	Coastal-Puget Sound	Puget Sound	Lower Skagit River	Upper South Fork Sauk River	L	11597.50	8.98	0.50
87	Columbia River	Middle Columbia	Yakima River	American River	L	50820.34	37.06	0.47
141	Columbia River	Upper Columbia	Wenatchee River	Icicle Creek	L	137202.12	92.67	0.43
92	Columbia River	Middle Columbia	Yakima River	Deep Creek	L	15495.20	10.41	0.43
132	Columbia River	Upper Columbia	Methow River	Early Winters Creek	L	51475.53	30.52	0.38
11	Coastal-Puget Sound	Olympic Peninsula	Skokomish River	North Fork Skokomish River	L	27356.85	16.20	0.38
94	Columbia River	Middle Columbia	Yakima River	Indian Creek	L	10547.53	5.78	0.35
121	Columbia River	Snake River Basin in Washington	Tucannon River	Panjab Creek	L	7421.64	3.87	0.33
29	Coastal-Puget Sound	Puget Sound	Lower Skagit River	Lime Creek	L	11261.06	4.76	0.27
138	Columbia River	Upper Columbia	Methow River	Wolf Creek	L	25832.06	10.61	0.26
24	Coastal-Puget Sound	Puget Sound	Lower Skagit River	Cascade River	L	20867.55	7.86	0.24
72	Coastal-Puget Sound	Puget Sound	Upper Skagit River	Ruby Creek	L	112095.97	38.42	0.22
32	Coastal-Puget Sound	Puget Sound	Lower Skagit River	Newhalem Creek	L	17490.54	5.67	0.21
27	Coastal-Puget Sound	Puget Sound	Lower Skagit River	Goodell Creek	L	25042.10	7.83	0.20
137	Columbia River	Upper Columbia	Methow River	WFk Methow River	L	54601.53	16.54	0.19
2	Coastal-Puget Sound	Olympic Peninsula	Dungeness River	Gray Wolf River	L	48749.43	13.20	0.17
78	Columbia River	Grande Ronde	Grande Ronde River	Butte Creek	L	26506.08	6.77	0.16
79	Columbia River	Grande Ronde	Grande Ronde River	Crooked Creek	L	47821.04	9.77	0.13
5	Coastal-Puget Sound	Olympic Peninsula	Hoh River	Hoh River	L	66122.92	11.64	0.11
124	Columbia River	Umatilla-Walla Walla	Walla Walla River	Mill Creek (2)	L	13440.77	2.28	0.11

ID #	Distinct Population Segment	Management Unit	Core Area	Local Population Name	Local Population Type	Total Acres in Local Population	Total Miles of Road (10 and 99) in Local Population	Road Density in Local Population
23	Coastal-Puget Sound	Puget Sound	Lower Skagit River	Buck Creek	L	21765.02	2.77	0.08
9	Coastal-Puget Sound	Olympic Peninsula	Quinault River	Upper Quinault River	L	57524.40	6.24	0.07
144	Columbia River	Upper Columbia	Wenatchee River	Peshastin Creek	L	23545.38	2.34	0.06
33	Coastal-Puget Sound	Puget Sound	Lower Skagit River	South Fork Cascade River	L	23200.90	2.29	0.06
3	Coastal-Puget Sound	Olympic Peninsula	Elwha River	Elwha River	L	156679.22	14.79	0.06
8	Coastal-Puget Sound	Olympic Peninsula	Quinault River	North Fork Quinault River	L	42544.59	3.28	0.05
135	Columbia River	Upper Columbia	Methow River	Lost River	L	107396.44	7.34	0.04
20	Coastal-Puget Sound	Puget Sound	Chilliwack River	Upper Chilliwack River	L	35073.70	1.98	0.04
61	Coastal-Puget Sound	Puget Sound	Snohomish /Skykomish River	Troublesome Creek	L	8301.59	0.29	0.02
25	Coastal-Puget Sound	Puget Sound	Lower Skagit River	Downey Creek	L	22843.26	0.35	0.01
34	Coastal-Puget Sound	Puget Sound	Lower Skagit River	Stetattle Creek	L	14455.14	0.17	0.01
19	Coastal-Puget Sound	Puget Sound	Chilliwack River	Silesia Creek	L	25415.35	0.15	0.00
36	Coastal-Puget Sound	Puget Sound	Lower Skagit River	Sulphur Creek	L	21060.35	0.06	0.00
70	Coastal-Puget Sound	Puget Sound	Upper Skagit River	Panther Creek	L	23583.38	0.04	0.00
7	Coastal-Puget Sound	Olympic Peninsula	Queets River	Queets River	L	47007.09	0.00	0.00
17	Coastal-Puget Sound	Puget Sound	Chilliwack River	Depot Creek	L	7999.46	0.00	0.00
18	Coastal-Puget Sound	Puget Sound	Chilliwack River	Little Chilliwack River	L	8153.00	0.00	0.00
31	Coastal-Puget Sound	Puget Sound	Lower Skagit River	Milk Creek	L	9290.18	0.00	0.00
40	Coastal-Puget Sound	Puget Sound	Lower Skagit River	Upper Suiattle River	L	57546.05	0.00	0.00
41	Coastal-Puget Sound	Puget Sound	Lower Skagit River	Upper Whitechuck River	L	24573.88	0.00	0.00

ID #	Distinct Population Segment	Management Unit	Core Area	Local Population Name	Local Population Type	Total Acres in Local Population	Total Miles of Road (10 and 99) in Local Population	Road Density in Local Population
66	Coastal-Puget Sound	Puget Sound	Upper Skagit River	Big Beaver Creek	L	42238.31	0.00	0.00
67	Coastal-Puget Sound	Puget Sound	Upper Skagit River	Deer Creek PLP	P	234.16	0.00	0.00
68	Coastal-Puget Sound	Puget Sound	Upper Skagit River	Lightning Creek	L	72637.04	0.00	0.00
69	Coastal-Puget Sound	Puget Sound	Upper Skagit River	Little Beaver Creek	L	34428.62	0.00	0.00
71	Coastal-Puget Sound	Puget Sound	Upper Skagit River	Pierce Creek	L	2573.23	0.00	0.00
73	Coastal-Puget Sound	Puget Sound	Upper Skagit River	Silver Creek	L	10683.31	0.00	0.00
74	Coastal-Puget Sound	Puget Sound	Upper Skagit River	Thunder Creek	L	69414.77	0.00	0.00
						5597157.94	10707.13	1.22

Item: Transportation in FMO & FP Lands

Take values from Item 10 spreadsheet for FMO Acres

Take values from FMO Roads and FP Roads worksheets to get road desity totals
sources: WDNR Transportation 2005; US FWS FPLands 2005 & US FWS Draft Recovery Plan

Road Density by FMO (Totals and FP lands)

Recovery Plan Area Type: FMO = Foraging, Migration, and Overwintering habitat; RN = Research Need Area

NC = not computed / Research Need Areas
Road Type: 10 = Road; 20 = Trail; 30 = Railroad; 31 = Railroad Grade; 99 = unspecified transportation route

ID #	Distinct Population Segment	Management Unit	Recovery Plan Area Type	Recovery Plan Area Name	Total Acres in FMO of RP Area	Total (10,99) Miles in FMO of RP Area	Road Density in FMO of RP Area	Acres FPL in FMO of RP Area	FPL Total (10,99) Miles in FMO of RP Area	Road Density FPL in FMO of RP Area
23	Coastal-Puget Sound	Olympic Peninsula	RN	Grays Harbor	NC 8301.74242327832	NC	NC	NC 8301.74242327832	0.00	NC
24	Coastal-Puget Sound	Olympic Peninsula	RN	Hood Canal	NC 76007.4651180237	NC	NC	NC 76007.4651180237	0.00	NC
25	Coastal-Puget Sound	Olympic Peninsula	RN	Hoquiam	NC 779741.830877164	NC	NC	NC 779741.830877164	0.00	NC
39	Coastal-Puget Sound	Puget Sound	RN	Upper Green	NC 8690.77156701255	NC	NC	NC 8690.77156701255	NC	NC
40	Coastal-Puget Sound	Puget Sound	RN	Upper Nisqually	NC 100909.673229856	NC	NC	NC 100909.673229856	NC	NC
46	Columbia River	Grande Ronde	RN	Wenatchee	NC 433241.286359542	NC	NC	NC 433241.286359542	NC	NC
51	Columbia River	Lower Columbia	RN	Cowlitz/Kalama	NC 727230.320823129	NC	NC	NC 727230.320823129	NC	NC
54	Columbia River	Northeast Washington	RN	Northeast Washington	NC 4743135.64539057	NC	NC	NC 1560963.37803802	NC	NC
61	Columbia River	Upper Columbia	RN	Lake Chelan	NC 611390.741672225	NC	NC	NC 9095.9255246006	NC	NC
62	Columbia River	Upper Columbia	RN	Okanogan	NC 1287166.50060923	NC	NC	NC 259898.383319352	NC	NC

ID #	Distinct Population Segment	Management Unit	Recovery Plan Area Type	Recovery Plan Area Name	Total Acres in FMO of RP Area	Total (10,99) Miles in FMO of RP Area	Road Density in FMO of RP Area	Acres FPL in FMO of RP Area	FPL Total (10,99) Miles in FMO of RP Area	Road Density FPL in FMO of RP Area
38	Coastal-Puget Sound	Puget Sound	FMO Marine	Puget Sound	2682.43	996.93	237.86	2682.43	488.36	116.52
37	Coastal-Puget Sound	Puget Sound	FMO	Samish	3108.66	540.55	111.29	3108.66	316.81	65.22
34	Coastal-Puget Sound	Puget Sound	FMO	Lake Washington	81375.48	4210.81	33.12	81375.48	706.79	5.56
52	Columbia River	Middle Columbia	Core Area	Yakima	313478.95	12792.12	26.12	313478.95	1031.32	2.11
30	Coastal-Puget Sound	Puget Sound	Core Area	Puyallup	95989.51	2989.16	19.93	95989.51	1446.22	9.64
36	Coastal-Puget Sound	Puget Sound	FMO	Lower Nisqually	77322.23	2392.86	19.81	77322.23	1448.25	11.99
47	Columbia River	Lower Columbia	Core Area	Klickitat	121593.99	3249.53	17.10	121593.99	1535.09	8.08
31	Coastal-Puget Sound	Puget Sound	Core Area	Snohomish/Skykomish	331958.56	4184.88	8.07	331958.56	2484.42	4.79
32	Coastal-Puget Sound	Puget Sound	Core Area	Stillaguamish	177880.73	2111.08	7.60	177880.73	1029.45	3.70
7	Coastal-Puget Sound	Olympic Peninsula	FMO	Bell	12938.02	135.57	6.71	12938.02	40.83	2.02
48	Columbia River	Lower Columbia	Core Area	Lewis	258627.39	2306.46	5.71	258627.39	1027.96	2.54
15	Coastal-Puget Sound	Olympic Peninsula	FMO	Morse	71823.82	541.13	4.82	71823.82	238.06	2.12
9	Coastal-Puget Sound	Olympic Peninsula	FMO	Chehalis	344566.71	2480.64	4.61	344566.71	1098.31	2.04
12	Coastal-Puget Sound	Olympic Peninsula	FMO	Kalaloch	13648.90	85.27	4.00	13648.90	30.09	1.41
8	Coastal-Puget Sound	Olympic Peninsula	FMO	Cedar/Steamboat	13129.58	80.72	3.93	13129.58	31.16	1.52
16	Coastal-Puget Sound	Olympic Peninsula	FMO	Satsop	189525.95	1142.81	3.86	189525.95	244.01	0.82
10	Coastal-Puget Sound	Olympic Peninsula	FMO	Goodman	40434.04	216.36	3.42	40434.04	129.76	2.05
17	Coastal-Puget Sound	Olympic Peninsula	FMO	Wishkah	65799.08	327.76	3.19	65799.08	277.27	2.70
13	Coastal-Puget Sound	Olympic Peninsula	FMO	Raft	90344.66	442.46	3.13	90344.66	0.00	0.00

ID #	Distinct Population Segment	Management Unit	Recovery Plan Area Type	Recovery Plan Area Name	Total Acres in FMO of RP Area	Total (10,99) Miles in FMO of RP Area	Road Density in FMO of RP Area	Acres FPL in FMO of RP Area	FPL Total (10,99) Miles in FMO of RP Area	Road Density FPL in FMO of RP Area
3	Coastal-Puget Sound	Olympic Peninsula	Core Area	Hoh	90841.42	429.81	3.03	90841.42	149.88	1.06
6	Coastal-Puget Sound	Olympic Peninsula	Core Area	Skokomish	95922.81	445.46	2.97	95922.81	116.36	0.78
4	Coastal-Puget Sound	Olympic Peninsula	Core Area	Queets	241399.32	1120.73	2.97	241399.32	172.92	0.46
18	Coastal-Puget Sound	Olympic Peninsula	FMO	Wynoochee	125451.34	573.23	2.92	125451.34	290.15	1.48
11	Coastal-Puget Sound	Olympic Peninsula	FMO	Humptulips	157871.53	720.05	2.92	157871.53	460.65	1.87
28	Coastal-Puget Sound	Puget Sound	Core Area	Lower Skagit	929972.07	3690.03	2.54	929972.07	1823.53	1.25
14	Coastal-Puget Sound	Olympic Peninsula	FMO	Moclips/Copalis	100493.92	390.73	2.49	100493.92	266.67	1.70
29	Coastal-Puget Sound	Puget Sound	Core Area	Nooksack	291683.09	1117.15	2.45	291683.09	390.01	0.86
1	Coastal-Puget Sound	Olympic Peninsula	Core Area	Dungeness	59402.44	220.11	2.37	59402.44	72.98	0.79
2	Coastal-Puget Sound	Olympic Peninsula	Core Area	Elwha	34343.67	124.48	2.32	34343.67	61.62	1.15
53	Columbia River	Northeast Washington	Core Area	Pend Oreille	664133.27	1699.61	1.64	215697.70	409.93	1.22
57	Columbia River	Umatilla-Walla Walla	Core Area	Walla Walla	821259.59	2030.12	1.58	66990.00	209.34	2.00
5	Coastal-Puget Sound	Olympic Peninsula	Core Area	Quinault	179724.75	436.07	1.55	179724.75	44.01	0.16
58	Columbia River	Upper Columbia	Core Area	Entiat	337496.49	802.76	1.52	22648.00	109.16	3.08
56	Columbia River	Snake River Basin in Washington	Core Area	Tucannon	323242.89	643.34	1.27	4795.46	32.14	4.29
60	Columbia River	Upper Columbia	Core Area	Wenatchee	878461.95	1607.78	1.17	95265.84	388.45	2.61
35	Coastal-Puget Sound	Puget Sound	FMO	Lower Green	1187643.24	2156.03	1.16	1187643.24	555.40	0.30
					8825572.51	29461.01	2.14	6206375.33	19157.38	1.98
49	Columbia River	Lower Columbia	Core Habitat	White Salmon	750322.22	1061.48	0.91	750322.22	649.61	0.55
59	Columbia River	Upper Columbia	Core Area	Methow	1374606.43	1477.07	0.69	36507.10	113.33	1.99

ID #	Distinct Population Segment	Management Unit	Recovery Plan Area Type	Recovery Plan Area Name	Total Acres in FMO of RP Area	Total (10,99) Miles in FMO of RP Area	Road Density in FMO of RP Area	Acres FPL in FMO of RP Area	FPL Total (10,99) Miles in FMO of RP Area	Road Density FPL in FMO of RP Area
55	Columbia River	Snake River Basin in Washington	Core Area	Asotin	251257.11	251.13	0.64	11867.94	12.72	0.69
27	Coastal-Puget Sound	Puget Sound	Core Area	Chilliwack	359021.78	259.03	0.46	359021.78	123.23	0.22
20	Coastal-Puget Sound	Olympic Peninsula	FMO Marine	Hood Canal	95683.64	58.39	0.39	95683.64	43.15	0.29
41	Columbia River	Clark Fork	Core Area	Lake Pend Orielle	806027.31	376.99	0.30	806027.31	99.12	0.08
44	Columbia River	Coeur d'Alene Lake	Core Area	Coeur d'Alene Lake	148141.39	57.95	0.25	148141.39	47.54	0.21
50	Columbia River	Lower Columbia	FMO	Columbia	198462.36	41.12	0.13	198462.36	8.69	0.03
26	Coastal-Puget Sound	Puget Sound	Core Area	Chester Morse	238486.10	43.16	0.12	238486.10	0.52	0.00
21	Coastal-Puget Sound	Olympic Peninsula	FMO Marine	Pacific Coast	515684.37	57.19	0.07	515684.37	19.14	0.02
19	Coastal-Puget Sound	Olympic Peninsula	FMO Marine	Grays Harbor	62306.23	4.68	0.05	62306.23	0.51	0.01
45	Columbia River	Grande Ronde	Core Area	Grande Ronde	3117057.41	205.68	0.04	3117057.41	54.82	0.01
33	Coastal-Puget Sound	Puget Sound	Core Area	Upper Skagit	301623.34	16.74	0.04	301623.34	0.04	0.00
42	Columbia River	Clark Fork	Core Area	Priest Lake	415444.03	17.26	0.03	415444.03	-0.44	0.00
43	Columbia River	Clearwater	Core Area	Lower and Middle Fork Clearwater	217308.69	6.17	0.02	217308.69	0.00	0.00
22	Coastal-Puget Sound	Olympic Peninsula	FMO Marine	Strait of Juan DeFuca	562734.10	9.26	0.01	562734.10	0.00	0.00

Item: Number of Stream Road Crossings in Local Populations (Spawning and Rearing Habitat) in Washington

Take stream Road Xings from Item 7 Dec 2005 work and merge East/West and WRIA29 as appropriate
Clip WaStrRoadXing with WaLP; ID clipped file with WaLP
Frequency by LP and Road Type; future analysis could freq by stream type
sources: FPLands US FWS(selected areas from FFRLands.shp)
US FWS Draft Bull Trout Recovery Plans (2004& 2002)

Stream Crossings by Local Population (Road Types and Totals)

LP Type: L= Local Population; P= Potential Local Population

Road Type: 10 = Road; 20 = Trail; 30 = Railroad; 31 = Railroad Grade; 99 = unspecified transportation route

ID #	Distinct Population Segment	Management Unit	Core Area	Local Population Name	LP Type	Road Type = 10	Road Type = 20	Road Type = 30	Road Type = 31	Road Type = 99	Total	LP Acres	Xing Density
129	Columbia River	Upper Columbia	Entiat River	Mad River	L	2524	203	0	0	0	2727	58391	0.03
128	Columbia River	Upper Columbia	Entiat River	Entiat River	L	1953	159	0	0	0	2112	80643	0.06
46	Coastal-Puget Sound	Puget Sound	Nooksack River	Lower South Fork Nooksack River	L	1858	8	0	0	0	1866	76880	0.06
143	Columbia River	Upper Columbia	Wenatchee River	Nason Creek	L	1137	192	99	2	0	1430	70070	0.08
60	Coastal-Puget Sound	Puget Sound	Snohomish/Skykomish River	South Fork Skykomish River	L	1083	131	52	14	0	1280	175862	0.21
140	Columbia River	Upper Columbia	Wenatchee River	Chiwawa River	L	1072	226	0	0	3	1301	120809	0.15
55	Coastal-Puget Sound	Puget Sound	Puyallup River	Upper Puyallup & Mowich Rivers	L	933	241	0	0	0	1174	58489	0.08
101	Columbia River	Middle Columbia	Yakima River	Upper Yakima River	L	765	11	13	3	0	792	38889	0.08
86	Columbia River	Middle Columbia	Yakima River	Ahtamum Creek	L	714	23	0	0	0	737	69364	0.15
90	Columbia River	Middle Columbia	Yakima River	Cle Elum River	L	607	444	3	2	0	1056	141656	0.21
93	Columbia River	Middle Columbia	Yakima River	Gold Creek (2)	L	529	79	0	6	0	614	36233	0.09
141	Columbia River	Upper Columbia	Wenatchee River	Icicle Creek	L	491	529	0	0	0	1020	137202	0.21
96	Columbia River	Middle Columbia	Yakima River	NFk Teanaway River	L	452	409	0	0	0	861	60801	0.11
83	Columbia River	Lower Columbia	Lewis River	Pine Creek	L	449	29	0	0	0	478	15169	0.05

ID #	Distinct Population Segment	Management Unit	Core Area	Local Population Name	LP Type	Road Type = 10	Road Type = 20	Road Type = 30	Road Type = 31	Road Type = 99	Total	LP Acres	Xing Density
114	Columbia River	Snake River Basin in Washington	Asotin Creek	NFk Asotin River	L	441	1	0	0	0	442	66579	0.24
54	Coastal-Puget Sound	Puget Sound	Puyallup River	Greenwater River	L	433	20	0	0	0	453	32508	0.11
48	Coastal-Puget Sound	Puget Sound	Nooksack River	Upper Middle Fork Nooksack River	L	421	8	0	0	0	429	46066	0.17
145	Columbia River	Upper Columbia	Wenatchee River	White River	L	404	123	0	0	0	527	117473	0.35
131	Columbia River	Upper Columbia	Methow River	Chewack River	L	380	221	0	0	0	601	208424	0.54
63	Coastal-Puget Sound	Puget Sound	Stillaguamish River	North Fork Stillaguamish River	L	362	0	7	0	0	369	61305	0.26
45	Coastal-Puget Sound	Puget Sound	Nooksack River	Lower North Fork Nooksack River	L	359	0	0	0	0	359	21767	0.09
52	Coastal-Puget Sound	Puget Sound	Puyallup River	Carbon River	L	358	93	0	0	0	451	51796	0.18
100	Columbia River	Middle Columbia	Yakima River	Taneum Creek PLP	P	353	87	0	0	0	440	39980	0.14
14	Coastal-Puget Sound	Puget Sound	Chester Morse	Cedar River	L	342	1	0	0	0	343	27476	0.13
111	Columbia River	Northeast Washington	Pend Oreille River	Sullivan Creek PLP	P	292	0	0	0	0	292	45651	0.24
105	Columbia River	Northeast Washington	Pend Oreille River	Le Clerc Creek	L	288	0	0	0	0	288	48415	0.26
13	Coastal-Puget Sound	Puget Sound	Chester Morse	Boulder Creek	L	279	0	0	0	0	279	14688	0.08
82	Columbia River	Lower Columbia	Lewis River	Cougar Creek	L	279	8	0	0	0	287	10614	0.06
53	Coastal-Puget Sound	Puget Sound	Puyallup River	Clearwater River PLP	P	274	9	0	0	0	283	24734	0.14
44	Coastal-Puget Sound	Puget Sound	Nooksack River	Lower Middle Fork Nooksack River	L	263	0	0	0	0	263	17495	0.10
99	Columbia River	Middle Columbia	Yakima River	SFk Tieton River	L	252	45	0	0	0	297	57302	0.30
64	Coastal-Puget Sound	Puget Sound	Stillaguamish River	South Fork Stillaguamish River	L	248	73	0	0	0	321	46508	0.23
125	Columbia River	Umatilla-Walla Walla	Walla Walla River	North Fork Touchet River	L	247	3	0	0	0	250	38456	0.24
139	Columbia River	Upper Columbia	Wenatchee River	Chiwaukum Creek	L	233	257	6	0	0	496	31070	0.10
95	Columbia River	Middle Columbia	Yakima River	Kachess River	L	227	24	0	0	0	251	33061	0.21
115	Columbia River	Snake River Basin in Washington	Asotin Creek	Wormell Gulch PLP	P	219	12	0	0	0	231	48628	0.33
65	Coastal-Puget Sound	Puget Sound	Stillaguamish River	Upper Deer Creek	L	216	0	0	0	0	216	22599	0.16
1	Coastal-Puget Sound	Olympic Peninsula	Dungeness River	Dungeness River	L	201	1	0	0	3	205	22734	0.17
113	Columbia River	Snake River Basin	Asotin Creek	Charley Creek	L	201	0	0	0	0	201	14456	0.11

ID #	Distinct Population Segment	Management Unit	Core Area	Local Population Name	LP Type	Road Type = 10	Road Type = 20	Road Type = 30	Road Type = 31	Road Type = 99	Total	LP Acres	Xing Density
		in Washington											
56	Coastal-Puget Sound	Puget Sound	Puyallup River	Upper White River	L	194	88	0	0	0	282	96129	0.53
62	Coastal-Puget Sound	Puget Sound	Stillaguamish River	Canyon Creek	L	184	0	0	0	0	184	28852	0.25
142	Columbia River	Upper Columbia	Wenatchee River	Little Wenatchee River	L	182	41	0	0	0	223	64813	0.45
42	Coastal-Puget Sound	Puget Sound	Nooksack River	Glacier Creek	L	176	2	0	0	0	178	20320	0.18
136	Columbia River	Upper Columbia	Methow River	Twisp River	L	166	121	0	0	0	287	132274	0.72
106	Columbia River	Northeast Washington	Pend Oreille River	Mill Creek PLP	P	160	0	0	0	0	160	12428	0.12
12	Coastal-Puget Sound	Olympic Peninsula	Skokomish River	South Fork Skokomish River	L	158	23	0	0	0	181	24608	0.21
57	Coastal-Puget Sound	Puget Sound	Puyallup River	West Fork White River	L	156	39	0	0	0	195	41992	0.34
47	Coastal-Puget Sound	Puget Sound	Nooksack River	Middle North Fork Nooksack River	L	155	0	0	0	0	155	9010	0.09
10	Coastal-Puget Sound	Olympic Peninsula	Skokomish River	Brown Creek PLP	P	137	0	0	0	0	137	5102	0.06
85	Columbia River	Lower Columbia	Lewis River	Upper Lewis River PLP	P	137	29	0	0	0	166	73799	0.69
58	Coastal-Puget Sound	Puget Sound	Snohomish/Skykomish River	North Fork Skykomish River	L	125	40	0	0	0	165	52932	0.50
110	Columbia River	Northeast Washington	Pend Oreille River	Small Creek PLP	P	118	0	0	0	0	118	17211	0.23
126	Columbia River	Umatilla-Walla Walla	Walla Walla River	South Fork Touchet River	L	118	24	0	0	0	142	12482	0.14
97	Columbia River	Middle Columbia	Yakima River	NFk Tieton River	L	115	37	0	0	0	152	73144	0.75
43	Coastal-Puget Sound	Puget Sound	Nooksack River	Lower Canyon Creek	L	110	2	0	0	0	112	19767	0.28
103	Columbia River	Northeast Washington	Pend Oreille River	Harvey Creek PLP	P	110	0	0	0	0	110	25507	0.36
76	Columbia River	Clark Fork	Priest Lake	Granite Creek	L	103	0	0	0	0	103	40527	0.61
98	Columbia River	Middle Columbia	Yakima River	Rattlesnake Creek	L	103	66	0	0	0	169	69699	0.64
112	Columbia River	Northeast Washington	Pend Oreille River	Tacoma Creek PLP	P	102	0	0	0	0	102	15856	0.24
77	Columbia River	Clark Fork	Priest Lake	Kalispell Creek	L	100	1	0	0	0	101	14959	0.23
133	Columbia River	Upper Columbia	Methow River	Goat Creek	L	96	0	0	0	0	96	23026	0.37
49	Coastal-Puget Sound	Puget Sound	Nooksack River	Upper North Fork Nooksack River	L	92	3	0	0	0	95	29409	0.48

ID #	Distinct Population Segment	Management Unit	Core Area	Local Population Name	LP Type	Road Type = 10	Road Type = 20	Road Type = 30	Road Type = 31	Road Type = 99	Total	LP Acres	Xing Density
91	Columbia River	Middle Columbia	Yakima River	Crow Creek	L	88	41	0	0	0	129	54515	0.66
107	Columbia River	Northeast Washington	Pend Oreille River	Ruby Creek PLP (2)	P	87	0	1	0	0	88	19810	0.35
26	Coastal-Puget Sound	Puget Sound	Lower Skagit River	Forks of Sauk River	L	78	43	0	0	0	121	68178	0.88
6	Coastal-Puget Sound	Olympic Peninsula	Hoh River	South Fork Hoh River	L	73	5	0	0	3	81	34123	0.66
102	Columbia River	Northeast Washington	Pend Oreille River	Cedar Creek PLP	P	73	0	1	0	0	74	11655	0.25
22	Coastal-Puget Sound	Puget Sound	Lower Skagit River	Baker Lake	L	71	19	0	0	0	90	137800	2.39
28	Coastal-Puget Sound	Puget Sound	Lower Skagit River	Illabot Creek	L	71	1	0	0	0	72	27581	0.60
134	Columbia River	Upper Columbia	Methow River	Gold Creek (3)	L	69	38	0	0	0	107	38918	0.57
72	Coastal-Puget Sound	Puget Sound	Upper Skagit River	Ruby Creek	L	60	140	0	0	0	200	112096	0.88
89	Columbia River	Middle Columbia	Yakima River	Bumping River	L	60	39	0	0	0	99	57839	0.91
21	Coastal-Puget Sound	Puget Sound	Lower Skagit River	Bacon Creek	L	57	0	0	0	0	57	32670	0.90
109	Columbia River	Northeast Washington	Pend Oreille River	Slate Creek PLP	P	57	0	0	0	0	57	20545	0.56
4	Coastal-Puget Sound	Olympic Peninsula	Elwha River	Little River PLP	P	54	12	0	0	0	66	14642	0.35
127	Columbia River	Umatilla-Walla Walla	Walla Walla River	Wolf Fork Touchet River	L	54	30	0	0	0	84	6558	0.12
116	Columbia River	Snake River Basin in Washington	Tucannon River	Cummings Creek	L	53	0	0	0	0	53	12749	0.38
38	Coastal-Puget Sound	Puget Sound	Lower Skagit River	Tenas Creek	L	50	0	0	0	0	50	6706	0.21
132	Columbia River	Upper Columbia	Methow River	Early Winters Creek	L	50	50	0	0	0	100	51476	0.80
35	Coastal-Puget Sound	Puget Sound	Lower Skagit River	Straight Creek	L	45	0	0	0	0	45	7213	0.25
15	Coastal-Puget Sound	Puget Sound	Chester Morse	Rack Creek	L	43	0	0	0	0	43	1408	0.05
118	Columbia River	Snake River Basin in Washington	Tucannon River	Little Tucannon River	P	41	0	0	0	0	41	4805	0.18
87	Columbia River	Middle Columbia	Yakima River	American River	L	40	62	0	0	0	102	50820	0.78
79	Columbia River	Grande Ronde	Grande Ronde River	Crooked Creek	L	37	79	0	0	0	116	47821	0.64
75	Columbia River	Clark Fork	Priest Lake	Gold Creek	L	35	0	0	0	0	35	15366	0.69
81	Columbia River	Lower Columbia	Klickitat River	West Fork Klickitat River	L	35	4	0	0	0	39	58437	2.34

ID #	Distinct Population Segment	Management Unit	Core Area	Local Population Name	LP Type	Road Type = 10	Road Type = 20	Road Type = 30	Road Type = 31	Road Type = 99	Total	LP Acres	Xing Density
122	Columbia River	Snake River Basin in Washington	Tucannon River	Tucannon River	L	34	14	0	0	0	48	28757	0.94
30	Coastal-Puget Sound	Puget Sound	Lower Skagit River	Lower Whitechuck River	L	31	14	0	0	0	45	29936	1.04
24	Coastal-Puget Sound	Puget Sound	Lower Skagit River	Cascade River	L	30	0	0	0	0	30	20868	1.09
11	Coastal-Puget Sound	Olympic Peninsula	Skokomish River	North Fork Skokomish River	L	24	23	0	0	0	47	27357	0.91
137	Columbia River	Upper Columbia	Methow River	WFk Methow River	L	24	54	0	0	0	78	54602	1.09
59	Coastal-Puget Sound	Puget Sound	Snohomish/Skykomish River	Salmon Creek	L	22	0	0	0	0	22	5304	0.38
88	Columbia River	Middle Columbia	Yakima River	Box Cayon Creek	L	22	19	0	0	0	41	7966	0.30
39	Coastal-Puget Sound	Puget Sound	Lower Skagit River	Upper South Fork Sauk River	L	20	3	0	0	0	23	11598	0.79
120	Columbia River	Snake River Basin in Washington	Tucannon River	Meadow Creek	L	20	23	0	0	0	43	4516	0.16
84	Columbia River	Lower Columbia	Lewis River	Rush Creek	L	18	26	0	0	0	44	16874	0.60
104	Columbia River	Northeast Washington	Pend Oreille River	Indian Creek PLP (2)	P	18	0	0	0	0	18	3441	0.30
144	Columbia River	Upper Columbia	Wenatchee River	Peshastin Creek	L	15	164	0	0	0	179	23545	0.21
2	Coastal-Puget Sound	Olympic Peninsula	Dungeness River	Gray Wolf River	L	14	78	0	0	0	92	48749	0.83
108	Columbia River	Northeast Washington	Pend Oreille River	SFk Tacoma Creek PLP	P	14	1	0	0	0	15	10373	1.08
9	Coastal-Puget Sound	Olympic Peninsula	Quinault River	Upper Quinault River	L	13	49	0	0	1	63	57524	1.43
130	Columbia River	Upper Columbia	Methow River	Blue Buck Creek	L	13	10	0	0	0	23	5429	0.37
138	Columbia River	Upper Columbia	Methow River	Wolf Creek	L	13	52	0	0	0	65	25832	0.62
5	Coastal-Puget Sound	Olympic Peninsula	Hoh River	Hoh River	L	11	31	0	0	10	52	66123	1.99
51	Coastal-Puget Sound	Puget Sound	Nooksack River	Wanlick Creek	L	11	1	0	0	0	12	6276	0.82
23	Coastal-Puget Sound	Puget Sound	Lower Skagit River	Buck Creek	L	10	5	0	0	0	15	21765	2.27
27	Coastal-Puget Sound	Puget Sound	Lower Skagit River	Goodell Creek	L	10	0	0	0	0	10	25042	3.91
32	Coastal-Puget Sound	Puget Sound	Lower Skagit River	Newhalem Creek	L	10	0	0	0	0	10	17491	2.73
117	Columbia River	Snake River Basin in Washington	Tucannon River	Hixon Creek	P	10	0	0	0	0	10	1988	0.31
16	Coastal-Puget Sound	Puget Sound	Chester Morse	Shotgun Creek PLP	P	8	0	0	0	0	8	515	0.10

ID #	Distinct Population Segment	Management Unit	Core Area	Local Population Name	LP Type	Road Type = 10	Road Type = 20	Road Type = 30	Road Type = 31	Road Type = 99	Total	LP Acres	Xing Density
50	Coastal-Puget Sound	Puget Sound	Nooksack River	Upper South Fork Nooksack River	L	8	6	0	0	0	14	13348	1.49
3	Coastal-Puget Sound	Olympic Peninsula	Elwha River	Elwha River	L	7	84	0	0	0	91	156679	2.69
37	Coastal-Puget Sound	Puget Sound	Lower Skagit River	Sulphur Creek (Lake Shannon) PLP	P	7	8	0	0	0	15	6443	0.67
92	Columbia River	Middle Columbia	Yakima River	Deep Creek	L	7	12	0	0	0	19	15495	1.27
80	Columbia River	Grande Ronde	Grande Ronde River	North Fork Wenaha River	L	6	0	0	0	0	6	11292	2.94
29	Coastal-Puget Sound	Puget Sound	Lower Skagit River	Lime Creek	L	4	0	0	0	0	4	11261	4.40
33	Coastal-Puget Sound	Puget Sound	Lower Skagit River	South Fork Cascade River	L	4	45	0	0	0	49	23201	0.74
94	Columbia River	Middle Columbia	Yakima River	Indian Creek	L	4	14	0	0	0	18	10548	0.92
135	Columbia River	Upper Columbia	Methow River	Lost River	L	3	99	0	0	0	102	107396	1.65
61	Coastal-Puget Sound	Puget Sound	Snohomish/Skykomish River	Troublesome Creek	L	2	0	0	0	0	2	8302	6.49
119	Columbia River	Snake River Basin in Washington	Tucannon River	Little Turkey Creek	L	2	0	0	0	0	2	1504	1.18
121	Columbia River	Snake River Basin in Washington	Tucannon River	Panjab Creek	L	2	11	0	0	0	13	7422	0.89
8	Coastal-Puget Sound	Olympic Peninsula	Quinault River	North Fork Quinault River	L	1	12	0	0	5	18	42545	3.69
25	Coastal-Puget Sound	Puget Sound	Lower Skagit River	Downey Creek	L	1	6	0	0	0	7	22843	5.10
34	Coastal-Puget Sound	Puget Sound	Lower Skagit River	Stetattle Creek	L	1	6	0	0	0	7	14455	3.23
36	Coastal-Puget Sound	Puget Sound	Lower Skagit River	Sulphur Creek	L	1	3	0	0	0	4	21060	8.23
123	Columbia River	Snake River Basin in Washington	Tucannon River	Turkey Creek	L	1	2	0	0	0	3	2874	1.50
7	Coastal-Puget Sound	Olympic Peninsula	Queets River	Queets River	L	0	15	0	0	0	15	47007	4.90
17	Coastal-Puget Sound	Puget Sound	Chilliwack River	Depot Creek	L	0	0	0	0	0	0	7999	#DIV/0!
18	Coastal-Puget Sound	Puget Sound	Chilliwack River	Little Chilliwack River	L	0	0	0	0	0	0	8153	#DIV/0!
19	Coastal-Puget Sound	Puget Sound	Chilliwack River	Silesia Creek	L	0	13	0	0	0	13	25415	3.05
20	Coastal-Puget Sound	Puget Sound	Chilliwack River	Upper Chilliwack River	L	0	48	0	0	9	57	35074	0.96
31	Coastal-Puget Sound	Puget Sound	Lower Skagit River	Milk Creek	L	0	13	0	0	0	13	9290	1.12
40	Coastal-Puget Sound	Puget Sound	Lower Skagit River	Upper Suiattle River	L	0	45	0	0	0	45	57546	2.00

ID #	Distinct Population Segment	Management Unit	Core Area	Local Population Name	LP Type	Road Type = 10	Road Type = 20	Road Type = 30	Road Type = 31	Road Type = 99	Total	LP Acres	Xing Density
41	Coastal-Puget Sound	Puget Sound	Lower Skagit River	Upper Whitechuck River	L	0	25	0	0	0	25	24574	1.54
66	Coastal-Puget Sound	Puget Sound	Upper Skagit River	Big Beaver Creek	L	0	33	0	0	0	33	42238	2.00
67	Coastal-Puget Sound	Puget Sound	Upper Skagit River	Deer Creek PLP	P	0	1	0	0	0	1	234	0.37
68	Coastal-Puget Sound	Puget Sound	Upper Skagit River	Lightning Creek	L	0	17	0	0	0	17	72637	6.68
69	Coastal-Puget Sound	Puget Sound	Upper Skagit River	Little Beaver Creek	L	0	44	0	0	0	44	34429	1.22
70	Coastal-Puget Sound	Puget Sound	Upper Skagit River	Panther Creek	L	0	15	0	0	0	15	23583	2.46
71	Coastal-Puget Sound	Puget Sound	Upper Skagit River	Pierce Creek	L	0	2	0	0	0	2	2573	2.01
73	Coastal-Puget Sound	Puget Sound	Upper Skagit River	Silver Creek	L	0	0	0	0	0	0	10683	#DIV/0!
74	Coastal-Puget Sound	Puget Sound	Upper Skagit River	Thunder Creek	L	0	39	0	0	0	39	69415	2.78
78	Columbia River	Grande Ronde	Grande Ronde River	Butte Creek	L	0	24	0	0	0	24	26506	1.73
124	Columbia River	Umatilla-Walla Walla	Walla Walla River	Mill Creek (2)	L	0	68	0	0	0	68	13441	0.31
											33362	5597158	

APPENDIX H

Appendix H. Sedimentation - DRAFT

The general impacts of sedimentation or the effects that sediment have within an aquatic system are well known. However, when a biologist is reviewing a biological assessment (BA) or biological evaluation (BE) for a section 7 consultation, an effects determination needs to be made based on the data or information provided. In most cases, the information is not supplied or is not available for the biologist to conduct a thorough review and make that vital link between the project and the effect on listed fishes, specifically bull trout (*Salvelinus confluentus*), and their habitat.

The information that is needed by the biologist is very specific and is usually unknown by the action agency. The specific information needed relates to the physical and biological effects of sediment in a stream. The physical questions include:

1. Will the project result in increased sediment input into the stream?
2. How much sediment will result and for what duration?
3. How far downstream will the sediment move?

Based on these physical questions, the biological effects to listed fish species then need to be determined. The biological questions include:

1. What levels of sedimentation cause adverse effects?
2. What are the biological effects of sediment on fish and their habitat (the rationale to support the "take")?
3. What life stage(s) are affected by the sediment input?

OBJECTIVES

The objectives of this document are to answer the biological questions related to sediment effects on fish. However, because of the interrelationship between the physical and biological processes related to sediment, parts of the physical questions may be addressed. Paul Bakke, has been asked to address the physical questions and his information will be incorporated into this document. This document will be a "living document" that will be continuously updated as new physical and biological information, data, and literature are obtained and reviewed. This document will be useful to those biologists reviewing BAs and BEs to help in determining project related impacts from sediment and the effects on bull trout.

It was not the intent of the document to conduct a thorough literature review on the subject. Currently there are at least 19 major reviews on sediment impacts or effects on fish, invertebrates, and primary production (Waters 1995). Pertinent literature was reviewed to obtain the background information needed to answer the biological questions. As further documents are reviewed, the content of this document can be expanded to strengthen any section.

SEDIMENT CLASSIFICATIONS AND DEFINITIONS

Sediment within a stream can be classified into a variety of different categories: turbidity, suspended sediment, bedload, deposited sediment, and wash load (Waters 1995; Bash et al. 2001). Geomorphologists may classify sediment differently than a fisheries biologist. Sediment category definitions include:

- Turbidity - Optical property of water which results from the suspended and dissolved materials in the water that cause light to be scattered rather than transmitted in straight lines. Turbidity is measured in nephelometric turbidity units (NTUs). Measurements of turbidity can quickly estimate the amount of sediment within a sample of water.
- Suspended sediment - Represents the actual measure of mineral and organic particles transported in the water column. Suspended sediment is measured in mg/l and is an important measure of erosion, and is linked to the transport of nutrients, metals, and industrial and agricultural chemicals through the river system.
- Bedload - Consists of larger particles on the stream bottom that move by sliding, rolling, or saltating along the substrate surface. Bedload is measured in tons/day, or tons/year.
- Deposited sediment - The intermediate sized sediment particles that settle out of the water column in slack or slower moving water. Based on water velocity and turbulence, these intermediate size particles may be suspended sediment or bedload.
- Wash load - Finest particles in the suspended load that are continuously maintained in suspension by the flow turbulence, and thus, significant quantities are not found in the bed.

Suspended sediment, turbidity, and deposited sediment should not be considered mutually exclusive as to particle size, because they will overlap considerably depending on velocity, turbulence, and gradient (MacDonald et al. 1991; Waters 1995). Turbidity cannot always be correlated with suspended solid concentrations due to the effects of size, shape and refractive index of particles (Bash et al. 2001). Turbidity and suspended sediment affect the light available for photosynthesis, visual capability of aquatic animals, gill abrasion and physiological effects to fish. Suspended and deposited sediment affect the habitat available for macroinvertebrates, quality of gravel for fish spawning, and amount of habitat for fish rearing (Waters 1995).

The size of particles within the stream is also important. The quantity of “fines” within a stream ecosystem usually are associated with degradation of a fish population (Castro and Reckendorf 1995). Particle diameters less than 6.4 mm are generally defined as “fines” (Bjornn et al. 1977; Shepard et al. 1984; Hillman et al. 1987; Chapman 1988; Bjornn and Reiser 1991; Rieman and McIntyre 1993; Castro and Reckendorf 1995; MBTSG 1998).

DOCUMENTS AND BACKGROUND INFORMATION

In determining the overall impact of a project on bull trout, and to specifically understand whether increased sediment may adversely affect bull trout, the biologist will need to review specific information relating to the watershed and stream in which the project is located.

Important documents to review include:

1. Washington State Conservation Commission's Limiting Factors Analysis. The 1998 Washington State Legislative session produced a number of bills aimed at salmon recovery. One bill was to identify the limiting factors to salmonid populations within watersheds in Washington State. Limiting factors are defined as "conditions that limit the ability of habitat to fully sustain populations of salmon." Limiting factors analyses have been developed for numerous watersheds. The status of the limiting factors analyses for each Water Resource Inventory Area (WRIA) can be found at http://salmon.scc.wa.gov. The Endangered Species Division has final copies of completed documents.

2. Washington Department of Fish and Wildlife's (1998) Salmonid Stock Inventory (SaSI). The Washington Department of Fish and Wildlife (WDFW) inventoried bull trout and Dolly Varden (*S. malma*) stock status throughout the State. The intent of the inventory is to help identify available information and to guide future restoration planning and implementation. SaSI defines the stock within the watershed, life history forms, status and factors affecting production. Spawning distribution and timing for different life stages are provided (migration, spawning, etc.), if known.

3. U.S. Fish and Wildlife Service's (USFWS 1998a) Matrix of Diagnostics/Pathways and Indicators (MPI). The MPI was designed to facilitate and standardize determination of project effects on bull trout. The MPI provides a consistent, logical line of reasoning to aid in determining when and where adverse affects occur and why they occur. The MPI provides levels or values for different habitat indicators to assist the biologist in determining the level of effects or impacts to bull trout from a project and how these impacts may cumulatively change habitat within the watershed.

4. Individual Watershed Resources. Other resources may be available within a watershed that will provide information on habitat, fish species, and recovery and restoration activities being conducted. The action agency may cite a publication or identify a local watershed group within the BA or BE. These local groups provide valuable information specific to the watershed.

5. Washington State Department of Ecology (DOE) - The DOE has long and short-term water quality data for different streams within the State. Data can be found at www.ecy.wa.gov/programs/eap/fw_riv/rv_main. Clicking on a stream

or entering a stream name will provide information on current and past water quality data. This information will be useful for determining the specific turbidity/suspended sediment relationship for that stream (more information below).

6. Washington State Department of Ecology (DOE) - The DOE has also been collecting benthic macroinvertebrates and physical habitat data to describe conditions under natural and anthropogenic disturbed areas. Data can be found at www.ecy.wa.gov/programs/eap/fw_benth/93-98. Clicking on a stream or entering a stream name will provide habitat and macroinvertebrate data.

7. U.S. Forest Service, Watershed Analysis Documents - The U.S. Forest Service (USFS) is required by the Record of Decision for Amendments to the USFS and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl to conduct a watershed analysis for watersheds located on FS lands. The watershed analysis determines the existing condition of the watershed and makes recommendations for future projects that move the landscape towards desired conditions. Watershed analysis documents are available from individual National Forests or from the Forest Plan Division.

8. U.S. Fish and Wildlife Service - Bull Trout Recovery Plans and Critical Habitat Designations. The draft Bull Trout Recovery Plan for the Columbia River Distinct Population Segment (DPS) (also the Jarbidge River and the St. Mary-Belly River DPS) and the proposed critical habitat designations provide current species status, habitat requirements, and limiting factors for bull trout within specific individual recovery units. These documents are available from the Endangered Species Division as well as the Service's web page (www.fws.gov).

These documents and websites will provide baseline and background information on the current stream and watershed conditions. This information is critical to determining future sediment impacts to the aquatic system. A stream has a natural amount of sediment that is transported through the system. The amount of sediment is based on numerous factors: precipitation, topography, geology, streamflow, riparian vegetation, stream geomorphological characteristic, human disturbance, etc (Bash et al. 2001). However, the baseline or background levels need to be analyzed with respect to the limiting factors within the watershed.

Different watersheds have different levels of turbidity or suspended sediment. A glaciated stream will have higher sediment levels than a spring fed stream. Aquatic organisms have adapted to the natural variation in sediment load that occurs seasonally within the stream (ACMRR 1976; Birtwell et al. 1999). Field experiments have found a thirty-fold increase in tolerance of fish to suspended solids between August and November when naturally occurring concentration are expected to be high (Cederholm and Reid 1987). The questions are determining whether this natural seasonal variation in sediment has been altered due to human disturbances and whether additional input of sediment may result in increased bull trout impacts.

The introduction of sediment at levels in excess of natural amounts can have multiple adverse affects on channel conditions and bull trout (Rhodes et al. 1994). The effect of sediment beyond natural background conditions can be fatal at high levels. Low levels may result in sublethal effects such as loss or reduction of foraging capability, reduced growth, reduced resistance to disease, increased stress, and interference with orientation in homing and migration (McLeay et al. 1987; Newcombe and Jensen 1996; Bash et al. 2001).

Work-timing windows are usually incorporated into projects to minimize construction impacts to fish. Work-timing windows are time periods when salmonids are at a stage in their life cycle when they are least sensitive to disturbances or are least likely to be present. This is typically outside of the spawning or egg incubating period. Work-timing windows allow the fish to either move away from impacts or to better cope with short term, minimal changes to the habitat and/or decreased water quality. The work-timing windows are usually in July through September. This time may reduce impacts to spawning fish and egg incubating periods, but may exacerbate impacts to juveniles, sub-adults, and adults. Protective mucous secretions are inadequate during the summer months, when natural sediment levels are low in a stream system, and thereby sediment introduction at this time may increase fish risk to stress and disease (Bash et al. 2001).

BIOLOGICAL EFFECTS OF SEDIMENT ON BULL TROUT

Classification of Sediment Effects

In the absence of detailed local information on population dynamics and habitat use, any increase in the proportion of fines in substrates should be considered a risk to the productivity of an environment and to the persistence of associated bull trout populations (Rieman and McIntyre 1993). Specific effects of sediment on fish and their habitat can be put into three classes that include (Newcombe and MacDonald 1991; Waters 1995; Bash et al. 2001):

Lethal: Direct mortality to any life stage, reduction in egg-to-fry survival, and loss of spawning or rearing habitat. These effects damage the capacity of the ecosystem to produce fish and future populations.

Sublethal: Reduction in feeding and growth rates, decrease in habitat quality, reduced tolerance to disease and toxicants, respiratory impairment, and physiological stress. While not leading to immediate death, may produce mortalities and population decline over time.

Behavioral: Avoidance and distribution, homing and migration, and foraging and predation. Behavioral effects change the activity patterns or alter the kinds of activity usually associated with an unperturbed environment. Behavior effects may lead to immediate death or population decline or mortality over time.

Aquatic systems are complex interactive systems, and isolating the effects of sediment to fish is difficult (Castro and Reckendorf 1995). Environmental factors affecting sedimentation impacts on salmonids include duration of exposure, frequency of exposure, toxicity, temperature, life stage of fish, angularity and size of particle, severity/magnitude of pulse, time of occurrence, general condition of biota, and availability of and access to refugia (Bash et al. 2001). The difficulty in determining which environmental variables act as limiting factors has made it difficult to establish the specific effects of sediment impacts on fish (Chapman 1988). For example, excess fines in the spawning gravels may not lead to smaller populations of adults if the amount of juvenile winter habitat limits the number of juveniles that reach adulthood. Often there are multiple independent variables with complex inter-relationships that can influence population size.

The ecological dominance of a given species is often determined by environmental variables. A chronic input of sediment could tip the ecological balance in favor of one species in mixed salmonid populations or in species communities composed of salmonids and nonsalmonids (Everest et al. 1987). Bull trout have more spatially restrictive biological requirements at the individual and population levels than other salmonids (USFWS 1998b). Therefore, they are especially vulnerable to environmental changes such as sediment deposition.

Bull trout are apex predators that prey on a variety of species including terrestrial and aquatic insects and fish (Rieman and McIntyre 1993). Fish are common in the diet of individual bull trout that are over 110 millimeters or longer. Large bull trout may feed almost exclusively on fish. Therefore, when analyzing impacts of sediment on bull trout, it is very important to consider other fish species. While sediment may not directly impact bull trout, the increased sediment input may affect the spawning and population levels of Chinook and coho salmon, cutthroat trout, and steelhead, which are potential prey species for bull trout. The following effects of sediment are not just bull trout specific. All salmonids can be affected similarly.

Direct effects

Gill trauma

High levels of suspended sediment and turbidity can result in direct mortality of fish by damaging and clogging gills. Fish gills are delicate and easily damaged by abrasive silt particles (Bash et al. 2001). As sediment begins to accumulate in the gill filaments, fish excessively open and close their gills to expunge the silt. If irritation continues, mucus is produced to protect the gill surface, which may impede the circulation of water over the gills and interfere with fish respiration (Bash et al. 2001). Gill flaring or coughing abruptly changes buccal cavity pressure and is a means of clearing the buccal cavity of sediment. Gill sediment accumulation may result when fish become too fatigued to continue clearing particles via the cough reflex (Servizi and Martens 1991).

Spawning, redds, eggs, and alevins

The effects of suspended sediment, deposited in a redd and potentially reducing water flow and smothering eggs or alevins or impeding fry emergence, are related to sediment particle sizes of the spawning habitat (Bjornn and Reiser 1991). Sediment particle size determines the pore openings in the redd gravel. With small pore openings, more suspended sediments are deposited and water flow is reduced compared to large pore openings.

Survival of eggs is dependent on a continuous supply of well oxygenated water through the streambed gravels (Cederholm and Reid 1987). Eggs and alevins are generally more susceptible to stress by suspended solids than are adults. Accelerated sedimentation can reduce the flow of water and, therefore, oxygen to eggs and alevins which can decrease egg survival, decrease fry emergence rates (Cederholm and Reid 1987; Chapman 1988; Bash et al. 2001), delay development of alevins (Everest et al. 1987), reduce growth and cause premature hatching and emergence (Birtwell et al. 1999). Fry delayed in their timing of emergence are less able to compete for environmental resources than other fish that have undergone normal development and emergence (intra- or interspecific competition) (Everest et al. 1987).

Several studies have documented that fine sediment can reduce the reproductive success of salmonids. Natural egg-to-fry survival of coho salmon, sockeye and kokanee has been measured at 23%, 23% and 12%, respectively (Slaney et al. 1977). Substrates containing 20% fines can reduce emergence success by 30-40% (MacDonald et al. 1991). A decreases of 30% in mean egg-to-fry survival can be expected to reduce salmonid fry production to extremely low levels (Slaney et al. 1977).

Although bull trout generally have a narrow, specific spawning habitat requirement and therefore, spawn in a small percentage of the stream habitat available to them (MBTSG 1998), they seem to be more tolerant of sedimentation during development and emergence than other salmonids. Survival of bull trout embryos through emergence appears to be unaffected when the percentage of fines comprise up to 30% of the streambed. However, at levels above 30%, embryo survival through emergence dropped off sharply with survival below 20% for substrates with 40% fine material (Shepard et al. 1984).

Indirect effects

Macroinvertebrates

Turbidity and suspended solids can affect macroinvertebrates in multiple ways through increased invertebrate drift, feeding impacts, respiratory problems, and loss of habitat (Cederholm and Reid 1987). Certain groups of macroinvertebrates are favored by salmonids as food items. These include mayflies, caddisflies, and stoneflies. These species prefer large substrate particles in riffles and are negatively affected by fine sediment (Everest et al. 1987; Waters 1995).

The effect of light reduction from turbidity has been well documented and results in increased invertebrate drift (Waters 1995; Birtwell et al. 1999). This may be a behavioral response associated with the night-active diel drift patterns of macroinvertebrates. While increased turbidity results in increased macroinvertebrate drift, it is thought that the overall invertebrate populations would not fall below the point of severe depletion (Waters 1995).

Increased suspended sediment can affect macroinvertebrates by abrasion of respiratory surface and interference with food uptake for filter-feeders (Birtwell et al. 1999). Increased suspended sediment levels tend to clog feeding structures and reduce feeding efficiencies, which results in reduced growth rates, increased stress, or death of the invertebrates (Newcombe and MacDonald 1991). Invertebrates living in the substrate are also subject to scouring or abrasion which can damage respiratory organs (Bash et al. 2001).

Benthic invertebrates inhabit the stream bottom. Therefore, any modification of the streambed by deposited sediment will most likely have a profound effect upon the benthic invertebrate community (Waters 1995). Increased sediment can affect macroinvertebrate habitat by filling of interstitial space and rendering attachment sites unsuitable. This may cause invertebrates to seek a more favorable habitat (Rosenberg and Snow 1975). The degree to which substrate particles are surrounded by fine material was found to have a strong correlation with macroinvertebrate abundance and composition (Birtwell et al. 1999). At an embeddedness of one-third, insect abundance can decline by about 50 percent, especially for riffle-inhabiting taxa (Waters 1995).

Feeding Efficiency

Increased turbidity and suspended sediment can affect a number of factors related to feeding for salmonids, including feeding rates, reaction distance, and prey selection (Bash et al. 2001). Changes in feeding behavior are primarily related to the reduction in visibility that occurs in turbid water. Effects on feeding ability are important as salmonids must meet energy demands to compete with other fishes for resources and to avoid predators.

Distance of prey capture and prey capture success both were found to decrease significantly when turbidity was increased (Berg and Northcote 1985). Waters (1995) states that loss of visual capability, leading to reduced feeding, is one of the major sublethal effects of high suspended sediment. Increases in turbidity was reported to decrease the percentage of prey captured (Bash et al. 2001). At 0 NTUs, 100% of the prey items were consumed; at 10 NTUs, fish frequently were unable to capture prey species; at 60 NTUs, only 35% of the prey items were captured. At 20 to 60 NTUs, significant delay in the response of fish to prey was observed. Loss of visual capability and capture of prey leads to depressed growth and reproductive capability.

Sigler et al. (1984) found that a reduction in growth occurred in steelhead and coho salmon when turbidity was as little as 25 NTUs. The slower growth was presumed to be from a reduced ability to feed; however, more complex mechanisms such as the quality of light may also affect feeding success rates. Redding *et al.* (1987) found that suspended sediment may inhibit normal feeding activity, as a result of a loss of visual ability or as an indirect consequence of increased stress.

Habitat Effects

Compared to other salmonids, bull trout have more specific habitat requirements that appear to influence their distribution and abundance (Rieman and McIntyre 1993). All life history stages are associated with complex forms of cover including large woody debris, undercut banks, boulders, and pools. Other habitat characteristic important to bull trout include channel and hydrologic stability, substrate, temperature, and the presence of migration corridors (Rieman and McIntyre 1993).

The physical implications of sediment in streams include degradation of spawning and rearing habitat, simplification and damage to habitat structure and complexity, loss of habitat, and decreased connectivity between habitat (Bash et al. 2001). Biological implications of this habitat damage include underutilization of stream habitat, abandonment of traditional spawning habitat, displacement of fish from their habitat, and avoidance of habitat (Newcombe and Jensen 1996).

As sediment enters a stream it is transported downstream under normal fluvial processes and deposited in areas of low shear stress (MacDonald and Ritland 1989). These areas are usually behind obstructions, near banks (shallow water) or within interstitial spaces. This episodic filling of successive storage compartments continues in a cascading fashion downstream until the flow drops below the threshold required for movement or all pools have reached their storage capacities (MacDonald and Ritland 1989). As sediment load increases, the stream compensates by geomorphologic changes in increased slope, increased channel width, decreased depths, and decreased flows (Castro and Reckendorf 1995). These processes contribute to increased erosion and sediment deposition which further degrade salmonid habitat.

Loss of acceptable habitat and refugia, as well as decreased connectivity between habitat reduces the carrying capacity of streams for salmonids (Bash et al. 2001). In systems lacking adequate number, distribution, and connectivity of habitat, fish may travel longer distance or use less desirable habitat and may encounter a variety of other conditions that can increase biological demands.

The addition of fine sediment (less than 6.4 mm) to natural streams during summer decreased abundance of juvenile Chinook salmon in almost direct proportion to the amount of pool volume lost to fine sediment (Bjornn et al. 1977; Bash et al. 2001). Similarly, the inverse relationship between fine sediment and densities of rearing Chinook salmon indicates the importance of winter habitat and high sediment loads (Bjornn et al. 1977). As fine sediments fill the interstitial spaces between the cobble

substrate, juvenile Chinook salmon were forced to leave preferred habitat and to utilize cover that may be more susceptible to ice scouring, predation, and decreased food availability (Hillman et al. 1987). Deposition of sediment on substrate may lower winter carrying capacity for bull trout (Shepard et al. 1984). Food production in the form of aquatic invertebrates may also be reduced.

Juvenile bull trout densities are highly influenced by substrate composition (Shepard et al. 1984; Rieman and McIntyre 1993; MBTSG 1998). During the summer, juvenile bull trout hold positions close to the stream bottom and often seek cover within the substrate itself. When streambed substrate contains more than 30% fine materials, juvenile bull trout densities drop off sharply (Shepard et al. 1984). Any loss of interstitial space or streambed complexity through the deposition of sediment would result in a loss of summer and winter habitats (MBTSG 1998). The reduction of rearing habitat will ultimately reduce the potential number of recruited juveniles and therefore reducing population numbers (Shepard et al. 1984).

Although an avoidance response by fish to increased sediment may be an initial adaptive survival strategy, displacement from cover could be detrimental. It is possible that the consequences of fish moving from preferred habitat, to avoid increasing levels of suspended sediment, may not be beneficial if displacement is to sub-optimal habitat, and that they also become stressed and more vulnerable to predation (Birtwell et al. 1999).

Physiological Effects

Sublethal levels of suspended sediment may cause undue physiological stress on fish, which may reduce the ability of the fish to perform vital functions (Cederholm and Reid 1987). At the individual fish level, stress may affect physiological systems, reduce growth, increase disease, and reduce its ability to tolerate additional stress (Bash et al. 2001). At the population level, the effects of stress may include reduced spawning success, increased larval mortality, reduced recruitment to succeeding life stages and, therefore, overall population declines (Bash et al. 2001).

Tolerance to suspended sediment may be the net result of a combination of physical and physiological factors related to oxygen availability and uptake by fish (Servizi and Martens 1991). The energy needed to perform repeated coughing (see Gill trauma section) increases metabolic oxygen demand. Metabolic oxygen demand is related to water temperature. As temperatures increase, so does metabolic oxygen demand, but concentrations of oxygen available in the water decreases. Therefore the fishes tolerance to suspended sediment may be primarily related to the capacity of the fish perform work associated with the cough reflex. However, as sediment increases, fish have less capability to do work, and therefore less tolerance for suspended sediment (Servizi and Martens 1991).

Redding *el al.* (1987) observed higher mortality in young steelhead trout exposed to a combination of suspended sediment (2500 mg/l) and a bacteria pathogen, than when

exposed to the bacteria alone. Physiological stress in fishes may decrease immunological competence, growth, and reproductive success (Bash et al. 2001).

Behavioral effects

Increased turbidity and suspended sediment may result in behavior changes in salmonids. This includes avoidance, distribution, homing and migration. Many behavioral effects result from changes in stream habitat (see Habitat effects). As suspended sediment concentration increases, habitat may be lost which results in abandonment and avoidance of preferred habitat. Stream reach emigration is a bioenergetic demand that may affect the growth or reproductive success of the individual fish (Bash et al. 2001). Pulses of sediment results in downstream migration of fish, which disrupts social structures, and causes downstream displacement of other fish (McLeay et al. 1987; Bash et al. 2001). Loss of territoriality and the breakdown of social structure can lead to secondary effects of decreased growth and feed rates, which may lead to mortality (Berg and Northcote 1985; Bash et al. 2001).

Downstream migration by bull trout provides access to more prey, better protection from avian and terrestrial predators, and alleviates potential intraspecific competition or cannibalism in rearing areas (MBTSG 1998). Benefits of migration from tributary rearing areas to larger rivers or estuaries may be increased growth potential. Increased sedimentation may result in premature or early migration of both juveniles and adults or avoidance of habitat and migration of nonmigratory resident bull trout. Migration exposes fish to many new hazards, including passage of sometimes difficult and unpredictable physical barriers, increased vulnerability to predators, exposure to introduced species, exposure to pathogens, and the challenges of new and unfamiliar habitats (MBTSG 1998).

High turbidity may delay migration back to spawning sites, although turbidity alone does not seem to affect homing. Delays in spawning migration and associated energy expenditure may reduce spawning success and therefore population size (Bash et al. 2001).

EFFECTS DETERMINATION

The question of when “take” of an individual(s) occurs for a specific project is not easy to answer. There are numerous factors which affect the determination for which data may be unavailable. Unknowns include project specific sediment input, existing sediment conditions, stream conditions (velocity, depth, etc.) during construction, weather or climate conditions (precipitation, wind, etc.), fish presence or absence (bull trout plus prey species), best management practices employed and effectiveness, plus many others.

Without specific project related water quality monitoring data, determining the level of take for the project will be subjective.

The Western Washington Fish and Wildlife Office (WWFWO) is currently drafting protocol to obtain specific project related sediment data. This protocol will be used to identify project related sediment input during construction, as well as long-term sedimentation that may result after completion of the project (i.e. high-flow events, channel adjustments, etc.). Following the protocol will be vital to obtain consistent information on project related sediment input to assist in effects determinations and quantifying take in biological opinions.

Newcombe and Jensen (1996) provide a basis for determining when a project will "likely to adversely affect" bull trout. Newcombe and Jensen (1996) conducted a literature review of pertinent documents on sediment effects to salmonids and nonsalmonids. They developed a model that calculated the severity of effect (SEV) based on the suspended sediment dose (exposure) and concentration.

A 15-point scale is used to qualitatively rank the effects of sediment on fish (Table 1). Specific SEV levels will be used to determine when a project is "likely to adversely affect" bull trout.

The following procedure will be used:

1. Select either a or b below.

a. Based on water quality monitoring data, determine the amount of sediment and the duration of sediment input into the stream. (Currently not enough data are available to use this step. As more project specific data becomes available this step will be used).

b. Use State water quality standards. Because action agencies must meet State water quality standards you can use the standard for determining sediment input into the stream. The Washington State water quality standards for turbidity are provided in Table 2.

Table 1 – Scale of the severity (SEV) of ill effects associated with excess suspended sediment.

SEV	Description of Effect
	Nil effect
0	No behavioral effects
	Behavioral effects
1	Alarm reaction
2	Abandonment of cover
3	Avoidance response
	Sublethal effects
4	Short-term reduction in feeding rates; short-term reduction in feeding success
5	Minor physiological stress; increase in rate of coughing; increased respiration rate
6	Moderate physiological stress
7	Moderate habitat degradation; impaired homing
8	Indications of major physiological stress; long-term reduction in feeding rate; long-term reduction in feeding success; poor condition
	Lethal and paralethal effects
9	Reduced growth rate; delayed hatching; reduced fish density
10	0-20% mortality; increased predation; moderate to sever habitat degradation
11	> 20 – 40% mortality
12	> 40 – 60% mortality
13	> 60 – 80% mortality
14	> 80 – 100% mortality

The State water quality standard allows for a mixing zone downstream of the project site. The point of compliance is based on stream discharge (Table 3).

The water quality standard must be converted from turbidity (NTUs) to suspended solids (mg/l). A ratio of 1:1 to 1:5 has been derived for converting turbidity to suspended solids (Birtwell et al. 1999). Washington Department of Ecology or U.S. Geological Survey data should be used to determine specific turbidity:suspended solid ratios for the stream on which the project will be conducted (see Documents and Background Information section). If site specific ratios can not be determined use worse case ratio of 1:4 or 1:5.

2. Based on the background information gathered, determine what life stage(s) of bull trout will be affected by sedimentation (see Documents and Background Information section). Use Figures 1 through 4 to determine what SEV level will result for the life stage affected by the project.

3. Use Table 4 to determine what ESA determination is made for the life stage affected.

4. If a LAA determination is made, then the basis for the rationale for "take" occurring is based on the SEV value obtained. The rationale is not just for that specific level (SEV = 6), but includes previous SEVs as well.

5. Use Table 5 to provide the basis for quantifying the "take." If water quality monitoring data were available, this information would be used to quantify the take (in terms of bull trout associated with x amount of habitat. Table 5 provides all the project specific water quality monitoring data received by the Service for individual projects. The data include the distance from the project where water quality sampling occurred and whether water quality standards were met. As additional monitoring data is obtained, this table will be used to quantify "take" for different projects.

Table 2 - Turbidity water quality standards for various classes of surface waters in the State of Washington.

Washington State Classes for Surface Waters	**Turbidity Characteristic**
Class AA (extraordinary)	Turbidity shall not exceed 5 NTU over background turbidity when the background turbidity is <= 50 NTU or have > 10 percent increase in turbidity when the background turbidity is > 50 NTU.
Class A (excellent)	Turbidity shall not exceed 5 NTU over background turbidity when the background turbidity is <=50 NTU or have > 10 percent increase in turbidity when the background turbidity is > 50 NTU
Class B (good)	Turbidity shall not exceed 10 NTU over background turbidity when the background turbidity is <=50 NTU or have > 20 percent increase in turbidity when the background turbidity is > 50 NTU

Table 3 - Turbidity mixing zones for turbidity water quality standards.

Waterbody Type	Point of Compliance
Stream:	
<= 10 cfs Stream Flow at Time of Construction	100 ft downstream of activity causing turbidity exceedance
>10 cfs up to 100 cfs Stream Flow at Time of Construction	200 ft downstream of activity causing turbidity exceedance
> 100 cfs Stream Flow at Time of Construction	300 ft downstream of activity causing turbidity exceedance

Figure 1 - Severity-of-ill-effect scores for juvenile and adult salmonids.

Juvenile and Adult Salmonids
Average severity-of-ill-effect scores

Concentration (mg/l)											
162755	10	11	11	12	12	13	14	14	-	-	-
59874	9	10	10	11	12	12	13	13	14	-	-
22026	8	9	10	10	11	11	12	13	13	14	-
8103	8	8	9	10	10	11	11	12	13	13	14
2981	7	8	8	9	9	10	11	11	12	12	13
1097	6	7	7	8	9	9	10	10	11	12	12
403	5	6	7	7	8	9	9	10	10	11	12
148	5	5	6	7	7	8	8	9	10	10	11
55	4	5	5	6	6	7	8	8	9	9	10
20	3	4	4	5	6	6	7	8	8	9	9
7	3	3	4	4	5	6	6	7	7	8	9
3	2	2	3	4	4	5	5	6	7	7	8
1	1	2	2	3	3	4	5	5	6	7	7
	1	3	7	1	2	6	2	7	4	11	30
	Hours			Days			Weeks		Months		

Figure 2 - Severity-of-ill-effect scores for adult salmonids.

Adult Salmonids
Average severity-of-ill-effect scores

Concentration (mg/l)											
162755	11	11	12	12	13	13	14	14	-	-	-
59874	10	10	11	11	12	12	13	13	14	14	-
22026	9	10	10	11	11	12	12	13	13	14	14
8103	8	9	9	10	10	11	11	12	12	13	13
2981	8	8	9	9	10	10	11	11	12	12	13
1097	7	7	8	8	9	9	10	10	11	11	12
403	6	7	7	8	8	9	9	10	10	11	11
148	5	6	6	7	7	8	8	9	9	10	10
55	5	5	6	6	7	7	8	8	9	9	9
20	4	4	5	5	6	6	7	7	8	8	9
7	3	4	4	5	5	6	6	7	7	7	8
3	2	3	3	4	4	5	5	6	6	7	7
1	2	2	3	3	4	4	5	5	5	6	6
	1	3	7	1	2	6	2	7	4	11	30
	Hours			Days			Weeks		Months		

Figure 3 - Severity-of-ill-effect scores for juvenile salmonids.

Juvenile Salmonids
Average severity-of-ill-effect scores

Concentration (mg/l)											
162755	9	10	11	11	12	13	14	14	-	-	-
59874	9	9	10	11	11	12	13	14	14	-	-
22026	8	9	9	10	11	11	12	13	13	14	-
8103	7	8	9	9	10	11	11	12	13	13	14
2981	6	7	8	9	9	10	11	11	12	13	13
1097	6	6	7	8	9	9	10	11	11	12	13
403	5	6	6	7	8	9	9	10	11	11	12
148	4	5	6	6	7	8	9	9	10	11	11
55	4	4	5	6	6	7	8	8	9	10	11
20	3	4	4	5	6	6	7	8	8	9	10
7	2	3	4	4	5	6	6	7	8	8	9
3	1	2	3	4	4	5	6	6	7	8	8
1	1	1	2	3	4	4	5	6	6	7	8
	1	3	7	1	2	6	2	7	4	11	30
	Hours			Days			Weeks		Months		

Figure 4 - Severity-of-ill-effect scores for eggs and alevins of salmonids.

Eggs and Alevins of Salmonids
Average severity-of-ill-effect scores

Concentration (mg/l)											
162755	7	9	10	11	12	13	14	-	-	-	-
59874	7	8	9	10	12	13	14	-	-	-	-
22026	7	8	9	10	11	12	13	-	-	-	-
8103	7	8	9	10	11	12	13	14	-	-	-
2981	6	7	8	10	11	12	13	14	-	-	-
1097	6	7	8	9	10	11	12	14	-	-	-
403	6	7	8	9	10	11	12	13	14	-	-
148	5	6	7	9	10	11	12	13	14	-	-
55	5	6	7	8	9	10	12	13	14	-	-
20	5	6	7	8	9	10	11	12	13	-	-
7	4	5	7	8	9	10	11	12	13	14	-
3	4	5	6	7	8	10	11	12	13	14	-
1	4	5	6	7	8	9	10	11	13	14	-
	1	3	7	1	2	6	2	7	4	11	30
	Hours			Days			Weeks		Months		

Table 4 - ESA Effect calls for different bull trout life stages in relation to the duration of effect and severity-of-ill-effect.

Life Stage	SEV	ESA Effect Call
Egg/alevin	1 to 4 5 to 14	not applicable - alevins are still in gravel and are not feeding. LAA - any stress to egg/alevin reduces survival
Juvenile	1 to 4 5 to 14	NLAA LAA
Subadult and Adult	1 to 5 6 to 14	NLAA LAA

Table 5 - Water quality monitoring data received by the Western Washington Fish and Wildlife Office showing distance downstream where data were recorded and whether State water quality standards were met.

Project	Distance downstream from project that data were recorded	Distance downstream that State water quality standards are met.
Debris jam removal (SR - 20)	Not provided	Met standard
Rock placed in stream (Hoh River emergency bank protection)	100 - 200 feet	Met standard
Bridge construction (SR - 90) Stated removal of coffer dams and diversion resulted in increased turbidity.	Not provided	NTUs over standard 19 days checked, standard not met 7 days. NTUs over standard 25, 3, 7, 2, 2, 7, 16.
River scour protection (SR 12) Contract no. C-6186	300 feet and 600 feet	Day 1 - Standard not met at 300 feet, did meet at 600 feet. Day 2 - Met standard 300 feet Day 3 - Did not meet at 300 feet and 600 feet (9.3 NTUs over). Day 4 - Did not meet at 300 feet or 600 feet (up to 4.5 NTUs over). Next 5 monitoring days - met standard.
Bridge construction	200 feet	Standard not met and had spike in turbidity as high as 169 NTU's
Culvert replacement project not described (SR241) - Contract # 6270 - Sulpher Cr.	100 feet and 200 feet	Standard not met 200 feet downstream. Increase NTUs over 30 NTUs
Bank stabilization (Saxon Cr.)	300 feet	Met standard - First 9 days of project, 1 sampling day - 35.2 NTUs over standard and 3.53 NTUs over standard. Remaining time within standard.
Culvert replacement - Stossel Creek Way	Not provided	Standard met on all occasions except one that occurred during initial dewatering – 24 NTUs over background.
Culvert Replacement - Stevens Creek	178 feet and 576 feet	Standard not met at 300 feet or 600 feet (185 NTU over background).

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APPENDIX I

from Olympic BO

Activity	Combined injury threshold distances: murrelet / spotted owl
a blast, a large helicopter, a large airplane	1 mile* / 1 mile*
a small helicopter or a single-engine airplane	120 yards / 120 yards
an impact pile driver, a jackhammer, or a rock drill	60 yards / 60 yards
chainsaws (firewood cutting, hazard trees, pre-commercial thinning, and commercial thinning)	45 yards / 65 yards
heavy equipment	35 yards / 35 yards

* Site-, equipment-, and method-specific information can be used to shorten or lengthen the 1-mile distance for these activities.

Appendix I. In-air sound attenuation calculations based on state route ambient sound pressure and machinery generated sound pressure.

Table 1. State routes with ambient sound pressures of 62 dBA at 50 ft plus 4 dBA to allow for bird hearing (for a total of 66 dBA to affect birds)

Type of Machinery	Sound pressure from machinery at 50 ft	sound pressure plus 3 dBA to account for additional sound of same pressure at 50 ft	25 ft - calculated assuming hard surface between sound and measurement (increase by 6 dBA) between 25 and 50 ft (doubling distance)	Distance to Reach Ambient Sound Pressure Conditions from Sound Source Measured (assume 7.5 dBA attenuation per doubling distance assume soft surface). Greatest distance is assumed if sound pressure falls between the two distances.							
				100 ft	200 ft	400 ft	800 ft	1600 ft	3200 ft	6400 ft	12800 ft
Generator (<25KVA, VMS signs); Refrigerator Unit	73	76	82	68.5	61	53.5					
Flat Bed Truck; Welder/Torch	74	77	83	69.5	62	54.5					
Man Lift; Pickup Truck	75	78	84	70.5	63	55.5					
Dump Truck	76	79	85	71.5	64	56.5					
Slurry Plant	78	81	87	73.5	66	58.5	51				
Rivet Buster/chipping gun; Drill Rig Truck; Ventilation Fan	79	82	88	74.5	67	59.5	52	44.5	37	29.5	
Drum Mixer; Roller;Slurry Trenching Machine; Vibratory Concrete Mixer	80	83	89	75.5	68	60.5	53	45.5	38	30.5	
Concrete Pump Truck; Pump	81	84	90	76.5	69	61.5	54	46.5	39	31.5	

Type of Machinery	Sound pressure from machinery at 50 ft	sound pressure plus 3 dBA to account for additional sound of same pressure at 50 ft	25 ft - calculated assuming hard surface between sound and measurement (increase by 6 dBA) between 25 and 50 ft (doubling distance)	Distance to Reach Ambient Sound Pressure Conditions from Sound Source Measured (assume 7.5 dBA attenuation per doubling distance assume soft surface). Greatest distance is assumed if sound pressure falls between the two distances.							
				100 ft	200 ft	400 ft	800 ft	1600 ft	3200 ft	6400 ft	12800 ft
Dozer; Generator;Horizontal Boring Hydr. Jack;Vacuum Street Sweeper	82	85	91	77.5	70	62.5	55	47.5	40	32.5	
Boring Jack Power Unit; Compactor (ground);Gradall excavator;Warning Horn	83	86	92	78.5	71	63.5	56	48.5	41	33.5	26
Auger Drill Rig; Scaper; Tractor	84	87	93	79.5	72	64.5	57	49.5	42	34.5	27
Pneumatic Tools;Vacuum Excavator (Vac-truck)	85	88	94	80.5	73	65.5	58	50.5	43	35.5	28
Clam Shovel (dropping);Grapple (on backhoe); Vibrating Hopper	87	90	96	82.5	75	67.5	60	52.5	45	37.5	30
Compressor (air);Concrete Mixer Truck	88	91	97	83.5	76	68.5	61	53.5	46	38.5	31

Type of Machinery	Sound pressure from machinery at 50 ft	sound pressure plus 3 dBA to account for additional sound of same pressure at 50 ft	25 ft - calculated assuming hard surface between sound and measurement (increase by 6 dBA) between 25 and 50 ft (doubling distance)	Distance to Reach Ambient Sound Pressure Conditions from Sound Source Measured (assume 7.5 dBA attenuation per doubling distance assume soft surface). Greatest distance is assumed if sound pressure falls between the two distances.							
				100 ft	200 ft	400 ft	800 ft	1600 ft	3200 ft	6400 ft	12800 ft
Crane; Grinder; Paver	89	92	98	84.5	77	69.5	62	54.5	47	39.5	32
Backhoe; Concrete Saw; Front End Loader; Heavy Trucks; Mounted Impact Hammer (hoe ram); Pavement Scarafier	90	93	99	85.5	78	70.5	63	55.5	48	40.5	33
Water Jet deleading	92	95	101	87.5	80	72.5	65	57.5	50	42.5	35
Grader	93	96	102	88.5	81	73.5	66	58.5	51	43.5	36
Sand Blasting (Single Nozzle); Shears (on backhoe)	96	99	105	91.5	84	76.5	69	61.5	54	46.5	39
Excavator	97	100	106	92.5	85	77.5	70	62.5	55	47.5	40
Blasting (mitigated rock fracturing)	98	101	107	93.5	86	78.5	71	63.5	56	48.5	41
Jackhammer; Rock Drill	99	102	108	94.5	87	79.5	72	64.5	57	49.5	42
Vibratory Pile Driver	101	104	110	96.5	89	81.5	74	66.5	59	51.5	44
Chain Saw	104	107	113	99.5	92	84.5	77	69.5	62	54.5	47
Impact Pile Driver	110	113	119	105.5	98	90.5	83	75.5	68	60.5	53

Type of Machinery	Sound pressure from machinery at 50 ft	sound pressure plus 3 dBA to account for additional sound of same pressure at 50 ft	25 ft - calculated assuming hard surface between sound and measurement (increase by 6 dBA) between 25 and 50 ft (doubling distance)	Distance to Reach Ambient Sound Pressure Conditions from Sound Source Measured (assume 7.5 dBA attenuation per doubling distance assume soft surface). Greatest distance is assumed if sound pressure falls between the two distances.							
				100 ft	200 ft	400 ft	800 ft	1600 ft	3200 ft	6400 ft	12800 ft
	NLAA	less than 92 dBA more than ambient (66 dBA)									
	LAA	92 dBA and greater (see note below)									

NOTE: Sound pressure may attenuate to below 92 dBA prior to the maximum distance indicated by the red box for each of the activiites provided. For example, impact pile driving is expected to be at least 98 dBA at 100 ft and 90.5 dBA at 200 ft. We did not calculate at what distance between 100 ft and 200 ft the sound pressure would be less than 92 dBA, but recoginze that it is at some point between these two distances. Our analysis assumes in this example, that attenuation to less than 92 dBA will be at 200 ft.

Table 2. State routes with ambient sound pressures of 71 dBA at 50 ft plus 4 dBA to allow for bird hearing (= 75 dBA to effect birds).

Type of Machinery	**Sound pressure from machinery at 50 ft**	**Sound pressure plus 3 dBA to account for additional sound of same pressure at 50 ft**	**Distance to Reach Ambient Sound Pressure Conditions from Sound Source Measured (assume 7.5 dBA attenuation per doubling distance)**					
			25 ft - calculated assuming hard surface between sound and measurement (6 dBA attenuation per doubling distance)	**100 ft**	**200 ft**	**400 ft**	**800 ft**	**1600 ft**
Generator (<25KVA, VMS signs); Refrigerator Unit	73	76	82	68.5	61			
Flat Bed Truck; Welder/Torch	74	77	83	69.5	62			
Man Lift; Pickup Truck	75	78	84	70.5	63			
Dump Truck	76	79	85	71.5	64			
Slurry Plant	78	81	87	73.5	66			
Rivet Buster/chipping gun; Drill Rig Truck; Ventilation Fan	79	82	88	74.5	67			
Drum Mixer; Roller;Slurry Trenching Machine; Vibratory Concrete Mixer	80	83	89	75.5	68			
Concrete Pump Truck; Pump	81	84	90	76.5	69			
Dozer; Generator;Horizontal Boring Hydr. Jack;Vacuum Street Sweeper	82	85	91	77.5	70			
Boring Jack Power Unit; Compactor (ground);Gradall excavator;Warning Horn	83	86	92	78.5	71			

Type of Machinery	Sound pressure from machinery at 50 ft	Sound pressure plus 3 dBA to account for additional sound of same pressure at 50 ft	Distance to Reach Ambient Sound Pressure Conditions from Sound Source Measured (assume 7.5 dBA attenuation per doubling distance)					
			25 ft - calculated assuming hard surface between sound and measurement (6 dBA attenuation per doubling distance)	100 ft	200 ft	400 ft	800 ft	1600 ft
Auger Drill Rig; Scaper; Tractor	84	87	93	79.5	72			
Pneumatic Tools;Vacuum Excavator (Vac-truck)	85	88	94	80.5	73			
Clam Shovel (dropping);Grapple (on backhoe); Vibrating Hopper	87	90	96	82.5	75			
Compressor (air);Concrete Mixer Truck	88	91	97	83.5	76	68.5		
Crane; Grinder; Paver	89	92	98	84.5	77	69.5		
Backhoe; Concrete Saw; Front End Loader; Heavy Trucks; Mounted Impact Hammer (hoe ram); Pavement Scarafier	90	93	99	85.5	78	70.5		
Water Jet deleading	92	95	101	87.5	80	72.5		
Grader	93	96	102	88.5	81	73.5		
Sand Blasting (Single Nozzle); Shears (on backhoe)	96	99	105	91.5	84	76.5	69	
Excavator	97	100	106	92.5	85	77.5	70	
Blasting (mitigated rock fracturing)	98	101	107	93.5	86	78.5	71	
Jackhammer; Rock Drill	99	102	108	94.5	87	79.5	72	

Type of Machinery	Sound pressure from machinery at 50 ft	Sound pressure plus 3 dBA to account for additional sound of same pressure at 50 ft	Distance to Reach Ambient Sound Pressure Conditions from Sound Source Measured (assume 7.5 dBA attenuation per doubling distance)					
			25 ft - calculated assuming hard surface between sound and measurement (6 dBA attenuation per doubling distance)	100 ft	200 ft	400 ft	800 ft	1600 ft
Vibratory Pile Driver	101	104	110	96.5	89	81.5	74	66.5
Chain Saw	104	107	113	99.5	92	84.5	77	69.5
Impact Pile Driver	110	113	119	105.5	98	90.5	83	75.5

	NLAA	less than 92 dBA more than ambient (75 dBA)
	LAA	92 dBA and greater

Table 3. State routes with ambient sound pressures of 77 dBA at 50 ft plus 4 dBA to allow for bird hearing (= 81 dBA to effect birds).

Type of Machinery	**Sound pressure from machinery at 50 ft**	**sound pressure plus 3 dBA to account for additional sound of same pressure at 50 ft**	**Distance to Reach Ambient Sound Pressure Conditions from Sound Source Measured (assume 7.5 dBA attenuation per doubling distance)**					
			25 ft - calculated assuming hard surface between sound and measurement (6 dBA attenuation per doubling distance)	**100 ft**	**200 ft**	**400 ft**	**800 ft**	**1600 ft**
Dump Truck	76	79	85					
Slurry Plant	78	81	87					
Rivet Buster/chipping gun; Drill Rig Truck; Ventilation Fan	79	82	88					
Drum Mixer; Roller;Slurry Trenching Machine; Vibratory Concrete Mixer	80	83	89					
Concrete Pump Truck; Pump	81	84	90	76.5				
Dozer; Generator;Horizontal Boring Hydraulic. Jack;Vacuum Street Sweeper	82	85	91	77.5				

Type of Machinery	Sound pressure from machinery at 50 ft	sound pressure plus 3 dBA to account for additional sound of same pressure at 50 ft	Distance to Reach Ambient Sound Pressure Conditions from Sound Source Measured (assume 7.5 dBA attenuation per doubling distance)					
			25 ft - calculated assuming hard surface between sound and measurement (6 dBA attenuation per doubling distance)	100 ft	200 ft	400 ft	800 ft	1600 ft
Boring Jack Power Unit; Compactor (ground);Gradall excavator;Warning Horn	83	86	92	78.5				
Auger Drill Rig; Scaper; Tractor	84	87	93	79.5				
Pneumatic Tools;Vacuum Excavator (Vac-truck)	85	88	94	80.5				
Clam Shovel (dropping);Grapple (on backhoe); Vibrating Hopper	87	90	96	82.5	75			
Compressor (air);Concrete Mixer Truck	88	91	97	83.5	76			
Crane; Grinder; Paver	89	92	98	84.5	77			

Type of Machinery	Sound pressure from machinery at 50 ft	sound pressure plus 3 dBA to account for additional sound of same pressure at 50 ft	Distance to Reach Ambient Sound Pressure Conditions from Sound Source Measured (assume 7.5 dBA attenuation per doubling distance)					
			25 ft - calculated assuming hard surface between sound and measurement (6 dBA attenuation per doubling distance)	100 ft	200 ft	400 ft	800 ft	1600 ft
Backhoe; Concrete Saw; Front End Loader; Heavy Trucks; Mounted Impact Hammer (hoe ram); Pavement Scarafier	90	93	99	85.5	78			
Water Jet deleading	92	95	101	87.5	80			
Grader	93	96	102	88.5	81			
Sand Blasting (Single Nozzle); Shears (on backhoe)	96	99	105	91.5	84	76.5		
Excavator	97	100	106	92.5	85	77.5		
Blasting (mitigated rock fracturing)	98	101	107	93.5	86	78.5		
Jackhammer; Rock Drill	99	102	108	94.5	87	79.5		
Vibratory Pile Driver	101	104	110	96.5	89	81.5		
Chain Saw	104	107	113	99.5	92	84.5	77	
Impact Pile Driver	110	113	119	105.5	98	90.5	83	

NLAA less than 92 dBA more than ambient (81 dBA)

Type of Machinery	Sound pressure from machinery at 50 ft	sound pressure plus 3 dBA to account for additional sound of same pressure at 50 ft	Distance to Reach Ambient Sound Pressure Conditions from Sound Source Measured (assume 7.5 dBA attenuation per doubling distance)					
			25 ft - calculated assuming hard surface between sound and measurement (6 dBA attenuation per doubling distance)	100 ft	200 ft	400 ft	800 ft	1600 ft
	LAA 92 dBA and greater							

APPENDIX J

APPENDIX J. Dichotomous Key to Evaluate the Potential for Stream Incision at Sites Being Considered for Culvert Replacement or Removal Projects

Criteria for determining risk of channel incision following culvert removal or replacement with stream simulation design:

1. Identify and quantify break in grade on longitudinal profile:
   Is break greater than 0.6 feet?

   a. No: **Low risk**
   b. Yes: Go to (2)

2. Identify fate of headcut

   a. Compute $H_{bf} \bullet S/d_{84}$, where: H_{bf} = maximum bankfull depth
      S = channel slope
      d_{84} = 84th percentile streambed particle size, in same units as H_{bf}
      i. If less than 0.024860, then bed is relatively immobile: **Low risk**
      ii. If greater than 0.0248, proceed to (b)

   b. Are the following natural grade-control elements present within 50 feet upstream:

      i. Buried, channel-spanning large wood?
      ii. Bedrock or dense, cemented gravel?

      If yes:Headcut will stabilize
      (**Low risk, but headcut could be potential fish-passage barrier**)

   If no: **Risk is High**

60 This is based on a simple Shields stress threshold of 0.03 for mobility, with d84 mobility at twice the maximum bankfull depth, which has been correlated in some settings to the 50-year peak discharge)

APPENDIX K

Appendix K . Estimates of distances at which incidental take of murrelets and spotted owls due to harassment are anticipated from sound-generating, forest-management activities in Olympic National Forest[61].

Introduction

The Marbled Murrelet Recovery Plan (USDI 1997:103) stated that harassment distances for murrelets may be modified from 1/4 mile for most activities and 1 mile for explosives "if: (1) site-specific conditions warrant it; (2) if future research suggests that marbled murrelets are relatively tolerant of human activities, or (3) if experimentation or literature review reveal that noises are attenuated to ambient levels in shorter distances." In this programmatic Biological Opinion and this Appendix, we are complying with all three of these conditions: (1) we allow for site-specific modification of harassment distances for projects; (2) research completed subsequent to the Recovery Plan suggests that murrelets are tolerant of human activities (see below); and (3) we are concerned with the distances at which sound results in injury to murrelets, not the distances at which noises attenuate to ambient levels, so this attenuation to ambient levels is not applicable.

Scope of This Analysis

This analysis presents our thought-process for estimating the distances at which we anticipate incidental take of murrelets and spotted owls due to harassment from sound-generating, forest-management activities in Olympic National Forest (ONF). This analysis does not address anticipated incidental take due to smoke, or harm due to direct or indirect effects. If, for example, it is determined for a project that trees to be felled are likely to either contain nesting murrelets or spotted owls or physically hit a murrelet or a spotted owl, then additional analyses would be required to address those direct effects due to harm. Also, if the likelihood that murrelets would be killed by predators such as corvids would be increased due to these activities, then those indirect effects due to harm would be analyzed separately from this analysis. This analysis also does not address anticipated effects due to the duration of sound-generating activities; these effects should be addressed in the Effects of the Action analyses in individual Biological Opinions.

Factors That Affect Sound

For activities that could disturb murrelets or spotted owls, the proximity of the sights and loudness of a sound are affected by many factors: the ambient and background noise levels present, the equipment used, topography, atmospheric conditions, vegetation, rate of onset, and proximity. Following is a very brief description of these factors, and how we used these factors in the following presentation of the analysis of effects on murrelets and spotted owls.

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[61] Written by Kent Livezey, USFWS, Western Washington Fish and Wildlife Office, Lacey, WA, August 3, 2003

Ambient and Background Noise and Visual Levels

Ambient levels of sights and sounds here are considered to be sights and sounds from natural causes only—from wind, rain, thunder, a river, or other animals. Background levels of sights and sounds here are considered to be sights and sounds that are generated by people, including vehicles, generators, and traffic sounds. These can vary seasonally as weather, water levels, and traffic patterns change. In the following presentation, we used a general ambient sound level for the Olympic National Forest as the place from which to determine the sound-only detectability threshold.

Types of Equipment Used

For this analysis, we grouped man-caused noises into the following categories: aircraft (helicopter, fixed-winged airplane); blasting; high-impact concussive equipment (impact pile drivers, jackhammers); heavy equipment; and chainsaws. In the following presentation, we determined sound-only injury thresholds for each of these sound-source categories.

Topography

Topography affects whether visual cues can be seen at a distance and how well sound carries. Sound carries farther over flat ground, or from a high point of ground. A ridge can serve as a buffer to noise and visual disturbance, whereas a canyon can contain and amplify noise disturbance. Topography can be used in site-specific cases to analyze effects due to noise, but cannot be used effectively in this programmatic consultation; consequently, we assumed that areas would be flat. If site-specific analyses warrant, topographic features can be used to modify harassment distances as presented here.

Atmospheric Conditions

Temperature and humidity affect how well sounds travel. For example, the tests the U.S. Army conducts of bombs and other loud sound-producing devices in its bases near human populations often are timed when atmospheric conditions “dampen” these sounds (Delaney, US Army COE, pers. comm.). High humidity transmits sounds better than low humidity. Due to the unpredictability of atmospheric conditions, we did not use that factor in the following presentation.

Vegetation

Sounds and sights do not carry as far through vegetation as they do over hard-packed ground or water. All of the activities covered in this programmatic consultation are expected to be conducted in vegetated—usually forested—settings, so we assumed that all areas would be vegetated. We ran the chainsaw sound tests on July 3, 2003, on a “hard site” (on asphalt).

Rate of Onset

There is some evidence (as presented below) that a noise or visual disturbance that starts low and builds, such as a vehicle driving down a road or a helicopter flying from a distance, may result in less risks than a sharp blast, an intense noise, or a sudden movement, such as a rifle shot or a blast during quarry operations. We do not have sufficient information to quantitatively estimate these effects, therefore we did not include these in this presentation.

Proximity

The proximity of a disturbance affects disturbance behavior. Delaney et al. (1999:72) stated that "Distance was a better predictor of spotted owl response to helicopter flights than noise levels." In the following presentation, actual proximity or "apparent proximity" (the apparent closeness of the threat) were the main concerns used to estimate the injury thresholds.

Stress as Evidenced by Increased Levels of Corticosterone

It is possible that murrelets and spotted owls may not visibly react to a disturbance but, nonetheless, produce increased levels of corticosterone in reaction to the disturbance. Corticosterone is released by the hypothalamo-pituitary-adrenal gland to help animals respond to environmental stress. Chronic high levels of corticosterone may have negative effects on reproduction or physical condition (Marra and Holberton 1998). Male spotted owls whose home-range centers were in 0.41 km of a major logging road or recent (within 10 years) timber activity showed higher levels of corticosterone than those with home-range centers farther from logging roads or recent timber activity; females showed no such increase in hormone levels (Wasser et al. 1997). Delaney et al. (1999:67) reported that: "All flushes recorded during the nesting season occurred after fledging; no flushes were elicited by manipulations during the incubation and nestling phases" but 30 percent of spotted owls did flush from branches during the fledging period when the person and operating chainsaw were within 60 meters of the owls. This may indicate that these spotted owls were suppressing their desire to flush during the early nesting season, and that the later-season flush-distance of 60 meters is the distance at which they would become stressed due to chainsaw work.

Black-legged kittiwakes (*Rissa tridactyla*) injected with corticosterone spent nearly 20 times more time away from their nests and less time brooding and guarding their chicks than placebo-implanted birds; however, researchers on that project could not show an effect of corticosterone levels on breeding success (Kitaysky et al. 2001). Nestling mockingbirds (*Mimus polyglottos*) less than 10 days old showed little or no secretion of corticosterone, but late-stage nestlings showed elevated levels when they were to fledge, indicating that young-stage nestlings may not be susceptible to corticosterone effects due to disturbance (Sims and Holberton 2000); it could also be that corticosterone is naturally produced to help in the fledging process.

It is assumed that natural selection would favor incubating adult murrelets and nestling murrelets which were able to stay motionless or nearly motionless so that predators would be less apt to locate them. Consequently, adult murrelets and older nestling murrelets may suffer from increased levels of corticosterone from disturbances but be reluctant to move or, for the adults, flush from the nest. However, we do not know this to be the case. The Marbled Murrelet Technical Group (USDI 2003:28), organized through the FWS Office of Technical Support in Portland, who, in their analysis of effects of sound and visual harassment of murrelets "decided not to include the possible effects of elevated corticosterone... given the lack of data for any avian species showing a clear correlation between elevated corticosterone levels and effects to feeding, breeding or sheltering." In the following presentation, we agreed with them and did not include possible effects of elevated corticosterone.

Summary of Best-Available Information Concerning Disturbance of Birds Other than Murrelets and Spotted Owls

Appendix D of the May 2002 programmatic BO for projects to be conducted in ONF (USDI 2002) presented a summary of the best-available information concerning disturbance of birds other than murrelets and spotted owls but somewhat similar to them. This summary included publications concerning human disturbance of June 25, 2003, birds of the Charadriiformes (alcids, shorebirds, gulls, terns), Gaviiformes (loons), Procellariiformes (albatrosses, petrels), Anseriformes (waterfowl), Falconiformes (hawks, eagles), and Strigiformes (owls) which are on file at the Western Washington Fish and Wildlife Office (WWFWO).

Summary of Best-Available Information Concerning Disturbance of Murrelets

How noises and human presence disturb nesting murrelets are not well known. To date, there have been no tests of the visual or decibel (dB) levels or distances from sounds and/or visual stimuli at which murrelets react or flush from the nest, or the effect of such disturbance on productivity. Typically, we have positive data (instances of reactions) but no negative data (number of times an action was done near a nesting murrelet with no reaction by the murrelet).

Virtually all of the available information concerning disturbance of murrelets is obtained from observations of murrelets incidental to other surveys and research. Long and Ralph (1998:21), in their summary of all available information concerning disturbance of murrelets, reported that "[Marbled] Murrelets appeared generally undisturbed by passing vehicles, or sharp or prolonged loud noise" and "Overall, it appears that Marbled Murrelets are not easily disrupted from nesting attempts by human disturbance except when confronted at or very near the nest itself."

<u>Disturbances to Murrelets Due to Researchers</u>

"Most...impacts were due to the more intrusive influence of investigators...People in the nest tree and especially at the nest cup caused some of the greatest disruptions...Murrelets

did not appear to be disturbed by other, less intrusive human activities" (Long and Ralph 1998:20). Researchers approaching within a few meters of the nest caused delayed or aborted attempts to deliver food to young, and caused chicks to defend themselves with open beaks (Hamer and Nelson 1998, Long and Ralph 1998). However, adults also successfully delivered fish to young while Hamer (pers. comm. in Long and Ralph 1998) was 3 meters from the adult in the nest tree but out of view from the adult.

In 1997, a nest was found at the Ruby Beach site on the Olympic Peninsula in which the nest tree was located 8 meters from Hwy 101 (Hamer and Nelson 1998). People walking within 40 meters of the nest in clear view of the nest caused the adults to abort nest visits or flush from the nest 27 percent of the time (n = 30). (Hamer and Nelson 1998:9 states "40 in" in two places, but it should be "40 m" per T. Hamer, Aug 1, 2003, pers. comm.) The length of time the adults stayed on the nest with their chicks when disturbances were present (mean = 11.3 min., SD = 6.8 min., n = 16) vs. when no disturbances were present (mean = 15.0 min., SD = 7.9 min., n = 31) differed, but not significantly (Hamer and Nelson 1998). This nest fledged successfully. According to Tom Hamer (Aug 1, 2003, pers. comm.), this nest was not a typical murrelet nest for the Olympic Peninsula or the Mt. Baker Snoqualmie National Forest (MBS) for three reasons: (1) the adults chose to nest very close to a very busy highway; (2) the nest was situated only about 35-40 feet from the ground, whereas typical nests in the ONF and MBS are situated 75-100 feet from the ground; and (3) the murrelets used the open highway as their approach to the nest, clearing the pavement by only about 1 foot on their approach, and then flew up and "stalled" at the nest. The people walking within 40 meters of the nest described above were along the highway and were in the flight path of the approaching murrelets. In more typical settings, murrelets do not fly so low to the ground to approach nests so that pedestrians would be in their flight paths, and pedestrians typically would be obscured from view by vegetation (T. Hamer, Aug 1, 2003, pers. comm.).

At the North Rector nest, a ground observer who moved from being out of sight 35 meters away to the base of the nest tree caused a murrelet that was attempting to feed its chick to drop its fish and fly away; the same adult returned 1 hour 21 minutes later and fed the chick (Hamer and Nelson 1998). Of the 125 murrelet nests studied in an ongoing study in British Columbia (R. Bradley, Univ. BC, pers. comm.), the researchers have been able to access the base of only approximately 40 percent of the nest trees (or approximately 50 nests) due to difficult terrain, and have been able to observe the adult on the nest at about 10 percent of the nests (or approximately 12 nests). (They check nests for signs of success—fecal ring and down ring—after the estimated fledging date.) In all of these close approaches to nest trees, only once have they observed an adult flush from the nest; in that case, the biologist approached on foot within 20 yards of the nest in direct line of sight of the nest. Changing camera batteries 15-20 times per season has caused "disturbance" to chicks (apparently within about 1-2 m), but chicks became habituated to these people even when only 1 meter away (Long and Ralph 1998:16-17).

Researchers 3-10 meters from chicks caused three postponed feedings (in one case, the adult waited on the nest branch until the researcher climbed down the tree and then walked to the chick and fed it) and one feeding attempt that was either postponed or

aborted (Long and Ralph 1998:16). A camera set up 1 meter from a chick caused “2-3" cases of postponed or aborted feeding attempts, but the adults resumed feeding after the camera was moved to 5 meters from the nest (Long and Ralph 1998:17). However, cameras placed at least 4 meters from chicks did not postpone or abort feeding attempts (Long and Ralph 1998:17). There are many cases in which nests fledged successfully after research activities near the nests, including chicks being handled every day for 9 and 20 days (Nelson and Hamer 1995:94).

Chicks appear to be much more difficult to disturb than adults. Chicks “did not seem to pay attention” or “looked toward the person” when researchers were within 6-35 meters (e.g., 6, 10, 20, 35 meters in Long and Ralph 1998:16).

Researchers may have contributed to failure of two nests (Brown pers. comm. and Binford et al. 1975 in Nelson and Hamer 1995), although Nelson and Hamer (1995) did not describe how these researchers did so. One of these nests was located on tree roots at ground level (Nelson and Hamer 1995). “In contrast [to these nests], intensive disturbance occurred at three successful nests. In Oregon, the only nest tree that was climbed while active was successful, and in Washington, chicks at two nests fledged despite regular climbing (approximately once a day for 9-20 days) to collect nestling growth and development data” (Nelson and Hamer 1995:94).

There are no documented instances of a nestling murrelet falling due to sound or visual disturbance, including disturbances due to researchers climbing nest trees, handling young, and placing cameras close to young.

Disturbances to Murrelets Due to Vehicles and Loud Noises

“Murrelets appeared generally undisturbed by passing vehicles...[or] sharp or prolonged loud noise” (Long and Ralph 1998:21). A murrelet study conducted in the Olympic National Park (Hall 2000) found no difference in average number of occupied detections or average number of all detections between developed sites and pristine sites (number of detections is a good metric for presence and occupancy, but is not a reliable indicator of effects of disturbance). Hamer (pers. comm. in Long and Ralph 1998) reported no reaction from a murrelet (the paper does not state if it was an adult or a chick) due to many rifle shots within 200 meters from the nest. An incubating adult “jumped, but did not abandon the nest” in response to a car door slamming within 150 meters of the nest (Nelson pers. comm. in Long and Ralph 1998). Long and Ralph (1998) reported very little responses by adults or chicks due to road-grading, logging operations within 0.5 mile, and loud radios. Murrelet chicks show little or no response to vehicles passing within 70 meters of the nest on lightly-used roads or heavily-used roads (Long and Ralph 1998). Typically, two large trucks needed to criss-cross in front of the Ruby Beach nest—the nest tree was located 8 meters from Hwy. 101—for the incubating adult to flush from the nest. The location of this nest indicates that the murrelets which chose to be so close to a busy highway were, apparently, relatively oblivious to vehicle traffic. The adult murrelets, when flying to this nest to feed the young, occasionally flew directly behind trucks, apparently using the trucks to “draft” during their nest-approach (K.

Nelson, Oregon State Univ., pers. comm.). Murrelets nest successfully in campgrounds with nests located directly above frequently-used picnic tables (K. Nelson, Oregon State Univ., pers. comm.). In Redwoods National Park, a murrelet chick was videotaped in 2001 for 1-1/2 hours while a person ran a chainsaw intermittently within approximately 40 meters of the nest tree. The chick dozed, preened, and stretched during the action, but showed no reaction to the noise or the people (P. Hebert, Cal. Dept. Fish and Game, pers. comm.). A man felled a tan oak with a chainsaw within 30 meters of an incubating adult murrelet, but the nest was successful; however, they could not determine whether the murrelet flushed (E. Burkett, Cal. Dept. Fish and Game, pers. comm.).

Disturbances to Murrelets Due to Aircraft

During the long-term study being conducted in British Columbia (R. Bradley, Univ. BC, 2002 pers. comm.), murrelets were captured at sea and fitted with radio transmitters. Once the marked birds were present on the water on alternate days, indicating that they were incubating an egg on the other days, Robinson 44 (four-seater) or 22 (two-seater) piston-engine helicopters were used to locate the incubating adults once per nest by low circling and hovering directly over the nest within 100-300 meters of the nest. This circling and hovering usually took about 3 minutes. None of the radio-tagged adults incubating any of the 125 nests located in this manner flushed (R. Bradley, Univ. BC, 2002, pers. comm.).

"Murrelets did not respond to either airplanes or helicopters flying overhead, except perhaps when they passed at low altitude" (Long and Ralph 1998:18). A chick had no response to an airplane passing twice within 0.25 mile at 1,000 ft, but another chick lay flat on the branch "when an aircraft passed at low altitudes" ("low altitudes" was not defined) (Long and Ralph 1998:18).

Disturbances to Murrelets Due to Pedestrians Near the Nest Not Due to Research

The following two instances were observed in Big Basin State Park (E. Burkett, Cal. Dept. Fish and Game, pers. comm.). In 1996, a radio-tagged male murrelet entered a stand of suitable habitat within a picnic area three mornings in a row during survey hours. He was only tracked the first morning, but was visually observed the second and third mornings. The second morning, he landed on a branch, stayed perched for some minutes, and then flew from the area. The third morning, he landed on a branch, and then some people arrived in a car, slammed the car doors, and talked loudly within 30 meters of the tree in which the murrelet was perched. The murrelet vocalized as if "agitated," and then he and his mate flew from limb to limb, and then they flew from the stand. The male was predated by a peregrine falcon (*Falco peregrinus*) later that day, so it is unknown if he would have returned to nest. The second instance also took place along a road. In this case, two perched murrelets flushed from a branch 10 meters from some pedestrians.

Adult murrelets in nest trees located 10 meters and 25 meters from heavily used hiking trails (and located 10 meters from a park sewage treatment plant and within a picnic area, respectively), and three nests overhanging a trail used by 25,000 visitors per year "rarely

showed behavior suggesting agitation from human presence or noise" or showed "no visible reaction to loud talking [or] yelling...near the nest tree" (Singer 1991 in Long and Ralph 1998:17) (it is assumed that the bases of the nest-trees were 10 meters and 25 meters from the trails and treatment plant). Nests located directly over lightly used hiking trails (30 hikers/day) fledged successfully (Long and Ralph 1998:17). It was not stated in any of these studies how high off the ground these nests were situated.

Summary of Best-Available Information Concerning Disturbance of Spotted Owls

Spotted owls are well known for being naive, and frequently continue normal behaviors including mutual-preening, feeding, caching of prey, and sleeping within a few yards of observers. Few studies, however, have dealt with the effects of human disturbance on spotted owls. Fortunately, however, Delaney et al. (1999) tested the effects of helicopter noise and chainsaw use on nesting Mexican spotted owls (*Strix occidentalis lucida*) in New Mexico. In this study, Delaney et al. (1999:68) found that "during the non-nesting season, spotted owls did not flush from perches when the SEL [sound exposure level] noise level for helicopters was ≤104 dBO [owl-adjusted dB level] (92 dBA) and the LEQ [equivalent sound level] for chainsaws was ≤65 dBO (51 dBA). During the nesting season, spotted owls did not flush from perches when the SEL sound level for helicopters was ≤102 dBO (92 dBA) and the LEQ level for chainsaws was ≤59 dBO (46 dBA)." The 46 dB noise-level should not be viewed, however, as the sole cause of the flush. "Although chainsaws were ...operated out of sight, ... field crews had to set up recording equipment beneath the spotted owls... Subsequent chainsaw operations may have been associated more with this ground-based human activity" (Delaney et al. 1999:72). Their ambient sound-levels due to natural sounds were 25-40 dB. The owls returned to pre-disturbance behavior 10-15 minutes after the event. With their chainsaw tests, one of 21 tests (4.7%) at distances 75-105 meters caused a flush from a perch, whereas 7 of 23 tests (30.4%) caused flushes from perches at 60 meters. This one flush at 75-105 meters was at 105 meters which was also the farthest distance at which the spotted owls flushed due to helicopters. Their Table 3 (p. 67) presented the distances at which spotted owls flushed due to sights and sounds; when chainsaw tests were greater than 60 m from the spotted owls, there were no flushes during the non-nesting season, and during the nesting season, they had only one flush at distances greater than 60 m (at 105 m). They found a difference in flush response due to time of year: "All flushes recorded during the nesting season occurred after fledging; no flushes were elicited by manipulations during the incubation and nestling phases" (p. 67). They found no difference in reproductive success between manipulated and non-manipulated owls, but, due to the slight differences found, there were not enough nests in their study area to permit sufficient power to detect a significant difference. They stated (p. 67): "Overall, helicopters elicited 0 percent spotted owl response when beyond 105 m, 14 percent within 105 m, 19 percent within 60 m, and 50 percent within 30 m." They wrote that implementation of a 105-meter (350 foot) buffer zone for helicopter overflights on Lincoln National Forest would minimize flush responses of nesting Mexican spotted owls and any potential effects on nesting activities.

Delaney and Grubb (2001:13) referenced studies of ospreys (*Pandion haliaetus*) and spotted owls and stated: "In those studies that reported stimulus distance, it was rare for birds to flush when the stimulus was greater than 60 m..." They also stated (p. 13): "Snyder et al. (1978) reported that Snail Kites (*Rostrhamus sociabilis*) did not flush even when noise levels were up to 105 decibels, A-weighted (dBA) from commercial jet traffic. This result was qualified by the fact that the test birds were living near airports and may have habituated to the noise. Edwards et al. (1979) found a dose-response relationship for flush responses of several species of gallinaceous birds when approach distances were between 30 and 60 m and noise levels approximated 95 dBA." They noted that motorcycle noise levels at microphones placed 10 m above ground level in trees were louder and lost less noise energy over distance than microphones placed at the base of the same trees.

In Johnson and Reynolds (2002), Mexican spotted owls were observed during military fixed-wing aircraft training in which maximum noise levels measured at the owl site were 78, 92, and 95 dB for the three fly-bys, respectively. The overflights were approximately 460 m above the canyon rims. Behavior of the spotted owls ranged from no response to a sudden turning of the head.

Swarthout and Steidl (2001) studied flush responses of Mexican spotted owls in constricted canyons in the Utah desert in which hikers walked close to roosting spotted owls. They found that 95 percent of flushes by adult and juvenile spotted owls occurred within 24 m and 12 m, respectively, of the hikers, and that a 55-m buffer "would eliminate virtually all behavioral responses of owls to hikers" (p. 312). They noted that the spotted owls became sensitized to the hikers—that after spotted owls were flushed, the odds increased almost 7 times that they would flush on subsequent approaches.

Swarthout and Steidl (2003) analyzed how hikers walking past Mexican spotted owl nests affected the time that male and female spotted owls spent in various behaviors (active, alert, prey-handling, maintenance, incubating, resting) during 4-hour periods centered on sunrise (morning), midday, and sunset (evening). In response to hikers, females significantly decreased maintenance during midday and prey-handling behaviors during all time periods, and significantly increased the frequency of nest-attendance bouts and contact-calling during the evening period. The only changes in the males were that they made significantly more contact calls when hikers were present in the evening period, and they significantly delayed the start of vocalizations (by 24 minutes) when hikers were present during the morning period. The time that females and males spent attending the nest was not significantly affected by the hikers.

The following information concerning Swarthout and Steidl (2001 and 2003) was obtained during a phone conversation between K. Livezey of WWFWO and E. Swarthout on June 23, 2003. The hikers walked past the nests four times each hour for 4 hours, for a total of 16 passes. The disturbance effects in the papers were cumulative effects during all of the 15-min walking periods. The spotted owls nested in holes in the canyon walls. In their paper, they stated that the hikers walked "past" the nests, but they did not state how close. He told me that the nests were 11 to 68 meters directly above the hikers. The

spotted owls did not have access to anywhere other than where the disturbance was; they did not fly up to the top of the canyon walls, because it was too hot up there. They had linear paths only, along the valley floor in the narrow riparian strip, and would be pushed up and down the canyon by the hikers. Their disturbance behavior could have been increased by their inability to escape the disturbance. In a forest, spotted owls can move in any direction, and can more easily escape. He agreed that the owls may have felt more hemmed-in in the canyons than they would in a forest. He said that, after capturing many spotted owls in forests in the Flagstaff area, how much more easily these owls flushed from the cliffs than the owls flushed in the forests near Flagstaff.

Harassment of Murrelets and Spotted Owls and Likelihood of Injury

Harassment is defined by 50 CFR §17.3 as "an intentional or negligent act or omission which creates the likelihood of injury by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, and sheltering." Such an act would create the likelihood that the animal in question would suffer reduced productivity or survival (e.g., lower fledging weight, physical injury or death of adult, hatchling, or egg) due to a sufficient number of aborted feedings or flushes.

During a FWS Project Leaders' meeting in the Portland Regional Office, February 22, 2002, the Project Leaders and biologists decided that behaviors indicating potential injury (harassment) to murrelets are: an adult flushing from the nest, aborting a feeding attempt, and postponing a feeding attempt if it cannot be determined whether the feeding attempt was aborted or merely postponed. At that meeting, we did not differentiate specifically between a postponed or an aborted feeding attempt. In the May, 2002, programmatic BO for projects to be conducted in ONF (USDI 2002), we defined "postponed" as a feeding that was still completed within the same morning or evening of the initial attempt. Herein, we modify this definition so that a postponed feeding for murrelets and spotted owls is one in which the adult successfully completes feeding its young with the same prey item. A postponed feeding is considered to be disturbance, not harassment.

Because our definition of injury includes only those behaviors which can take place during incubation and nestling periods (flushing from the nest and missed feeding), effects during those periods are pertinent to our analysis here. When murrelets fledge, they leave the area and fly to the ocean, so they are no longer of concern once they fledge. Recently fledged spotted owls, however, are dependent on feedings by their parents; therefore, we are including anticipated effects to juvenile spotted owls during the whole nesting period, including the first month after they fledge.

Introduction to the Thresholds

<u>The Sound Data Used Here</u>

The threshold analysis estimated here is a continuation of and refinement to the initial attempt to make such estimations for murrelets and spotted owls as presented in USDI

(2002b). Much of the sound-level analysis herein relies on dB data from a relatively old publication (Canter 1977). To make future analyses more current, the WWFWO recently acquired two sophisticated dB meters (Sokki Sound Level Meters Model LA-5111, Microphone No. 19353, Preamplifier No. 14247), and we anticipate gathering more current dB data for heavy equipment and, especially, for blasting during 2003 and 2004. It is expected that additional dB information and subsequent analyses will result in adjustments of some of the distances presented here.

For this BO, M. Hodgkins of WWFWO took dB readings of chainsaws on July 3, 2003, at the Hoodsport Office of ONF using the brand and sizes of chainsaws used on commercial timber sales in ONF (Stihl 34 and Stihl 38, both with 32-inch bars, circa 1998). The data are on file in the WWFWO. He took 1-minute readings, and the exhaust mufflers were pointed directly at the microphone, which was set on a sturdy tripod 50 feet from the chainsaws. The ground surface in between the chainsaw and the meter was grass and gravel. The min, max, and peak readings for the Stihl 34 chainsaw were 81.1, 84.2, and 97.5 dB, respectively, and min, max, and peak readings for the Stihl 38 chainsaw were 73.5, 90.8, and 104.2 dB, respectively. Canter (1977, p.134) reported 86 dB as the sound reading for a chainsaw, which is similar to our max readings. For our analysis here, we use the peak reading for the larger chainsaw (104 dB) because it more accurately represents the highest sound levels that could be expected from these chainsaws.

Differences Between the Thresholds

Not all human-caused sights or sounds are detected by murrelets and spotted owls; they may be too far from the sight or sound to detect it. Or, once detected, not all sights or sounds result in adverse effects. To help clarify this idea, one could consider that there are four distances, or thresholds, for sights and sounds that are above ambient levels: (1) the detectability threshold (where the sight or sound is detectable, but a murrelet or spotted owl has not shown any reaction); (2) the alert threshold (where a murrelet or spotted owl shows apparent interest in the sight or sound by orienting its head toward the action or extending its neck); (3) the disturbance threshold (where a murrelet or spotted owl shows apparent avoidance of the sight or sound by hiding, defending itself, moving its wings or body, or postponing a feeding so that the adult still feeds its young the same prey item); and (4) the injury threshold (where a murrelet or spotted owl is actually injured—here defined here as an adult flushing from the nest or a young missing a feeding).

The four categories just described were modified from Brown (1990), Awbrey and Bowles (1990), Delaney et al. (1999), and Swarthout and Steidl (2001). Brown (1990): (1) divided what is termed here as alert behavior into “scanning behaviour” (head-turning) and “alert behaviour” (e.g., fully extended neck, more tense body, take a few steps); (2) defined “startle/avoidance behaviour” as raising wings or flapping wings without flushing, which is the disturbance threshold here; and (3) defined “escape behaviour” as flight, which includes flushing and aborted/postponed feedings, which is the injury threshold here. Awbrey and Bowles (1990:Figure 2.4) assigned behaviors to

the following categories: "none"; "alert" (bird raised its head or turned sharply to look at the stimulus); "respond" (bird reacted by moving (e.g., standing, crouching, calling, turning, walking a few steps) but did not flush from the nest; and "flight (flying from the nest). Delaney et al. (1999) defined "alert" (head movement), "react" (wing or body movements), and "flush" (taking to flight) behaviors. Swarthout and Steidl (2001) noted distances at which spotted owls became "alert" and shorter distances at which they "flushed."

Birds respond to sound and sight stimuli differently. Therefore, these threshold distances need to be determined separately. First, we estimated the sound-only threshold distances for detectability, alert, disturbance, and injury for murrelets and spotted owls. Then, we estimated the sight-only injury threshold distance and combined injury threshold distances for murrelets. Finally, we estimated the sight-only injury threshold distance and combined injury threshold distances for spotted owls. We made no attempt to estimate the sight-only thresholds for detectability, alert, or disturbance. The sight-only detectability threshold distance is completely dependent upon the eyesight of the bird, and whatever in the area of concern obscures or blocks visibility which could, at far distances, be due to the curvature of the earth. This distance threshold could be a few yards in some areas and miles in others. To determine this for a nesting murrelet or spotted owl would require tests of what their eyes are capable of seeing at various distances, and tests of visibility of stationary and moving objects from specific branches, at various distances, and at various ranges of vegetation and topography. To our knowledge, such an analysis has not been done.

<u>Detectability, Alert, Disturbance, and Injury Thresholds for Murrelets and Spotted Owls</u>

Process to Estimate Sound-only Thresholds for Murrelets and Spotted Owls

(1) We estimated that the *ambient* noise levels for the ONF were 40 dB. This value was based on the few ambient-level data available in the area, which are: 34.7-37.1 dB at Friday Harbor (San Juan Islands, L. Magnoni, WA Dept. of Transportation, pers. comm.), 42.5-43.9 dB within 200 meters of the South Fork of the Solduc River in the ONF in a 15-year old timber stand (S. Dilley, FWS, pers. comm.), and 35-57 dB in various locations in the Mt. Baker-Snoqualmie NF (Storm, MBS NF, pers. comm.). Ambient sound levels are expected to be different in various parts of the ONF, but this 40 dB level is estimated to be an average for relatively undisturbed areas. (The exact ambient dB level is not needed for the following presentation, so the approximate nature of these data is not important.)

(2) We estimated that the *sound-only detectability threshold* was 44 dB, which is 4 dB above the ambient level. Dooling and Hulse (1989) found that 16 species of birds showed an average sensitivity of 4 dB to detect a sound. In areas where the ambient or background sound levels differ from 40 dB, the detectability threshold would change accordingly.

(3) The *sound-only alert and disturbance thresholds* are between the detectability and injury thresholds, but we are unaware of any data that would allow us to estimate these directly with even the approximate precision as the other thresholds. Consequently, we subjectively and simplistically placed them between and equidistant from the detectability and injury thresholds and from each other. We think that it is important to include these thresholds, even though their precise dB levels are unknown, to help remind us that we do not expect that a bird would flush from a sound that is only a few dB louder than a sound that the bird is just barely able to detect.

(4) We estimated the *sound-only injury threshold* by using the only known data available for sound-only flushes. These data were from Thiessen and Shaw (1957), Awbrey and Bowles (1990), Brown (1990), and Delaney et al. (1999). Thiessen and Shaw (1957) found that caged ring-billed gulls (*Larus delawarensis*) subjected to sounds at a range of frequencies and decibel levels reacted by cringing at 83-91 dB at 150 cps (cycles per second = Hertz) and by increased heart rates at 92 dB; it is unknown at what dB level these birds would have flushed. Awbrey and Bowles (1990:21) stated that "what little published literature [on raptors] is available suggests that noise begins to disturb most birds at around 80-85 dB sound levels and that the threshold for the flight response is around 95 dB." Brown (1990) subjected crested terns to experimental noises imitating aircraft overflights in an area with 55-75 dB ambient noise levels, and found that, at 70 dB, about 55 percent were alert and, at 95 dB (the loudest they tested), approximately 15 percent were startled and 8 percent flushed. Delaney et al. (1999) found that Mexican spotted owls, during both the nesting season and the non-nesting season, did not flush from helicopter noise unless the noise was at least 92 dB(A). Due to results from all of these studies, we estimate the sound-only injury threshold to be 92-95 dB (rounded down to 92 dB). Unlike the ambient and background sound levels and detectability levels which are expected to differ somewhat throughout the ONF with its varying topography, weather conditions, etc., the sound-only injury thresholds presented here are expected to remain relatively constant.

(5) We produced a *sound attenuation figure* (Figure 1) by presenting the sound-only thresholds (as above) and the maximum sound attenuations for noise-generating activities. To produce the sound attenuations in this figure, we used the maximum sound levels reported in Canter (1977), and graphed approximate noise attenuation over distance for various noise-generating activities. Noise-levels typically are recorded at 50 feet from the noise-generating equipment. The reduction rate or attenuation of sound over distance is calculated by subtracting 7.5 dB(A) per doubling of distance for "soft sites" (e.g., vegetated areas). However, noise reductions result from certain atmospheric conditions, topography, and very dense vegetation; due to this, these reductions would, in the real world, be much less gradual than graphed here. Wind alone can reduce noise by as much as 20-30 dB at long distances (USDOT 1980). A break in the line of sight between the source and dB receptor can result in a 5 dB reduction, and dense vegetation can result in a 5 dB reduction for every 30 meters of dense vegetation, up to a maximum of 10 dB (USDOT 1980). The influences of these additional reducing factors are impossible to estimate due to their variability, and are not taken into account here.

Consequently, predictions of expected noise levels are expected to be higher on average than what would actually occur.

The maximum levels reported in Canter (1977) were: (1) piston helicopters (range 73-86 dB at 500 feet, or approximately 114 dB at 50 feet) and turbine helicopters (range 65-78 dB at 500 feet) (2-7 seats; Bell Jet Ranger or smaller) grouped with single-engine propeller airplanes (range 67-77 dB at approach at 1,000 feet or approximately 114 dB at 50 feet); (2) impact pile drivers (peak 106 dB); (3) jackhammers, rock drills (range 82-97 dB); (4) heavy equipment (range 72-96 dB); and (4) multi-engine propeller airplane (range 79-93 at takeoff). For chainsaws, we used the peak reading (104 dB) taken in our effort as described above. Due to the concussive nature of jackhammers and rock drills, we placed those activities with impact pile drivers.

We graphed the dB levels by: (1) taking the dB level from Canter (1977) at 50 ft (approximated to 15 yards here); (2) 7.5 dB was subtracted from each of these initial readings with the doubling of distance (at 30 yards, 60 yards, 120 yards, 240 yards, and 480 yards) following US DOT (1980); (3) intervening values at 15-yard intervals were approximated to generate smooth curves; and (4) the results were graphed for the range of 0 to 480 yards. The curves in Figure 1 are not as smooth as they would be if the data had been generated directly from the sound-attenuation equation, but the overall shapes were kept in check by the actual doubling-of-distance figures. So we estimated these sound-only levels to be: 40 dB for the ambient sound level; 44 dB for the detect threshold; 57 dB for the alert threshold; 70 dB for the disturbance threshold; and 92 for the injury threshold.

We do not have dB data for large helicopters (such as Sikorsky-type helicopters used for logging) on which to determine thresholds for these activities. In addition, we do not have sufficient information to place blasts of different sizes and locations into injury-distance categories, due to variables including differences in loudness of blasting materials, methods used to place blasts (e.g., above ground, below ground), and topography around blast sites. Therefore, we consider the injury distance for all blasts to be 1 mile, unless method-specific and/or site-specific information indicates shorter or longer distances. Analysis of such information should be addressed by the Level 1 Team.

From Figure 1 (and its associated spreadsheet), the distances at which the sound-only injury thresholds were reached for murrelets and spotted owls were:

for an impact pile driver, a jackhammer, or a rock drill—60 yards

for a helicopter or a single-engine airplane—120 yards

for chainsaws—45 yards

for heavy equipment—25 yards

Process to Estimate Sight-only Injury Thresholds for Murrelets

We estimated the sight-only injury threshold—the distance at which a murrelet would be flushed from its nest or cause it to miss feeding one of its young by the sight (not sight *and* sound) of human activity—using the incidental and experimental experiences of murrelet researchers as described above. Overall, the farthest murrelets flushed from perches or nests due to the presence of thousands of pedestrians (without motorized equipment) was 10 meters (11 yards), other than the unusually situated nest at Ruby Beach (see "Disturbances to Murrelets Due to Researchers" and "Disturbances to Murrelets Due to Vehicles and Loud Noises" above). So the sight-only injury threshold distance for murrelets is 11 yards.

Process to Estimate Combined Injury Thresholds for Murrelets

(1) The longer distance for each of the thresholds, using the distances for the sound-only injury thresholds and the sight-only injury thresholds, was used as a minimum for the combined injury thresholds. In every case, the sound-only injury distances were longer than the sight-only injury distances, so we kept the sound-only distances as the combined injury threshold distances.

(2) The combined injury thresholds correspond to more typical occurrences—activities that are both seen and heard. We anticipate that there is a synergistic effect between such activities, and that murrelets could react to such activities at farther distances than those merely heard or seen. We also anticipate that many activities could be both seen and heard by murrelets at the relatively short sight-only and sound-only injury thresholds proposed here. The observation of the radio-tagged male murrelet and his mate that flushed from a suitable-habitat stand due to people slamming car doors and talking loudly within 30 meters (32.8 yards) of the tree in which one of the murrelets was perched (E. Burkett, Cal. Dept. Fish and Game, pers. comm.) is our farthest-distance example of such an occurrence. This activity was similar to the use of heavy equipment. To accommodate this observation, we extended the combined injury threshold for heavy equipment for murrelets to 35 yards (rounded up from 32.8 yards).

(3) We know of no literature to indicate that the sight of a falling tree due to chainsaw work would cause harassment to murrelets farther away than the sound-only injury threshold of 45 yards. Consequently, we did not extend this distance for timber-harvest activities. If a tree is felled and then limbed, the final, combined injury distance would be calculated not only from where the tree was felled, but also from where it was limbed.

(4) The best-available information we have concerning effects to murrelets from helicopters is from the long-term study conducted in British Columbia (R. Bradley, Univ. BC, 2002 pers. comm.). Due to the high-nesting behavior of murrelets, we anticipate that many of the murrelets could see these helicopters, and may have been able to feel the downwash of the helicopter blades. In this BC study, they had no flushes from nests when the helicopters circled and hovered directly over the nest within 100-300 meters of the nest (n = 125), so we do not know at what distance murrelets would flush from

helicopters. We view our 120-yard (110-meter) harassment distance for helicopters estimated using 92dB as the sound-only criterion, therefore, as conservative.

(5) The combined injury thresholds for murrelets and spotted owls are presented at the end of the spotted owl section below.

Conservative Distance Estimates for Murrelets

We chose to be conservative in assuming that these activities could injure murrelets at all. We have no data showing that human-caused activities described in the Project Descriptions have caused injury of murrelets, and there are many cases of close encounters with humans, trucks, and helicopters that did not cause the birds to flush from the nest. The data we have indicate that the most disturbing human activity is researchers climbing murrelet nest trees. Especially, we do not have any data showing injury of murrelets due to sound alone, with no visual cues.

Likelihood of Injury to Murrelets

Because we do not have adequate data relative to the numbers of murrelets or their distribution in ONF, we use their habitat as their surrogate, and assume equal distribution of these projects throughout suitable, occupied habitat. To estimate the likelihood of injury, we estimate the number of presumed occupied, suitable acres within the injury distances in which we anticipate that injury would occur. However, we do not assume that all of the area within each activity-site is equally likely to be disturbed or injured (harassed). We do not have sufficient data to accurately quantify the disturbance-related injury that is "reasonably certain to occur" or what is "likely to occur," but here we provide a general description of how much of this injury we are attempting to include in these injury distances. We anticipate that high percentages of murrelets at very close distances to these actions could be injured, and that the percentage of affected murrelets would decrease with increasing distance so that, at the far ends of the injury thresholds for each action, a very small percentage of the murrelets could be injured as a result of the disturbance. Consequently, we do not anticipate that all murrelets within these injury distances would be injured. We anticipate that this attenuation of effects probably drops for some distance and then levels off, similar to the attenuation of sounds over distance, but this is unknown and expected to differ by many factors including type of disturbance, loudness of sounds, topography, and experience of the murrelets in question concerning these disturbances.

It is possible that adverse effects due to people (non-researchers) in murrelet habitat not using motorized equipment (e.g., hikers, hunters) could occur, but here we need to estimate if any injury due to people not using motorized equipment is reasonably certain to occur. In such an analysis, habituation (decrease of disturbance behavior over time) and sensitization (increase of disturbance behavior over time) of murrelets to human presence is of issue. As stated in Long and Ralph (1998:15), "It should be noted that previous exposure to people may influence the reaction of murrelets to disturbances." Murrelets can become either habituated to nearby activity, such as adults becoming used

to hikers on trails or chicks becoming used to researchers changing batteries in cameras, or they can become sensitized to activity, such as adults that flushed from nests after researchers had climbed the nest tree and then closely approached the nest (Long and Ralph 1998). The most-probable examples of disturbance-related injury of murrelets from the literature are from researchers that closely approached nests, and from subsequent visits to the nest after, probably, the adults had been sensitized. It may be that to injure murrelets, they need to feel that they are physically threatened by the presence of a possible predator very close to the nest. If so, then only those nesting birds which have been very closely approached—subjects of increased sensitivity to human disturbance—would likely be injured. Because such close approach only occurs due to research, it may be that disturbance-related injury is most likely from research and from activities with visual clues that are very close to nest trees and when the adults of those specific nests have been sensitized. Consequently, people in murrelet habitat who are not using motorized equipment (other than researchers who climb the nest tree) or blasting are not considered here to be likely to result in disturbance-related injury.

Process to Estimate Sight-only Injury Thresholds for Spotted Owls

We estimated the sight-only injury threshold—the distance at which a spotted owl would be flushed from its nest or cause it to miss feeding one of its young by the sight (not sight *and* sound) of human activity using two types of sources. First, we used experiences by northern spotted owl biologists (pers. comm. from: (1) T. Fleming, Nat. Council for Air and Stream Improvement, Brush Prairie, WA; (2) E. Forsman, U.S. Forest Service, Corvallis, OR; (3) D. Herter, Raedeke Assoc., Seattle, WA; (4) R. Pearson, owl surveyor, Packwood, WA; (5) J. Reid, Bureau of Land Mgmt., Roseburg, OR; and (6) D. Rock, Nat. Council for Air and Stream Improvement, Amboy, OR) expressly for this BO. These biologists stated that: spotted owls rarely flush due to disturbance from people; when a spotted owl is sitting on a perch, the person would likely need to be within 2-6 yards to flush it; when a spotted owl is sitting on its open nest, the person would need to climb the nest tree; and when a spotted owl is sitting in its cavity nest, the person would need to look into the nest hole. Second, we used results from the Mexican spotted owls study by Swarthout and Steidl (2001) who found that 95 percent of flushes by adult and juvenile spotted owls occurred within 24 m and 12 m, respectively, of the hikers, and that a 55-m buffer "would eliminate virtually all behavioral responses of owls to hikers" (p. 312). Their 55-meter distance would include not only our injury threshold, but our alert and disturbance thresholds as well. The 12- and 24-meter distances correspond to our injury thresholds for juvenile and adult spotted owls. Rather than set the sight-only injury distance at 6 yards, we anticipate that some spotted owls could act more like the Mexican spotted owls, so we conservatively compromised between 6 yards and 26 yards and set the sight-only injury threshold at 20 yards.

Process to Estimate Combined Injury Thresholds for Spotted Owls

(1) The longer distance for each of the thresholds, using the distances for the sound-only injury thresholds and the sight-only injury thresholds, was used as a minimum for the

combined injury thresholds. In every case, the sound-only injury distances were longer than the sight-only injury distances.

(2) The combined injury thresholds correspond to more typical occurrences—activities that are both seen and heard. We anticipate that there is a synergistic effect between such activities, and that spotted owls could react to such activities at farther distances than those merely heard or seen. We also anticipate that many activities could be both seen and heard by spotted owls at the relatively short sight-only and sound-only injury thresholds proposed here. The study by Delaney et al. (1999) includes the most pertinent results concerning reactions of spotted owls to ground-based, mechanized activities that could be both seen and heard by the spotted owls.

(3) As stated above, behaviors indicating potential injury (harassment) to spotted owls are: flushing from the nest, aborted feeding, and postponed feeding. For spotted owls, the peer-reviewed research data presented here (i.e., Delaney et al. 1999, Swarthout and Steidl 2001) concerned flushing spotted owls from perches—not from nests. We have no data to indicate that spotted owls flush from the nest or abort feedings due to disturbances at farther distances than the sound-only injury threshold distances presented here, and the spotted owls studied by Delaney et al. (1999) never flushed during the incubation and nestling phases in the chainsaw and helicopter tests. Those findings would indicate that we need not increase the sound-only injury distances presented above to produce longer combined injury threshold distances. However, Delaney et al. (1999) did observe relatively frequent flushes from branches up to 60 meters from the disturbance during the later part of the nesting period. The one flush from farther than 60 meters (at 105 meters) observed by Delaney et al. (1999) was an unusual event; only 4.8% (1 of 21) of their chainsaw trials greater than 60 meters and less than 105 meters from the spotted owls resulted in a flush, whereas 30.4% (7 of 23) of their chainsaw trials at 60 meters resulted in a flush. We consider flushes farther than 60 meters to be unlikely events, so we did not increase the chainsaw injury threshold beyond 60 meters. As stated above, we are concerned that an adult spotted owl flushing from a branch when the juveniles are no more than 1 month of age could result in a missed feeding. So, to include the observations of Delaney et al. (1999) concerning flushes during the later part of the nesting season, the combined injury threshold for chainsaws is increased to 65 yards (60 meters). We assumed that the effects due to heavy equipment would be similar to those of chainsaws (even though heavy equipment is quieter than chainsaws), so we increased the harassment distance for heavy equipment in the same proportion as we did for chainsaws, resulting in 35 yards for heavy equipment for spotted owls. (That is, 45 yards X 1.44 = 65 yards for chainsaws, and 25 yards X 1.40 = 35 yards for heavy equipment.)

(4) We know of no literature to indicate that the sight of a falling tree due to chainsaw work would cause harassment to spotted owls farther away than 65 yards. Consequently, we did not extend this distance for timber-harvest activities. If a tree is felled and then limbed, the final, combined injury distance would be calculated not only from where the tree was felled, but also from where it was limbed.

(5) The spotted owls apparently did not see the helicopters used in Delaney et al. (1999), so those results are pertinent to our sound-only threshold distances. The 120-yard (110-meter) harassment distance for helicopters estimated in our analysis here using 92dB as the sound-only criterion is 5 meters farther than the distance at which Delaney et al. (1999) reported *any* responses by spotted owls, so we view this helicopter-harassment distance as conservative.

Likelihood of Injury to Spotted Owls

The likelihood of injury was presented above in the murrelet section of that title; we anticipate similar effects to spotted owls. It is possible that adverse effects due to people (non-researchers) in spotted owl habitat not using motorized equipment (e.g., hikers, hunters) could occur, but here we need to estimate if injury due to people not using motorized equipment is reasonably certain to occur. In such an analysis, naiveté, habituation, and sensitization of spotted owls to human presence are of issue. Spotted owls are well known for being naive, and frequently continue normal behaviors including mutual-preening, feeding, caching of prey, and sleeping within a few yards of observers. The protocol to find spotted owl nests and to determine whether young are present is to feed mice to adult spotted owls and watch to see whether they go to their nests, or feed their mates or young ("mousing") (USDA and USDI 1999). The spotted owl biologists listed in "Process to Estimate Sight-only Injury Thresholds for Spotted Owls" agree that surveying for spotted owls by hooting, mousing, and by marking is more disruptive to spotted owls than any of the mechanized projects covered in this BO, and that there are many spotted owl pairs nesting successfully only 50-100 yards from active roads. The differences between the setting in the Utah desert in which the Mexican spotted owls studied by Swarthout and Steidl (2001, 2003) and ONF were described above, and are here used in support of not estimating harassment for spotted owls due to pedestrians for ONF. For the above-stated reasons, people in spotted owl habitat who are not using motorized equipment (other than researchers who climb the nest tree) or blasting are not considered here to be likely to result in disturbance-related injury.

Summary of Process to Estimate Injury Thresholds for Murrelets and Spotted Owls

(1) Noises as low as of 92-95 dB can cause birds of all tested taxa to flush, so we set the sound-only injury threshold at 92 dB. Using a typical sound attenuation graph, we set the sound-only injury distances for these activities.

(2) We did not have dB data to allow us to place various sized blasts into the sound attenuation graph.

(3) For murrelets, we set the sight-only injury distance at 11 yards, which was the farthest distance of flushing due to pedestrians (without other noises) from incidental accounts. For spotted owls, we set the sight-only injury distance at 20 yards, which was a compromise between 2-6 yards as reported to us by northern spotted owl biologists, and 26 yards in a Mexican spotted owl study.

(4) In every case, the sound-only injury distances were either longer than or equal to the sight-only injury distances.

(5) For the final, combined injury threshold distances for murrelets, we increased the sound-only distance of 25 yards for heavy equipment to 35 yards to accommodate the reported instance of a pair of murrelets that left a suitable-habitat stand (one of which flushed from a branch) due to people slamming car doors and talking loudly within 30 meters (32.8 yards) of the tree in which the murrelet was perched.

(6) For the final, combined injury threshold distances for spotted owls, we used data concerning flushing of adults from perches during the late nesting season due to chainsaws to lengthen that distance to 65 yards. We assumed that the effects due to heavy equipment would be relatively similar to those of chainsaws (even though heavy equipment is quieter than chainsaws), so we increased the harassment distance for heavy equipment in the same proportion as we had done for the chainsaws, resulting in 35 yards for heavy equipment for spotted owls.

(7) Our combined injury threshold distances are in agreement with published literature and anecdotal accounts of harassment of murrelets and spotted owls, other than our injury threshold distances for helicopters, which we view as conservative.

(8) The combined injury threshold distances for murrelets and spotted owls are presented in the following table. The only differences between the species are in the chainsaw distances.

Activity	**Combined injury threshold distances: murrelet / spotted owl**
a blast, a large helicopter, a large airplane	1 mile* / 1 mile*
a small helicopter or a single-engine airplane	120 yards / 120 yards
an impact pile driver, a jackhammer, or a rock drill	60 yards / 60 yards
chainsaws (firewood cutting, hazard trees, pre-commercial thinning, and commercial thinning)	45 yards / 65 yards
heavy equipment	35 yards / 35 yards

* Site-, equipment-, and method-specific information can be used to shorten or lengthen the 1-mile distance for these activities.

(9) We recently acquired two sophisticated dB meters, and we anticipate gathering more current dB data for heavy equipment and, especially, for blasting during 2003 and 2004. It is expected that additional dB information and subsequent analyses will result in adjustments of some of these distances.

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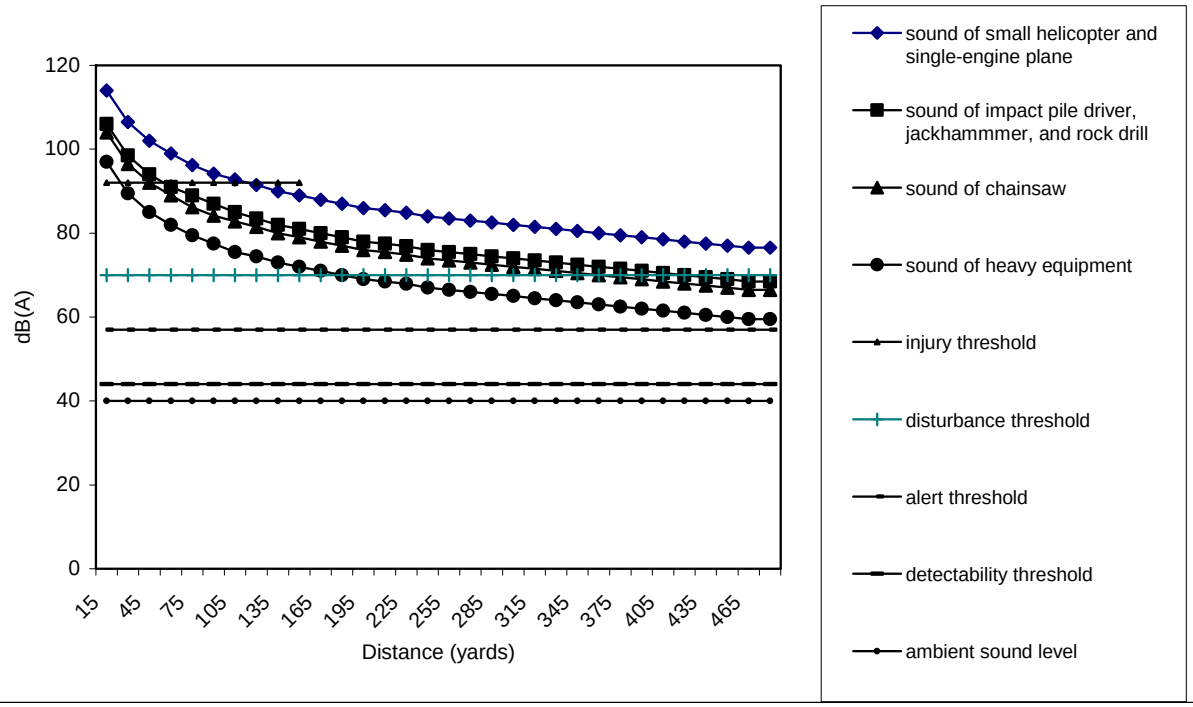
Figure 1. Calculated sound attenuation of maximum dB levels of noise-generating actions in a vegetated area and estimated sound-only detectability, alert, disturbance, and injury thresholds



APPENDIX L

Bull Trout Status of the Species
Bull Trout Critical Habitat
Marbled Murrelet Status of the Species
Marbled Murrelet Critical Habitat
Northern Spotted Owl Status of the Species
Northern Spotted Owl Critical Habitat

STATUS OF THE SPECIES (Bull Trout)

Listing Status

The coterminous United States population of the bull trout (*Salvelinus confluentus*) was listed as threatened on November 1, 1999 (64 FR 58910). The threatened bull trout generally occurs in the Klamath River Basin of south-central Oregon; the Jarbidge River in Nevada; the Willamette River Basin in Oregon; Pacific Coast drainages of Washington, including Puget Sound; major rivers in Idaho, Oregon, Washington, and Montana, within the Columbia River Basin; and the St. Mary-Belly River, east of the Continental Divide in northwestern Montana (Cavender 1978; Bond 1992; Brewin and Brewin 1997; Leary and Allendorf 1997).

Throughout its range, the bull trout are threatened by the combined effects of habitat degradation, fragmentation, and alterations associated with dewatering, road construction and maintenance, mining, grazing, the blockage of migratory corridors by dams or other diversion structures, poor water quality, entrainment (a process by which aquatic organisms are pulled through a diversion or other device) into diversion channels, and introduced non-native species (64 FR 58910). Although all salmonids are likely to be affected by climate change, bull trout are especially vulnerable given that spawning and rearing are constrained by their location in upper watersheds and the requirement for cold water temperatures (Battin et al. 2007; Rieman et al. 2007). Poaching and incidental mortality of bull trout during other targeted fisheries are additional threats.

The bull trout was initially listed as three separate Distinct Population Segments (DPSs) (63 FR 31647; 64 FR 17110). The preamble to the final listing rule for the United States coterminous population of the bull trout discusses the consolidation of these DPSs with the Columbia and Klamath population segments into one listed taxon and the application of the jeopardy standard under section 7 of the Act relative to this species (64 FR 58910):

> Although this rule consolidates the five bull trout DPSs into one listed taxon, based on conformance with the DPS policy for purposes of consultation under section 7 of the Act, we intend to retain recognition of each DPS in light of available scientific information relating to their uniqueness and significance. Under this approach, these DPSs will be treated as interim recovery units with respect to application of the jeopardy standard until an approved recovery plan is developed. Formal establishment of bull trout recovery units will occur during the recovery planning process.

Current Status and Conservation Needs

In recognition of available scientific information relating to their uniqueness and significance, five segments of the coterminous United States population of the bull trout are considered essential to the survival and recovery of this species and are identified as interim recovery units: 1) Jarbidge River, 2) Klamath River, 3) Columbia River, 4) Coastal-Puget Sound, and 5) St. Mary-Belly River (USFWS 2002a; 2004a; 2004b). Each of these interim recovery units is necessary to maintain the bull trout's distribution, as well as its genetic and phenotypic diversity, all of which are important to ensure the species' resilience to changing environmental conditions.

A summary of the current status and conservation needs of the bull trout within these interim recovery units is provided below and a comprehensive discussion is found in the Service's draft recovery plans for the bull trout (USFWS 2002a; 2004a; 2004b).

The conservation needs of bull trout are often generally expressed as the four "Cs": cold, clean, complex, and connected habitat. Cold stream temperatures, clean water quality that is relatively free of sediment and contaminants, complex channel characteristics (including abundant large wood and undercut banks), and large patches of such habitat that are well connected by unobstructed migratory pathways are all needed to promote conservation of bull trout at multiple scales ranging from the coterminous to local populations (a local population is a group of bull trout that spawn within a particular stream or portion of a stream system). The recovery planning process for bull trout (USFWS 2002a; 2004a; 2004b) has also identified the following conservation needs: 1) maintenance and restoration of multiple, interconnected populations in diverse habitats across the range of each interim recovery unit, 2) preservation of the diversity of life-history strategies, 3) maintenance of genetic and phenotypic diversity across the range of each interim recovery unit, and 4) establishment of a positive population trend. Recently, it has also been recognized that bull trout populations need to be protected from catastrophic fires across the range of each interim recovery unit (Rieman et al. 2003).

Central to the survival and recovery of bull trout is the maintenance of viable core areas (USFWS 2002a; 2004a; 2004b). A core area is defined as a geographic area occupied by one or more local bull trout populations that overlap in their use of rearing, foraging, migratory, and overwintering habitat. Each of the interim recovery units listed above consists of one or more core areas. There are 121 core areas recognized across the coterminous range of the bull trout (USFWS 2002a; 2004a; 2004b).

Jarbidge River Interim Recovery Unit

This interim recovery unit currently contains a single core area with six local populations. Less than 500 resident and migratory adult bull trout, representing about 50 to 125 spawning adults, are estimated to occur in the core area. The current condition of the bull trout in this interim recovery unit is attributed to the effects of livestock grazing, roads, incidental mortalities of released bull trout from recreational angling, historic angler harvest, timber harvest, and the introduction of non-native fishes (USFWS 2004b). The

draft bull trout recovery plan (USFWS 2004b) identifies the following conservation needs for this interim recovery unit: 1) maintain the current distribution of the bull trout within the core area, 2) maintain stable or increasing trends in abundance of both resident and migratory bull trout in the core area, 3) restore and maintain suitable habitat conditions for all life history stages and forms, and 4) conserve genetic diversity and increase natural opportunities for genetic exchange between resident and migratory forms of the bull trout. An estimated 270 to 1,000 spawning bull trout per year are needed to provide for the persistence and viability of the core area and to support both resident and migratory adult bull trout (USFWS 2004b).

Klamath River Interim Recovery Unit

This interim recovery unit currently contains three core areas and seven local populations. The current abundance, distribution, and range of the bull trout in the Klamath River Basin are greatly reduced from historical levels due to habitat loss and degradation caused by reduced water quality, timber harvest, livestock grazing, water diversions, roads, and the introduction of non-native fishes ((USFWS 2002b). Bull trout populations in this interim recovery unit face a high risk of extirpation (USFWS 2002b). The draft Klamath River bull trout recovery plan (USFWS 2002b) identifies the following conservation needs for this interim recovery unit: 1) maintain the current distribution of bull trout and restore distribution in previously occupied areas, 2) maintain stable or increasing trends in bull trout abundance, 3) restore and maintain suitable habitat conditions for all life history stages and strategies, 4) conserve genetic diversity and provide the opportunity for genetic exchange among appropriate core area populations. Eight to 15 new local populations and an increase in population size from about 2,400 adults currently to 8,250 adults are needed to provide for the persistence and viability of the three core areas (USFWS 2002b).

Columbia River Interim Recovery Unit

The Columbia River interim recovery unit includes bull trout residing in portions of Oregon, Washington, Idaho, and Montana. Bull trout are estimated to have occupied about 60 percent of the Columbia River Basin, and presently occur in 45 percent of the estimated historical range (Quigley and Arbelbide 1997). This interim recovery unit currently contains 97 core areas and 527 local populations. About 65 percent of these core areas and local populations occur in central Idaho and northwestern Montana. The Columbia River interim recovery unit has declined in overall range and numbers of fish (63 FR 31647). Although some strongholds still exist with migratory fish present, bull trout generally occur as isolated local populations in headwater lakes or tributaries where the migratory life history form has been lost. Though still widespread, there have been numerous local extirpations reported throughout the Columbia River basin. In Idaho, for example, bull trout have been extirpated from 119 reaches in 28 streams (Idaho Department of Fish and Game *in litt*. 1995). The draft Columbia River bull trout recovery plan (USFWS 2002d) identifies the following conservation needs for this interim recovery unit: 1) maintain or expand the current distribution of the bull trout within core areas, 2) maintain stable or increasing trends in bull trout abundance, 3)

restore and maintain suitable habitat conditions for all bull trout life history stages and strategies, and 4) conserve genetic diversity and provide opportunities for genetic exchange.

This interim recovery unit currently contains 97 core areas and 527 local populations. About 65 percent of these core areas and local populations occur in Idaho and northwestern Montana. The condition of the bull trout within these core areas varies from poor to good. All core areas have been subject to the combined effects of habitat degradation and fragmentation caused by the following activities: dewatering; road construction and maintenance; mining; grazing; the blockage of migratory corridors by dams or other diversion structures; poor water quality; incidental angler harvest; entrainment into diversion channels; and introduced non-native species. The Service completed a core area conservation assessment for the 5-year status review and determined that, of the 97 core areas in this interim recovery unit, 38 are at high risk of extirpation, 35 are at risk, 20 are at potential risk, 2 are at low risk, and 2 are at unknown risk (USFWS 2005).

Coastal-Puget Sound Interim Recovery Unit

Bull trout in the Coastal-Puget Sound interim recovery unit exhibit anadromous, adfluvial, fluvial, and resident life history patterns. The anadromous life history form is unique to this interim recovery unit. This interim recovery unit currently contains 14 core areas and 67 local populations (USFWS 2004a). Bull trout are distributed throughout most of the large rivers and associated tributary systems within this interim recovery unit. Bull trout continue to be present in nearly all major watersheds where they likely occurred historically, although local extirpations have occurred throughout this interim recovery unit. Many remaining populations are isolated or fragmented and abundance has declined, especially in the southeastern portion of the interim recovery unit. The current condition of the bull trout in this interim recovery unit is attributed to the adverse effects of dams, forest management practices (e.g., timber harvest and associated road building activities), agricultural practices (e.g., diking, water control structures, draining of wetlands, channelization, and the removal of riparian vegetation), livestock grazing, roads, mining, urbanization, poaching, incidental mortality from other targeted fisheries, and the introduction of non-native species. The draft Coastal-Puget Sound bull trout recovery plan (USFWS 2004a) identifies the following conservation needs for this interim recovery unit: 1) maintain or expand the current distribution of bull trout within existing core areas, 2) increase bull trout abundance to about 16,500 adults across all core areas, and 3) maintain or increase connectivity between local populations within each core area.

St. Mary-Belly River Interim Recovery Unit

This interim recovery unit currently contains six core areas and nine local populations (USFWS 2002c). Currently, bull trout are widely distributed in the St. Mary-Belly River drainage and occur in nearly all of the waters that it inhabited historically. Bull trout are found only in a 1.2-mile reach of the North Fork Belly River within the United States.

Redd count surveys of the North Fork Belly River documented an increase from 27 redds in 1995 to 119 redds in 1999. This increase was attributed primarily to protection from angler harvest (USFWS 2002c). The current condition of the bull trout in this interim recovery unit is primarily attributed to the effects of dams, water diversions, roads, mining, and the introduction of non-native fishes (USFWS 2002c). The draft St. Mary-Belly bull trout recovery plan (USFWS 2002c) identifies the following conservation needs for this interim recovery unit: 1) maintain the current distribution of the bull trout and restore distribution in previously occupied areas, 2) maintain stable or increasing trends in bull trout abundance, 3) restore and maintain suitable habitat conditions for all life history stages and forms, 4) conserve genetic diversity and provide the opportunity for genetic exchange, and 5) establish good working relations with Canadian interests because local bull trout populations in this interim recovery unit are comprised mostly of migratory fish, whose habitat is mostly in Canada.

Life History

Bull trout exhibit both resident and migratory life history strategies. Both resident and migratory forms may be found together, and either form may produce offspring exhibiting either resident or migratory behavior (Rieman and McIntyre 1993). Resident bull trout complete their entire life cycle in the tributary (or nearby) streams in which they spawn and rear. The resident form tends to be smaller than the migratory form at maturity and also produces fewer eggs (Fraley and Shepard 1989; Goetz 1989). Migratory bull trout spawn in tributary streams where juvenile fish rear 1 to 4 years before migrating to either a lake (adfluvial form), river (fluvial form) (Fraley and Shepard 1989; Goetz 1989), or saltwater (anadromous form) to rear as subadults and to live as adults (Cavender 1978; McPhail and Baxter 1996; WDFW et al. 1997). Bull trout normally reach sexual maturity in 4 to 7 years and may live longer than 12 years. They are iteroparous (they spawn more than once in a lifetime). Repeat- and alternate-year spawning has been reported, although repeat-spawning frequency and post-spawning mortality are not well documented (Leathe and Graham 1982; Fraley and Shepard 1989; Pratt 1992; Rieman and McIntyre 1996).

The iteroparous reproductive strategy of bull trout has important repercussions for the management of this species. Bull trout require passage both upstream and downstream, not only for repeat spawning but also for foraging. Most fish ladders, however, were designed specifically for anadromous semelparous salmonids (fishes that spawn once and then die, and require only one-way passage upstream). Therefore, even dams or other barriers with fish passage facilities may be a factor in isolating bull trout populations if they do not provide a downstream passage route. Additionally, in some core areas, bull trout that migrate to marine waters must pass both upstream and downstream through areas with net fisheries at river mouths. This can increase the likelihood of mortality to bull trout during these spawning and foraging migrations.

Growth varies depending upon life-history strategy. Resident adults range from 6 to 12 inches total length, and migratory adults commonly reach 24 inches or more (Pratt 1985;

Goetz 1989). The largest verified bull trout is a 32-pound specimen caught in Lake Pend Oreille, Idaho, in 1949 (Simpson and Wallace 1982).

Habitat Characteristics

Bull trout have more specific habitat requirements than most other salmonids (Rieman and McIntyre 1993). Habitat components that influence bull trout distribution and abundance include water temperature, cover, channel form and stability, valley form, spawning and rearing substrate, and migratory corridors (Fraley and Shepard 1989; Goetz 1989; Hoelscher and Bjornn 1989; Sedell and Everest 1991; Howell and Buchanan 1992; Pratt 1992; Rieman and McIntyre 1993; Rieman and McIntyre 1995; Rich 1996; Watson and Hillman 1997). Watson and Hillman (1997) concluded that watersheds must have specific physical characteristics to provide the habitat requirements necessary for bull trout to successfully spawn and rear and that these specific characteristics are not necessarily present throughout these watersheds. Because bull trout exhibit a patchy distribution, even in pristine habitats (Rieman and McIntyre 1993), bull trout should not be expected to simultaneously occupy all available habitats (Rieman et al. 1997). Migratory corridors link seasonal habitats for all bull trout life histories. The ability to migrate is important to the persistence of bull trout (Rieman and McIntyre 1993; Rieman et al. 1997; Mike Gilpin *in litt*. 1997). Migrations facilitate gene flow among local populations when individuals from different local populations interbreed or stray to nonnatal streams. Local populations that are extirpated by catastrophic events may also become reestablished by bull trout migrants. However, it is important to note that the genetic structuring of bull trout indicates there is limited gene flow among bull trout populations, which may encourage local adaptation within individual populations, and that reestablishment of extirpated populations may take a long time (Rieman and McIntyre 1993; Spruell et al. 1999). Migration also allows bull trout to access more abundant or larger prey, which facilitates growth and reproduction. Additional benefits of migration and its relationship to foraging are discussed below under "Diet."

Cold water temperatures play an important role in determining bull trout habitat quality, as these fish are primarily found in colder streams (below 15 °C or 59 °F), and spawning habitats are generally characterized by temperatures that drop below 9 °C (48 °F) in the fall (Fraley and Shepard 1989; Pratt 1992; Rieman and McIntyre 1993).

Thermal requirements for bull trout appear to differ at different life stages. Spawning areas are often associated with cold-water springs, groundwater infiltration, and the coldest streams in a given watershed (Pratt 1992; Rieman and McIntyre 1993; Baxter et al. 1997; Rieman et al. 1997). Optimum incubation temperatures for bull trout eggs range from 2 °C to 6 °C (35 °F to 39 °F) whereas optimum water temperatures for rearing range from about 6 °C to 10 °C (46 °F to 50 °F) (McPhail and Murray 1979; Goetz 1989; Buchanan and Gregory 1997). In Granite Creek, Idaho, Bonneau and Scarnecchia (1996) observed that juvenile bull trout selected the coldest water available in a plunge pool, 8 °C to 9 °C (46 °F to 48 °F), within a temperature gradient of 8 °C to 15 °C (4 °F to 60 °F). In a landscape study relating bull trout distribution to maximum water temperatures, Dunham et al. (2003) found that the probability of juvenile bull trout occurrence does not

become high (i.e., greater than 0.75) until maximum temperatures decline to 11 °C to 12 °C (52 °F to 54 °F).

Although bull trout are found primarily in cold streams, occasionally these fish are found in larger, warmer river systems throughout the Columbia River basin (Fraley and Shepard 1989; Rieman and McIntyre 1993; Rieman and McIntyre 1995; Rieman et al. 1997; Buchanan and Gregory 1997). Availability and proximity of cold water patches and food productivity can influence bull trout ability to survive in warmer rivers (Myrick et al. 2002). For example, in a study in the Little Lost River of Idaho where bull trout were found at temperatures ranging from 8 °C to 20 °C (46 °F to 68 °F), most sites that had high densities of bull trout were in areas where primary productivity in streams had increased following a fire (Bart L. Gamett, Salmon-Challis National Forest, pers. comm. June 20, 2002).

All life history stages of bull trout are associated with complex forms of cover, including large woody debris, undercut banks, boulders, and pools (Fraley and Shepard 1989; Goetz 1989; Hoelscher and Bjornn 1989; Sedell and Everest 1991; Pratt 1992; Thomas 1992; Rich 1996; Sexauer and James 1997; Watson and Hillman 1997). Maintaining bull trout habitat requires stability of stream channels and maintenance of natural flow patterns (Rieman and McIntyre 1993). Juvenile and adult bull trout frequently inhabit side channels, stream margins, and pools with suitable cover (Sexauer and James 1997). These areas are sensitive to activities that directly or indirectly affect stream channel stability and alter natural flow patterns. For example, altered stream flow in the fall may disrupt bull trout during the spawning period, and channel instability may decrease survival of eggs and young juveniles in the gravel from winter through spring (Fraley and Shepard 1989; Pratt 1992; Pratt and Huston 1993). Pratt (1992) indicated that increases in fine sediment reduce egg survival and emergence.

Bull trout typically spawn from August through November during periods of increasing flows and decreasing water temperatures. Preferred spawning habitat consists of low-gradient stream reaches with loose, clean gravel (Fraley and Shepard 1989). Redds are often constructed in stream reaches fed by springs or near other sources of cold groundwater (Goetz 1989; Pratt 1992; Rieman and McIntyre 1996). Depending on water temperature, incubation is normally 100 to 145 days (Pratt 1992). After hatching, fry remain in the substrate, and time from egg deposition to emergence may surpass 200 days. Fry normally emerge from early April through May, depending on water temperatures and increasing stream flows (Pratt 1992; Ratliff and Howell 1992).

Early life stages of fish, specifically the developing embryo, require the highest inter-gravel dissolved oxygen (IGDO) levels, and are the most sensitive life stage to reduced oxygen levels. The oxygen demand of embryos depends on temperature and on stage of development, with the greatest IGDO required just prior to hatching.

A literature review conducted by the Washington Department of Ecology (WDOE 2002) indicates that adverse effects of lower oxygen concentrations on embryo survival are magnified as temperatures increase above optimal (for incubation). In a laboratory study

conducted in Canada, researchers found that low oxygen levels retarded embryonic development in bull trout (Giles and Van der Zweep 1996 in Stewart et al. 2007). Normal oxygen levels seen in rivers used by bull trout during spawning ranged from 8 to 12 mg/L (in the gravel), with corresponding instream levels of 10 to 11.5 mg/L (Stewart et al. 2007). In addition, IGDO concentrations, water velocities in the water column, and especially the intergravel flow rate, are interrelated variables that affect the survival of incubating embryos (ODEQ 1995). Due to a long incubation period of 220+ days, bull trout are particularly sensitive to adequate IGDO levels. An IGDO level below 8 mg/L is likely to result in mortality of eggs, embryos, and fry.

Migratory forms of bull trout may develop when habitat conditions allow movement between spawning and rearing streams and larger rivers, lakes or nearshore marine habitat where foraging opportunities may be enhanced (Frissell 1993; Goetz et al. 2004; Brenkman and Corbett 2005). For example, multiple life history forms (e.g., resident and fluvial) and multiple migration patterns have been noted in the Grande Ronde River (Baxter 2002). Parts of this river system have retained habitat conditions that allow free movement between spawning and rearing areas and the mainstem Snake River. Such multiple life history strategies help to maintain the stability and persistence of bull trout populations to environmental changes. Benefits to migratory bull trout include greater growth in the more productive waters of larger streams, lakes, and marine waters; greater fecundity resulting in increased reproductive potential; and dispersing the population across space and time so that spawning streams may be recolonized should local populations suffer a catastrophic loss (Rieman and McIntyre 1993; MBTSG 1998; Frissell 1999). In the absence of the migratory bull trout life form, isolated populations cannot be replenished when disturbances make local habitats temporarily unsuitable. Therefore, the range of the species is diminished, and the potential for a greater reproductive contribution from larger size fish with higher fecundity is lost (Rieman and McIntyre 1993).

Diet

Bull trout are opportunistic feeders, with food habits primarily a function of size and life-history strategy. A single optimal foraging strategy is not necessarily a consistent feature in the life of a fish, because this strategy can change as the fish progresses from one life stage to another (i.e., juvenile to subadult). Fish growth depends on the quantity and quality of food that is eaten (Gerking 1994), and as fish grow, their foraging strategy changes as their food changes, in quantity, size, or other characteristics. Resident and juvenile migratory bull trout prey on terrestrial and aquatic insects, macrozooplankton, and small fish (Boag 1987; Goetz 1989; Donald and Alger 1993). Subadult and adult migratory bull trout feed on various fish species (Leathe and Graham 1982; Fraley and Shepard 1989; Donald and Alger 1993; Brown 1994). Bull trout of all sizes other than fry have been found to eat fish half their length (Beauchamp and VanTassell 2001). In nearshore marine areas of western Washington, bull trout feed on Pacific herring (*Clupea pallasi*), Pacific sand lance (*Ammodytes hexapterus*), and surf smelt (*Hypomesus pretiosus*) (WDFW et al. 1997; Goetz et al. 2004).

Bull trout migration and life history strategies are closely related to their feeding and foraging strategies. Migration allows bull trout to access optimal foraging areas and exploit a wider variety of prey resources. Optimal foraging theory can be used to describe strategies fish use to choose between alternative sources of food by weighing the benefits and costs of capturing one source of food over another. For example, prey often occur in concentrated patches of abundance ("patch model" ; Gerking 1994). As the predator feeds in one patch, the prey population is reduced, and it becomes more profitable for the predator to seek a new patch rather than continue feeding on the original one. This can be explained in terms of balancing energy acquired versus energy expended. For example, in the Skagit River system, anadromous bull trout make migrations as long as 121 miles between marine foraging areas in Puget Sound and headwater spawning grounds, foraging on salmon eggs and juvenile salmon along their migration route (WDFW et al. 1997). Anadromous bull trout also use marine waters as migration corridors to reach seasonal habitats in non-natal watersheds to forage and possibly overwinter (Goetz et al. 2004; Brenkman and Corbett 2005).

Changes in Status of the Coastal-Puget Sound Interim Recovery Unit

Although the status of bull trout in Coastal-Puget Sound interim recovery unit has been improved by certain actions, it continues to be degraded by other actions, and it is likely that the overall status of the bull trout in this population segment has not improved since its listing on November 1, 1999. Improvement has occurred largely through changes in fishing regulations and habitat-restoration projects. Fishing regulations enacted in 1994 either eliminated harvest of bull trout or restricted the amount of harvest allowed, and this likely has had a positive influence on the abundance of bull trout. Improvement in habitat has occurred following restoration projects intended to benefit either bull trout or salmon, although monitoring the effectiveness of these projects seldom occurs. On the other hand, the status of this population segment has been adversely affected by a number of Federal and non-Federal actions, some of which were addressed under section 7 of the Act. Most of these actions degraded the environmental baseline; all of those addressed through formal consultation under section 7 of the Act permitted the incidental take of bull trout.

Section 10(a)(1)(B) permits have been issued for Habitat Conservation Plans (HCP) completed in the Coastal-Puget Sound population segment. These include: 1) the City of Seattle's Cedar River Watershed HCP, 2) Simpson Timber HCP, 3) Tacoma Public Utilities Green River HCP, 4) Plum Creek Cascades HCP, 5) Washington State Department of Natural Resources HCP, 6) West Fork Timber HCP (Nisqually River), and 7) Forest Practices HCP. These HCPs provide landscape-scale conservation for fish, including bull trout. Many of the covered activities associated with these HCPs will contribute to conserving bull trout over the long-term; however, some covered activities will result in short-term degradation of the baseline. All HCPs permit the incidental take of bull trout.

Changes in Status of the Columbia River Interim Recovery Unit

The overall status of the Columbia River interim recovery unit has not changed appreciably since its listing on June 10, 1998. Populations of bull trout and their habitat in this area have been affected by a number of actions addressed under section 7 of the Act. Most of these actions resulted in degradation of the environmental baseline of bull trout habitat, and all permitted or analyzed the potential for incidental take of bull trout. The Plum Creek Cascades HCP, Plum Creek Native Fish HCP, and Forest Practices HCP addressed portions of the Columbia River population segment of bull trout.

Changes in Status of the Klamath River Interim Recovery Unit

Improvements in the Threemile, Sun, and Long Creek local populations have occurred through efforts to remove or reduce competition and hybridization with non-native salmonids, changes in fishing regulations, and habitat-restoration projects. Population status in the remaining local populations (Boulder-Dixon, Deming, Brownsworth, and Leonard Creeks) remains relatively unchanged. Grazing within bull trout watersheds throughout the recovery unit has been curtailed. Efforts at removal of non-native species of salmonids appear to have stabilized the Threemile and positively influenced the Sun Creek local populations. The results of similar efforts in Long Creek are inconclusive. Mark and recapture studies of bull trout in Long Creek indicate a larger migratory component than previously expected.

Although the status of specific local populations has been slightly improved by recovery actions, the overall status of Klamath River bull trout continues to be depressed. Factors considered threats to bull trout in the Klamath Basin at the time of listing – habitat loss and degradation caused by reduced water quality, past and present land use management practices, water diversions, roads, and non-native fishes – continue to be threats today.

Changes in Status of the Saint Mary-Belly River Interim Recovery Unit

The overall status of bull trout in the Saint Mary-Belly River interim recovery unit has not changed appreciably since its listing on November 1, 1999. Extensive research efforts have been conducted since listing, to better quantify populations of bull trout and their movement patterns. Limited efforts in the way of active recovery actions have occurred. Habitat occurs mostly on Federal and Tribal lands (Glacier National Park and the Blackfeet Nation). Known problems due to instream flow depletion, entrainment, and fish passage barriers resulting from operations of the U.S. Bureau of Reclamation's Milk River Irrigation Project (which transfers Saint Mary-Belly River water to the Missouri River Basin) and similar projects downstream in Canada constitute the primary threats to bull trout and to date they have not been adequately addressed under section 7 of the Act. Plans to upgrade the aging irrigation delivery system are being pursued, which has potential to mitigate some of these concerns but also the potential to intensify dewatering. A major fire in August 2006 severely burned the forested habitat in Red Eagle and Divide Creeks, potentially affecting three of nine local populations and degrading the baseline.

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STATUS OF BULL TROUT CRITICAL HABITAT (Rangewide)

This Biological Opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02. Instead, we have relied upon the statute and the August 6, 2004, Ninth Circuit Court of Appeals decision in Gifford Pinchot Task Force v. U.S. Fish and Wildlife Service (No. 03-35279) to complete the following analysis with respect to critical habitat.

Legal Status

The Service published a final critical habitat designation for the coterminous United States population of the bull trout on September 26, 2005 (70 FR 56212); the rule became effective on October 26, 2005. The scope of the designation involved the Klamath River, Columbia River, Coastal-Puget Sound, and Saint Mary-Belly River population segments (also considered as interim recovery units). Rangewide, the Service designated 143,218 acres of reservoirs or lakes and 4,813 stream or shoreline miles as bull trout critical habitat (Table X).

Table X. Stream/shoreline distance and acres of reservoir or lakes designated as bull trout critical habitat by state.

	Stream/shoreline Miles	Stream/shoreline Kilometers	Acres	Hectares
Idaho	294	474	50,627	20,488
Montana	1,058	1,703	31,916	12,916
Oregon	939	1,511	27,322	11,057
Oregon/Idaho	17	27		
Washington	1,519	2,445	33,353	13,497
Washington (marine)	985	1,585		

Although critical habitat has been designated across a wide area, some critical habitat segments were excluded in the final designation based on a careful balancing of the benefits of inclusion versus the benefits of exclusion (see Section 3(5)(A) and Exclusions under Section 4(b)(2) in the final rule). This balancing process resulted in all proposed critical habitat being excluded in 9 proposed critical habitat units: Unit 7 (Odell Lake), Unit 8 (John Day River Basin), Unit 15 (Clearwater River Basin), Unit 16 (Salmon River Basin), Unit 17 (Southwest Idaho River Basins), Unit 18 (Little Lost River), Unit 21 (Upper Columbia River), Unit 24 (Columbia River), and Unit 26 (Jarbidge River Basin). The remaining 20 proposed critical habitat units were designated in the final rule. It is important to note that the exclusion of waterbodies from designated critical habitat does not negate or diminish their importance for bull trout conservation.

Conservation Role and Description of Critical Habitat

The conservation role of bull trout critical habitat is to support viable core area populations (70 FR 56212). The core areas reflect the metapopulation structure of bull trout and are the closest approximation of a biologically functioning unit for the purposes of recovery planning and risk analyses. Critical habitat units generally encompass one or more core areas and may include foraging, migration, and overwintering (FMO) areas, outside of core areas, that are important to the survival and recovery of bull trout.

Because there are numerous exclusions that reflect land ownership, designated critical habitat is often fragmented and interspersed with excluded stream segments. These individual critical habitat segments are expected to contribute to the ability of the stream to support bull trout within local populations and core areas in each critical habitat unit.

The primary function of individual critical habitat units is to maintain and support core areas which 1) contain bull trout populations with the demographic characteristics needed to ensure their persistence and contain the habitat needed to sustain those characteristics (Rieman and McIntyre 1993); 2) provide for persistence of strong local populations, in part, by providing habitat conditions that encourage movement of migratory fish (Rieman and McIntyre 1993; MBTSG 1998); 3) are large enough to incorporate genetic and phenotypic diversity, but small enough to ensure connectivity between populations (Rieman and McIntyre 1993; Hard 1995; Healey and Prince 1995; MBTSG 1998); and 4) are distributed throughout the historic range of the species to preserve both genetic and phenotypic adaptations (Rieman and McIntyre 1993; Hard 1995; MBTSG 1998; Rieman and Allendorf 2001).

The Olympic Peninsula and Puget Sound critical habitat units are essential to the conservation of amphidromous bull trout, which are unique to the Coastal-Puget Sound bull trout population. These critical habitat units contain nearshore and freshwater habitats, outside of core areas, that are used by bull trout from one or more core areas. These habitats, outside of core areas, contain Primary Constituent Elements (PCEs) that are critical to adult and subadult foraging, overwintering, and migration.

Within the designated critical habitat areas, the PCEs for bull trout are those habitat components that are essential for the primary biological needs of foraging, reproducing, rearing of young, dispersal, genetic exchange, or sheltering. Note that only PCEs 1, 6, 7, and 8 apply to marine nearshore waters identified as critical habitat; and all except PCE 3 apply to FMO habitat identified as critical habitat.

The PCEs are as follows:

> (1) Water temperatures that support bull trout use. Bull trout have been documented in streams with temperatures from 32º to 72 ºF (0º to 22 ºC) but are found more frequently in temperatures ranging from 36º to 59 ºF (2º to 15 ºC). These temperature ranges may vary depending on bull trout life-history stage and form, geography, elevation, diurnal and seasonal variation, shade, such as that provided by riparian habitat, and local

groundwater influence. Stream reaches with temperatures that preclude bull trout use are specifically excluded from designation.

(2) Complex stream channels with features such as woody debris, side channels, pools, and undercut banks to provide a variety of depths, velocities, and instream structures.

(3) Substrates of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. This should include a minimal amount of fine substrate less than 0.25 inch (0.63 centimeter) in diameter.

(4) A natural hydrograph, including peak, high, low, and base flows within historic ranges or, if regulated, currently operate under a biological opinion that addresses bull trout, or a hydrograph that demonstrates the ability to support bull trout populations by minimizing daily and day-to-day fluctuations and minimizing departures from the natural cycle of flow levels corresponding with seasonal variation.

(5) Springs, seeps, groundwater sources, and subsurface water to contribute to water quality and quantity as a cold water source.

(6) Migratory corridors with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and foraging habitats, including intermittent or seasonal barriers induced by high water temperatures or low flows.

(7) An abundant food base including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.

(8) Permanent water of sufficient quantity and quality such that normal reproduction, growth, and survival are not inhibited.

Critical habitat includes the stream channels within the designated stream reaches, the shoreline of designated lakes, and the inshore extent of marine nearshore areas, including tidally influenced freshwater heads of estuaries.

In freshwater habitat, critical habitat includes the stream channels within the designated stream reaches, and includes a lateral extent as defined by the ordinary high-water line. In areas where ordinary high-water line has not been defined, the lateral extent will be defined by the bankfull elevation. Bankfull elevation is the level at which water begins to leave the channel and move into the floodplain and is reached at a discharge that generally has a recurrence interval of 1 to 2 years on the annual flood series. For designated lakes, the lateral extent of critical habitat is defined by the perimeter of the water body as mapped on standard 1:24,000 scale topographic maps.

In marine habitat, critical habitat includes the inshore extent of marine nearshore areas between mean lower low-water (MLLW) and minus 10 meters (m) mean higher high-water (MHHW), including tidally influenced freshwater heads of estuaries. This refers to the area between the

average of all lower low-water heights and all the higher high-water heights of the two daily tidal levels. The offshore extent of critical habitat for marine nearshore areas is based on the extent of the photic zone, which is the layer of water in which organisms are exposed to light. Critical habitat extends offshore to the depth of 33 ft (10 m) relative to the MLLW.

Adjacent stream, lake, and shoreline riparian areas, bluffs, and uplands are not designated as critical habitat. However, it should be recognized that the quality of marine and freshwater habitat along streams, lakes, and shorelines is intrinsically related to the character of these adjacent features, and that human activities that occur outside of the designated critical habitat can have major effects on physical and biological features of the aquatic environment.

Activities that cause adverse effects to critical habitat are evaluated to determine if they are likely to "destroy or adversely modify" critical habitat by altering the PCEs to such an extent that critical habitat would not remain functional to serve the intended conservation role for the species (70 FR 56212, USFWS 2004). The Service's evaluation must be conducted at the scale of the entire critical habitat area designated, unless otherwise stated in the final critical habitat rule (USFWS and NMFS 1998). Therefore, adverse modification of bull trout critical habitat is evaluated at the scale of the final designation, which includes the critical habitat designated for the Klamath River, Columbia River, Coastal-Puget Sound, and Saint Mary-Belly River population segments.

Current Condition Rangewide

The condition of bull trout critical habitat varies across its range from poor to good. Although still relatively widely distributed across its historic range, the bull trout occurs in low numbers in many areas, and populations are considered depressed or declining across much of its range (67 FR 71240). This condition reflects the condition of bull trout habitat.

There is widespread agreement in the scientific literature that many factors related to human activities have impacted bull trout and their habitat, and continue to do so. Among the many factors that contribute to degraded PCEs, those which appear to be particularly significant and have resulted in a legacy of degraded habitat conditions are as follows: 1) fragmentation and isolation of local populations due to the proliferation of dams and water diversions that have eliminated habitat, altered water flow and temperature regimes, and impeded migratory movements (Rieman and McIntyre 1993; Dunham and Rieman 1999); 2) degradation of spawning and rearing habitat and upper watershed areas, particularly alterations in sedimentation rates and water temperature, resulting from forest and rangeland practices and intensive development of roads (Fraley and Shepard 1989; MBTSG 1998); 3) the introduction and spread of nonnative fish species, particularly brook trout and lake trout, as a result of fish stocking and degraded habitat conditions, which compete with bull trout for limited resources and, in the case of brook trout, hybridize with bull trout (Leary et al. 1993; Rieman et al. 2006); 4) in the Coastal-Puget Sound region where amphidromous bull trout occur, degradation of mainstem river FMO habitat, and the degradation and loss of marine nearshore foraging and migration habitat due to urban and residential development; and 5) degradation of FMO habitat resulting from reduced prey base, roads, agriculture, development, and dams.

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STATUS OF THE SPECIES: Marbled Murrelet

Legal Status

The murrelet was federally listed as a threatened species in Washington, Oregon, and northern California effective September 28, 1992 (57 FR 45328 [October 1, 1992]). The final rule designating critical habitat for the murrelet (61 FR 26256 [May 24, 1996]) became effective on June 24, 1996. The Service recently proposed a revision to the 1996 murrelet critical habitat designation (71 FR 44678 [July 31, 2008]). A final rule is expected in 2009. The species' decline has largely been caused by extensive removal of late-successional and old-growth coastal forests which serve as nesting habitat for murrelets. Additional listing factors included high nest-site predation rates and human-induced mortality in the marine environment from gillnets and oil spills.

The Service determined that the California, Oregon, and Washington distinct population segment of the murrelet does not meet the criteria set forth in the Service's 1996 Distinct Population Segment policy (61 FR 4722 [May 24, 1996]; (Beissinger and Nur 1997 in USFWS 2004). However, the murrelet retains its listing and protected status as a threatened species under the Act until the original 1992 listing decision is revised through formal rule-making procedures, involving public notice and comment.

Critical habitat was designated for the murrelet to addresses the objective of stabilizing the population size. To fulfill that objective, the Marbled Murrelet Recovery Plan (USFWS 1997b) (Recovery Plan), focuses on protecting adequate nesting habitat by maintaining and protecting occupied habitat and minimizing the loss of unoccupied but suitable habitat (USFWS 1997b, p. 119). The Recovery Plan identified six Conservation Zones throughout the listed range of the species: Puget Sound (Conservation Zone 1), Western Washington Coast Range (Conservation Zone 2), Oregon Coast Range (Conservation Zone 3), Siskiyou Coast Range (Conservation Zone 4), Mendocino (Conservation Zone 5), and Santa Cruz Mountains (Conservation Zone 6).

As explained in the Endangered Species Consultation Handbook (USFWS and NMFS 1998) and clarified for recovery units through Memorandum (USFWS 2006), jeopardy analyses must always consider the effect of proposed actions on the survival and recovery of the listed entity. In the case of the murrelet, the Service's jeopardy analysis will consider the effect of the action on the long-term viability of the murrelet in its listed range (Washington, Oregon, and northern California), beginning with an analysis of the action's effect on Conservation Zones 1 and 2 (described below).

<u>Conservation Zone 1</u>

Conservation Zone 1 includes all the waters of Puget Sound and most waters of the Strait of Juan de Fuca south of the U.S.-Canadian border and extends inland 50 mi from the Puget Sound, including the north Cascade Mountains and the northern and eastern sections of the Olympic Peninsula. Forest lands in the Puget Trough have been predominately replaced by urban development and the remaining suitable habitat in Zone 1 is typically a considerable distance

from the marine environment, lending special importance to nesting habitat close to Puget Sound (USFWS 1997b).

Conservation Zone 2

Conservation Zone 2 includes waters within 1.2 mi of the Pacific Ocean shoreline south of the U.S.-Canadian border off Cape Flattery and extends inland to the midpoint of the Olympic Peninsula. In southwest Washington, the Zone extends inland 50 mi from the Pacific Ocean shoreline. Most of the forest lands in the northwestern portion of Zone 2 occur on public (State, county, city, and Federal) lands, while most forest lands in the southwestern portion are privately owned. Extensive timber harvest has occurred throughout Zone 2 in the last century, but the greatest loss of suitable nest habitat is concentrated in the southwest portion of Zone 2 (USFWS 1997b). Thus, murrelet conservation is largely dependent upon Federal lands in northern portion of Zone 2 and non-Federal lands in the southern portion.

Life History

Murrelets are long-lived seabirds that spend most of their life in the marine environment, but use old-growth forests for nesting. Detailed discussions of the biology and status of the murrelet are presented in the final rule listing the murrelet as threatened (57 FR 45328 [October 1, 1992]), the Recovery Plan, Ecology and Conservation of the Marbled Murrelet (Ralph et al. 1995), the final rule designating murrelet critical habitat (61 FR 26256 [May 24, 1996]), and the Evaluation Report in the 5-Year Status Review of the Marbled Murrelet in Washington, Oregon, and California (McShane et al. 2004).

Physical Description

The murrelet is taxonomically classified in the family Alcidae (alcids), a family of Pacific seabirds possessing the ability to dive using wing-propulsion. The plumage of this relatively small (9.5 in to 10 in) seabird is identical between males and females, but the plumage of adults changes during the winter and breeding periods providing some distinction between adults and juveniles. Breeding adults have light, mottled brown under-parts below sooty-brown upperparts contrasted with dark bars. Adults in winter plumage have white under-parts extending to below the nape and white scapulars with brown and grey mixed upperparts. The plumage of fledged young is similar to the adult winter plumage (USFWS 1997b).

Distribution

The range of the murrelet, defined by breeding and wintering areas, extends from the northern terminus of Bristol Bay, Alaska, to the southern terminus of Monterey Bay in central California. The listed portion of the species' range extends from the Canadian border south to central California. Murrelet abundance and distribution has been significantly reduced in portions of the listed range, and the species has been extirpated from some locations. The areas of greatest concern due to small numbers and fragmented distribution include portions of central California, northwestern Oregon, and southwestern Washington (USFWS 1997b).

Reproduction

Murrelet breeding is asynchronous and spread over a prolonged season. In Washington, the murrelet breeding season occurs between April 1 and September 15 (Figure 3). Egg laying and incubation occur from late April to early August and chick rearing occurs between late May and late August, with all chicks fledging by early September (Hamer et al. 2003).

Murrelets lay a single-egg clutch (Nelson 1997), which may be replaced if egg failure occurs early (Hebert et al. 2003; McFarlane-Tranquilla et al. 2003). However, there is no evidence a second egg is laid after successfully fledging a first chick. Adults typically incubate for a 24-hour period, then exchange duties with their mate at dawn. Hatchlings appear to be brooded by an adult for one to two days and are then left alone at the nest for the remainder of the rearing period, except during feedings. Both parents feed the chick, which receives one to eight meals per day (Nelson 1997). Most meals are delivered early in the morning while about a third of the food deliveries occur at dusk and intermittently throughout the day (Nelson and Hamer 1995b). Chicks fledge 27 to 40 days after hatching. The initial flight of a fledgling appears to occur at dusk and parental care is thought to cease after fledging (Nelson 1997).

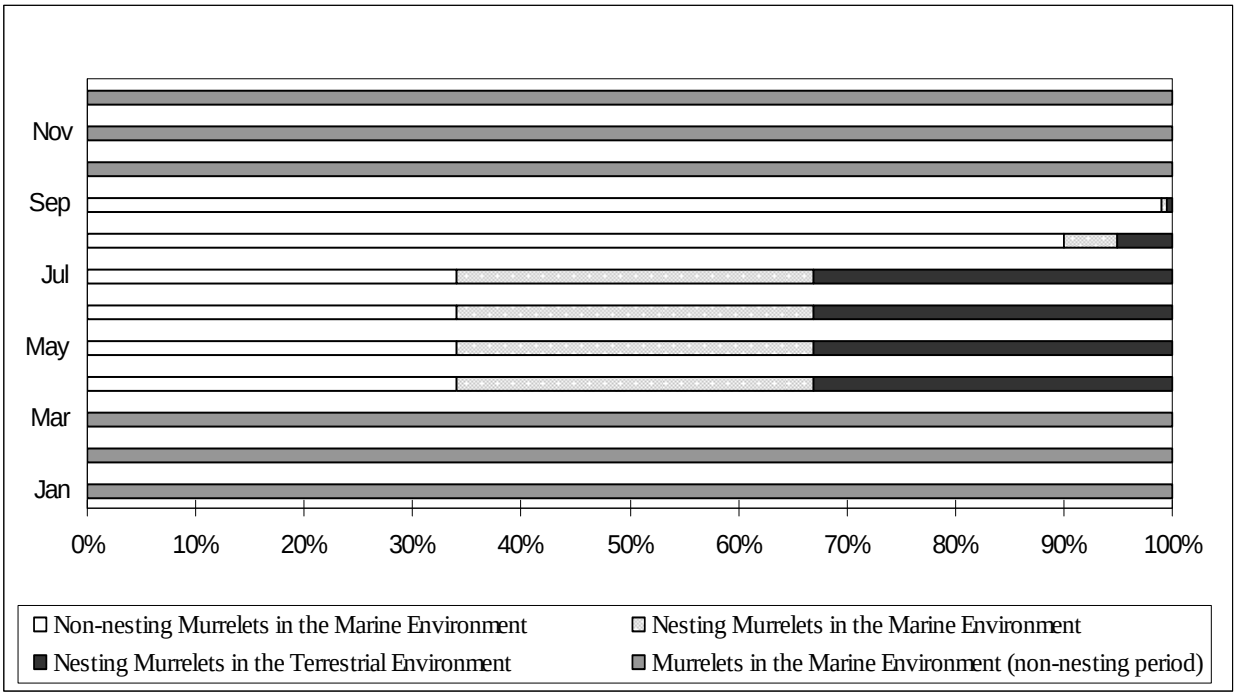

Figure 3. The seasonal changes in the relative proportion of breeding and non-breeding murrelets in the marine and terrestrial environments[62] within Washington State (Conservation Zones 1 and 2)

Vocalization

[62] Demographic estimates were derived from Peery et al. (2004) and nesting chronology was derived from Hamer and Nelson (1995) and Bradley et al. (2004) where April 1 is the beginning of the nesting season, September 15 is the end of the nesting season, and August 6 is the beginning of the late breeding season when an estimated 70 percent of the murrelet chicks have fledged.

Murrelets are known to vocalize between 480 Hertz and 4.9 kilohertz and have at least 5 distinct call types (Suzanne Sanborn, pers. comm. 2005). Murrelets tend to be more vocal at sea compared to other alcids (Nelson 1997). Individuals of a pair vocalize after surfacing apart from each other, after a disturbance, and during attempts to reunite after being separated (Strachan et al. 1995).

Murrelets in the Marine Environment

Murrelets are ususally found within 5 miles (8 kilometers) from shore, and in water less than 60 meters deep (Ainley et al. 1995; Burger 1995; Strachan et al. 1995; Nelson 1997; Day and Nigro 2000; Raphael et al. 2007). In general, birds occur closer to shore in exposed coastal areas and farther offshore in protected coastal areas (Nelson 1997). Courtship, foraging, loafing, molting, and preening occur in marine waters. Beginning in early spring, courtship continues throughout summer with some observations even noted during the winter period (Speckman 1996; Nelson 1997). Observations of courtship occurring in the winter suggest that pair bonds are maintained throughout the year (Speckman 1996; Nelson 1997). Courtship involves bill posturing, swimming together, synchronous diving, vocalizations, and chasing in flights just above the surface of the water. Copulation occurs both inland (in the trees) and at sea (Nelson 1997).

Loafing

When murrelets are not foraging or attending a nest, they loaf on the water, which includes resting, preening, and other activities during which they appear to drift with the current, or move without direction (Strachan et al. 1995). Strachan et al. (1995) noted that vocalizations occurred during loafing periods, especially during the mid-morning and late afternoon.

Molting

Murrelets go through two molts each year. The timing of molts varies temporally throughout their range and are likely influenced by prey availability, stress, and reproductive success (Nelson 1997). Adult (after hatch-year) murrelets have two primary plumage types: alternate (breeding) plumage and basic (winter) plumage. The pre-alternate molt occurs from late February to mid-May. This is an incomplete molt during which the birds lose their body feathers but retain their ability to fly (Carter and Stein 1995; Nelson 1997). A complete pre-basic molt occurs from mid-July through December (Carter and Stein 1995; Nelson 1997). During the pre-basic molt, murrelets lose all flight feathers somewhat synchronously and are flightless for up to two months (Nelson 1997). In Washington, there is some indication that the pre-basic molt occurs from mid-July through the end of August (Chris Thompson, pers. comm. 2003).

Flocking

Strachan et al. (1995) defines a flock as three or more birds in close proximity which maintain that formation when moving. Various observers throughout the range of the murrelet report flocks of highly variable sizes. In the southern portion of the murrelet's range (California, Oregon, and Washington), flocks rarely contain more than 10 birds. Larger flocks usually occur during the later part of the breeding season and may contain juvenile and subadult birds (Strachan et al. 1995).

Aggregations of foraging murrelets are probably related to concentrations of prey. In Washington, murrelets are not generally found in interspecific feeding flocks (Strachan et al. 1995). Strong et al. (in Strachan et al. 1995) observed that murrelets avoid large feeding flocks of other species and presumed that the small size of murrelets may make them vulnerable to kleptoparasitism or predation in mixed species flocks. Strachan et al. (1995) point out that if murrelets are foraging cooperatively, the confusion of a large flock of birds could reduce foraging efficiency.

Foraging Behavior

Murrelets are wing-propelled pursuit divers that forage both during the day and at night (Carter and Sealy 1986; Gaston and Jones 1998; Henkel et al. 2003; Kuletz 2005). Murrelets typically forage in pairs, but have been observed to forage alone or in groups of three or more (Carter and Sealy 1990; Strachan et al. 1995; Speckman et al. 2003). Strachan et al. (1995) believe pairing enhances foraging success through cooperative foraging techniques. For example, pairs consistently dive together during foraging and often synchronize their dives by swimming towards each other before diving (Carter and Sealy 1990) and resurfacing together on most dives. Strachan et al. (1995) speculate pairs may keep in visual contact underwater. Paired foraging is common throughout the year, even during the incubation period, suggesting that breeding murrelets may temporarily pair up with other foraging individuals (non-mates) (Strachan et al. 1995; Speckman et al. 2003).

Murrelets can make substantial changes in foraging sites within the breeding season, but many birds routinely forage in the same general areas and at productive foraging sites, as evidenced by repeated use over a period of time throughout the breeding season (Carter and Sealy 1990; Whitworth et al. 2000; Becker et al. 2001; Hull et al. 2001; Mason et al. 2002; Piatt et al. 2007). Murrelets are also known to forage in freshwater lakes (Nelson 1997). Activity patterns and foraging locations are influenced by biological and physical processes that concentrate prey, such as weather, climate, time of day, season, light intensity, up-wellings, tidal rips, narrow passages between islands, shallow banks, and kelp (*Nereocystis* spp.) beds (Ainley et al. 1995; Strong et al. 1995; Burger 1995; Speckman 1996; Nelson 1997).

Juveniles are generally found closer to shore than adults (Beissinger 1995) and forage without the assistance of adults (Strachan et al. 1995). Kuletz and Piatt (1999) found that in Alaska, juvenile murrelets congregated in kelp beds. Kelp beds are often with productive waters and may provide protection from avian predators (Kuletz and Piatt 1999). McAllister (in litt. in

Strachan et al. 1995) found that juveniles were more common within 328 ft of shorelines, particularly, where bull kelp was present.

Murrelets usually feed in shallow, near-shore water less than 30m (98 ft) deep (Huff et al. 2006), but are thought to be able to dive up to depths of 47 m (157 ft) (Mathews and Burger 1998). Variation in depth and dive patterns may be related to the effort needed to capture prey. Thick-billed murres (*Uria lomvia*) and several penguin species exhibit bi-modal foraging behavior in that their dive depths mimic the depth of their prey, which undergo daily vertical migrations in the water column (Croll et al. 1992; Butler and Jones 1997). Jodice and Collopy's (1999) data suggest murrelets follow this same pattern as they forage for fish that occur throughout the water column but undergo daily vertical migrations (to shallower depths at night and back to deeper depths during the day). Murrelets observed foraging in deeper water likely do so when upwelling, tidal rips, and daily activity patterns concentrate the prey near the surface (Strachan et al. 1995).

The duration of dives appears to depend upon age (adults vs. juveniles), water depth, visibility, and depth and availability of prey. Murrelet dive duration ranges from 8 seconds to 115 seconds, although most dives last between 25 and 45 seconds (Thorensen 1989; Jodice and Collopy 1999; Watanuki and Burger 1999; Day and Nigro 2000).

Adults and subadults often move away from breeding areas prior to molting and must select areas with predictable prey resources during the flightless period (Carter and Stein 1995; Nelson 1997). During the non-breeding season, murrelets disperse and can be found farther from shore (Strachan et al. 1995). Little is known about marine-habitat preference outside of the breeding season, but use during the early spring and fall is thought to be similar to that preferred during the breeding season (Nelson 1997). During the winter there may be a general shift from exposed outer coasts into more protected waters (Nelson 1997), for example many murrelets breeding on the exposed outer coast of Vancouver Island appear to congregate in the more sheltered waters within the Puget Sound and the Strait of Georgia in fall and winter (Burger 1995). However, in many areas, murrelets remain associated with the inland nesting habitat during the winter months (Carter and Erickson 1992) and throughout the listed range, murrelets do not appear to disperse long distances, indicating they are year-round residents (McShane et al. 2004).

Prey Species

Throughout their range, murrelets are opportunistic feeders and utilize prey of diverse sizes and species. They feed primarily on fish and invertebrates in marine waters although they have also been detected on rivers and inland lakes (Carter and Sealy 1986); 57 FR 45328 [October 1, 1992]). In general, small schooling fish and large pelagic crustaceans are the main prey items. Pacific sand lance *(Ammodytes hexapterus)*, northern anchovy *(Engraulis mordax)*, immature Pacific herring *(Clupea harengus)*, capelin *(Mallotus villosus)*, Pacific sardine (*Sardinops sagax*), juvenile rockfishes (*Sebastas* spp.) and surf smelt (Osmeridae) are the most common fish species taken. Squid (*Loligo* spp.), euphausiids, mysid shrimp, and large pelagic amphipods are the main invertebrate prey. Murrelets are able to shift their diet throughout the year and over years in response to prey availability (Becker et al. 2007). However, long-term adjustment to

less energetically-rich prey resources (such as invertebrates) appears to be partly responsible for poor marbled murrelet reproduction in California (Becker and Beissinger 2006).

Breeding adults exercise more specific foraging strategies when feeding chicks, usually carrying a single, relatively large (relative to body size) energy-rich fish to their chicks (Burkett 1995; Nelson 1997), primarily around dawn and dusk (Nelson 1997; Kuletz 2005). Freshwater prey appears to be important to some individuals during several weeks in summer and may facilitate more frequent chick feedings, especially for those that nest far inland (Hobson 1990). Becker et al. (Becker et al. 2007) found murrelet reproductive success in California was strongly correlated with the abundance of mid-trophic level prey (e.g. sand lance, juvenile rockfish) during the breeding and postbreeding seasons. Prey types are not equal in the energy they provide; for example parents delivering fish other than age-1 herring may have to increase deliveries by to up 4.2 times to deliver the same energy value (Kuletz 2005). Therefore, nesting murrelets that are returning to their nest at least once per day must balance the energetic costs of foraging trips with the benefits for themselves and their young. This may result in marbled murrelets preferring to forage in marine areas in close proximity to their nesting habitat. However, if adequate or appropriate foraging resources (i.e., "enough" prey, and/or prey with the optimum nutritional value for themselves or their young) are unavailable in close proximity to their nesting areas, marbled murrelets may be forced to forage at greater distances or to abandon their nests (Huff et al. 2006, p. 20). As a result, the distribution and abundance of prey suitable for feeding chicks may greatly influence the overall foraging behavior and location(s) during the nesting season, may affect reproductive success (Becker et al. 2007), and may significantly affect the energy demand on adults by influencing both the foraging time and number of trips inland required to feed nestlings (Kuletz 2005).

Predators

At-sea predators include bald eagles (*Haliaeetus leucocephalus*), peregrine falcons (*Falco peregrinus*), western gulls (*Larus occidentalis*), and northern fur seals (*Callorhinus ursinus*) (McShane et al. 2004). California sea lions (*Zalophus californianus*), northern sea lions (*Eumetopias jubatus*), and large fish may occasionally prey on murrelets (Burger 2002).

Murrelets in the Terrestrial Environment

Murrelets are dependent upon old-growth forests, or forests with an older tree component, for nesting habitat (Ralph et al. 1995; Hamer and Nelson 1995; McShane et al. 2004). Sites occupied by murrelets tend to have a higher proportion of mature forest age-classes than do unoccupied sites (Raphael et al. 1995). Specifically, murrelets prefer high and broad platforms for landing and take-off, and surfaces which will support a nest cup (Hamer and Nelson 1995). The physical condition of a tree appears to be the important factor in determining the tree's suitability for nesting (Ralph et al. 1995); therefore, presence of old-growth in an area does not assure the stand contains sufficient structures (i.e. platforms) for nesting. In Washington, murrelet nests have been found in conifers, specifically, western hemlock (*Tsuga heterophylla*), Sitka spruce (*Picea sitchensis*), Douglas-fir (*Pseudotsuga menziesii*), and western red cedar (*Thuja plicata*) (Hamer and Nelson 1995; Hamer and Meekins 1999). Nests have been found in

trees as small as 2.6 ft in diameter at breast height on limbs at least 65 ft from the ground and 0.36 ft in diameter (Hamer and Meekins 1999).

Murrelet populations may be limited by the availability of suitable nesting habitat. Although no data are available, Ralph et al. (1995) speculate the suitable nesting habitat presently available in Washington, Oregon, and California may be at or near carrying capacity based on: 1) at-sea concentrations of murrelets near suitable nesting habitat during the breeding season, 2) winter visitations to nesting sites, and 3) the limitation of nest sites available in areas with large amounts of habitat removal.

Murrelets have been observed visiting nesting habitat during non-breeding periods in Washington, Oregon, and California (Naslund 1993; Nelson 1997) which may indicate adults are defending nesting sites and/or stands (Ralph et al. 1995). Other studies provide further insight to the habitat associations of breeding murrelets, concluding that breeding murrelets displaced by the loss of nesting habitat do not pack in higher densities into remaining habitat (McShane et al. 2004). Thus, murrelets may currently be occupying nesting habitat at or near carrying capacity in highly fragmented areas and/or in areas where a significant portion of the historic nesting habitat has been removed (Ralph et al. 1995).

Unoccupied stands containing nesting structures are important to the population for displaced breeders or first-time breeding adults. Even if nesting habitat is at carrying capacity, there will be years when currently occupied stands become unoccupied as a result of temporary disappearance of inhabitants due to death or to irregular breeding (Ralph et al. 1995). Therefore, unoccupied stands will not necessarily indicate that habitat is not limiting or that these stands are not murrelet habitat (Ralph et al. 1995) and important to the species persistence.

Radar and audio-visual studies have shown murrelet habitat use is positively associated with the presence and abundance of mature and old-growth forests, large core areas of old-growth, low edge and fragmentation, proximity to the marine environment, total watershed area, and increasing forest age and height (McShane et al. 2004). In California and southern Oregon, areas with abundant numbers of murrelets were farther from roads, occurred more often in parks protected from logging, and were less likely to occupy old-growth habitat if it was isolated (more than 3 miles or 5 km) from other nesting murrelets (Meyer et al. 2002). Meyer et al. (2002) also found at least a few years passed before birds abandoned fragmented forests.

Murrelets do not form dense colonies which is atypical of most seabirds. Limited evidence suggests they may form loose colonies or clusters of nests in some cases (Ralph et al. 1995). The reliance of murrelets on cryptic coloration to avoid detection suggests they utilize a wide spacing of nests in order to prevent predators from forming a search image (Ralph et al. 1995). However, active nests have been seen within 328 ft (100 m) of one another in the North Cascades in Washington and within 98 ft (30 m) in Oregon (Kim Nelson, Oregon State University, pers. comm. 2005). Estimates of murrelet nest densities vary depending upon the method of data collection. For example, nest densities estimated using radar range from 0.007 to 0.104 mean nests per acre (0.003 to 0.042 mean nests per ha), while nest densities estimated from tree climbing efforts range from 0.27 to 3.51 mean nests per acre (0.11 to 1.42 mean nests per ha) (Nelson 2005).

There is little data available regarding murrelet nest site fidelity because of the difficulty in locating nest sites and observing banded birds attending nests. However, murrelets have been detected in the same nesting stands for many years (at least 20 years in California and 15 years in Washington), suggesting murrelets have a high fidelity to nesting areas, most likely at the watershed scale (Nelson 1997). Use of the same nest platform in successive years as well as multiple nests in the same tree have been documented, although it is not clear whether the repeated use involved the same birds (Nelson and Peck 1995; Divoky and Horton 1995; Nelson 1997; Manley 2000; Hebert et al. 2003). The limited observed fidelity to the same nest depression in consecutive years appears to be lower than for other alcids, but this may be an adaptive behavior in response to high predation rates (Divoky and Horton 1995). Researchers have suggested fidelity to specific or adjacent nesting platforms may be more common in areas where predation is limited or the number of suitable nest sites are fewer because large, old-growth trees are rare (Nelson and Peck 1995; Singer et al. 1995; Manley 1999).

Ralph et al. (1995) speculated that the fidelity to nest sites or stands by breeding murrelets may be influenced by the nesting success of previous rearing attempts. Although murrelet nesting behavior in response to failed nest attempts is unknown, nest failures could lead to prospecting for new nest sites or mates. Other alcids have shown an increased likelihood to relocate to a new nest in response to breeding failure (Divoky and Horton 1995). However, murrelets likely remain in the same watershed over time as long as stands are not significantly modified (Ralph et al. 1995).

It is unknown whether juveniles disperse from natal breeding habitat (natal dispersal) or return to their natal breeding habitat after reaching breeding age (natal philopatry). Natal dispersal distance can be expected to be as high or higher than other alcids given 1) the reduced extent of the breeding range, 2) the overlap between the wintering and breeding areas, 3) the distance individuals are known to move from breeding areas in the winter, 4) adult attendance of nesting areas during the non-breeding season where, in theory, knowledge of suitable nesting habitat is passed onto prospecting non-breeders, and 5) the 3-year to 5-year duration required for the onset of breeding age allowing non-breeding murrelets to prospect nesting and forage habitat for several years prior to reaching breeding age (Divoky and Horton 1995). Conversely, Swartzman et al. (1997 in McShane et al. 2004)) suggested juvenile dispersal is likely to be low, as it is for other alcid species. Nevertheless, the presence of unoccupied suitable nesting habitat on the landscape may be important for first-time nesters if they disperse away from their natal breeding habitat.

Murrelets generally select nests within 37 mi (60 kilometers (km) of marine waters (Miller and Ralph 1995). However, in Washington, occupied habitat has been documented 52 mi (84 km) from the coast and murrelets have been detected up to 70 mi (113 km) from the coast in the southern Cascade Mountains (Evans Mack et al. 2003).

When tending active nests during the breeding season (and much of the non-breeding season in southern parts of the range), breeding pairs forage within commuting distance of the nest site. Daily movements between nest sites and foraging areas for breeding murrelets averaged 10 mi in Prince William Sound, Alaska (McShane et al. 2004), 24 mi in Desolation Sound, British Columbia, Canada (Hull et al. 2001), and 48 mi in southeast Alaska. In California, Hebert and

Golightly (2003) found the mean extent of north-south distance traveled by breeding adults to be about 46 mi.

Murrelet nests have been located at a variety of elevations from sea level to 5,020 ft (Burger 2002). However, most nests have been found below 3,500 ft. In Conservation Zone 1, murrelets have exhibited "occupied" behaviors up to 4,400 ft elevation and have been detected in stands up to 4,900 ft in the north Cascade Mountains (Peter McBride, WDNR, *in litt*., 2005). On the Olympic Peninsula, survey efforts for nesting murrelets have encountered occupied stands up to 4,000 ft within Conservation Zone 1 and up to 3,500 ft within Conservation Zone 2. Surveys for murrelet nesting at higher elevations on the Olympic Peninsula have not been conducted. However, recent radio-telemetry work detected a murrelet nest at 3,600 ft elevation on the Olympic Peninsula in Conservation Zone 1 (Martin Raphael, USFWS, pers. comm. 2005).

Population Status in the Coterminous United States

Population Abundance

Research on murrelet populations in the early 1990s estimated murrelet abundance in Washington, Oregon, and California at 18,550 to 32,000 (Ralph et al. 1995). However, consistent population survey protocols were not established for murrelets in the coterminous United States until the late 1990s following the development of the marine component of the Environmental Monitoring (EM) Program for the NWFP (Bentivoglio et al. 2002). As a consequence, sampling procedures have differed and thus the survey data collected prior to the EM Program is unsuitable for estimating population trends for the murrelet (McShane et al. 2004).

The development of the EM Program unified the various at-sea monitoring efforts within the 5 Conservation Zones encompassed by the NWFP. The highest total population estimate for this area (20,500 +/- 4,600 birds at the 95 percent confidence interval) was in 2004 and the lowest total population estimate (17,400 +/- 4,600 birds at the 95 percent confidence interval) was in 2007 (Gary Falxa, *in litt*., 2008). The most recent population estimate for Conservation Zone 6 is 400 (+/- 140 birds at the 95 percent confidence interval) (Peery et al. 2008).

Population Trend

Estimated population trends within each Conservation Zone or for the entire coterminous population are not yet available from the marine survey data. Trend information will eventually be provided through the analysis of marine survey data from the EM Program (Bentivoglio et al. 2002) and from survey data in Conservation Zone 6 once a sufficient number of survey years have been completed. Depending on the desired minimum power (80 or 95 percent), at least 8 to 10 years of successive surveys are required for an overall population estimate and thus detection of an annual decrease, while 7 to 16 years are required for Conservation Zones 1 and 2 (Huff et al. 2003).

In the interim, demographic modeling has aided attempts to analyze and predict population trends and extinction probabilities of murrelets. Incorporating important population parameters

and species distribution data (Beissinger 1995; Beissinger and Nur 1997 in USFWS 1997b; Cam et al. 2003; McShane et al. 2004), demographic models can provide useful insights into potential population responses from the exposure to environmental pressures and perturbations. However, weak assumptions or inaccurate estimates of population parameters such as survivorship rates, breeding success, and juvenile-to-adult ratios (juvenile ratios), can limit the use of models. Thus, a cautious approach is warranted when forecasting long-term population trends using demographic models.

Most of the published demographic models used to estimate murrelet population trends employ Leslie Matrix modeling (McShane et al. 2004). Two other more complex, unpublished models (Akcakaya 1997 and Swartzman et al. 1997 in McShane et al. 2004) evaluate the effect of nest habitat loss on murrelets in Conservation Zone 4 (McShane et al. 2004). McShane et al. (2004) developed a stochastic Leslie Matrix model (termed "Zone Model") to project population trends in each murrelet Conservation Zone. The Zone Model was developed to integrate available demographic information for a comparative depiction of current expectations of future population trends and probability of extinction in each Conservation Zone (McShane et al. 2004). Table 1 lists rangewide murrelet demographic parameter values from four studies all using Leslie Matrix models.

Table 1. Rangewide murrelet demographic parameter values based on four studies all using Leslie Matrix models

Demographic Parameter	Beissinger 1995	Beissinger and Nur 1997*	Beissinger and Peery *in litt.* 2003	McShane et al. 2004
Juvenile Ratios	0.10367	0.124 or 0.131	0.089	0.02 - 0.09
Annual Fecundity	0.11848	0.124 or 0.131	0.06-0.12	(See nest success)
Nest Success			0.16-0.43	0.38 - 0.54
Maturation	3	3	3	2 - 5
Estimated Adult Survivorship	85 % – 90%	85 % – 88 %	82 % - 90 %	83 % – 92 %

*in (USFWS 1997b)

Regardless of model preference, the overall results of modeling efforts are in agreement, indicating murrelet abundance is declining (McShane et al. 2004, p. 6-27). The rates of decline are highly sensitive to the assumed adult survival rate used for calculation (Steven R. Beissinger and M. Z. Peery *in litt*., 2003). The most recent modeling effort using the "Zone Model" (McShane et al. 2004) suggests the murrelet zonal sub-populations are declining at a rate of 3.0 to 6.2 percent per year.

Estimates of breeding success are best determined from nest site data, but difficulties in finding nests has led to the use of other methods, such as juvenile ratios and radio-telemetry estimations, each of which have biases. The nest success data presented in Murrelet Table 1 under McShane et al. (2004) was derived primarily from radio telemetry studies; however the nests sampled in these studies were not representative of large areas and specifically did not include Washington or Oregon. In general, telemetry estimates are preferred over juvenile ratios for estimating breeding success due to fewer biases (McShane et al. 2004), but telemetry data are not currently

available for Washington or Oregon. Therefore, it is reasonable to expect that juvenile ratios derived from at-sea survey efforts best represent murrelet reproductive success in Washington, Oregon, and California.

Beissinger and Peery (Beissinger and Peery, *in litt*., 2003) performed a comparative analysis using data from 24 bird species to predict the juvenile ratios for murrelets of 0.27 (confidence intervals ranged from 0.15 to 0.65). Demographic models suggest murrelet population stability requires a minimum of 0.18 to 0.28 chicks per pair per year (Beissinger and Nur 1997 in USFWS 1997b). The lower confidence intervals for both the predicted juvenile ratio (0.15) and the stable population juvenile ratio (0.18) are greater than the juvenile ratios observed for any of the Conservation Zones (0.02 to 0.09 chicks per pair) (Beissinger and Nur 1997 in USFWS 1997b; Beissinger and Peery, *in litt*., 2003). Therefore, the juvenile ratios observed in the Conservation Zones are lower than predicted and are too low to obtain a stable population in any Conservation Zone. This indicates murrelet populations are declining in all Conservation Zones and will continue to decline until reproductive success improves.

Demographic modeling, the observed juvenile ratios, and adult survivorship rates suggests that the number of murrelets in Washington, Oregon, and California are too low to sustain a murrelet population. The rate of decline for murrelets throughout the listed range is estimated to be between 2.0 to 15.8 percent (Beissinger and Nur 1997 in USFWS 1997b; McShane et al. 2004).

<u>Murrelets in Washington (Conservation Zones 1 and 2)</u>

Population estimates

Historically, murrelets in Conservation Zones 1 and 2 were "common" (Rathbun 1915 and Miller et al. 1935 in USFWS 1997b), "abundant" (Edson 1908 and Rhoades 1893 in USFWS 1997b), or "numerous" (Miller et al. 1935 in McShane et al. 2004). Conservation Zone 1, encompassing the Puget Sound in northwest Washington, contains one of the larger murrelet populations in the species' listed range, and supports an estimated 41 percent of the murrelets in the coterminous United States (Huff et al. 2003). The 2007 population estimate (with 95 percent confidence intervals) for Conservation Zone 1 is 7,000 (4,100 – 10,400) and Conservation Zone 2 is 2,500 (1,300 – 3,800) (Falxa, *in litt.*, 2008). In Conservation Zone 2, a higher density of murrelets occurs in the northern portion of the Zone (Huff et al. 2003) where the majority of available nesting habitat occurs. In Conservation Zone 1, higher densities of murrelets occur in the Straits of Juan de Fuca, the San Juan Islands, and the Hood Canal (Huff et al. 2003), which are in proximity to nesting habitat on the Olympic Peninsula and the North Cascade Mountains.

Although population numbers in Conservation Zones 1 and 2 are likely declining, the precise rate of decline is unknown. The juvenile ratio derived from at-sea survey efforts in Conservation Zone 1 is 0.09. The juvenile ratios was not collected in Conservation Zone 2; however, the juvenile ratio for Conservation Zone 3 is 0.08. Therefore, it is reasonable to infer that the juvenile ratio for Conservation Zone 2 is likely between 0.08 and 0.09. These low juvenile ratios infer there is insufficient juvenile recruitment to sustain a murrelet population in Conservation Zones 1 and 2. Beissinger and Peery (Beissinger and Peery, *in litt*., 2003) estimated the rate of decline for Conservation Zone 1 to be between 2.0 to 12.6 percent and between 2.8 to 13.4

percent in Conservation Zone 3. It is likely that the rate of decline in Conservation Zone 2 is similar to that of Conservation Zones 1 and 3.

Juvenile ratios in Washington may be skewed by murrelets coming and going to British Columbia. At-sea surveys are timed to occur when the least number of murrelets from British Columbia are expected to be present. However, recent radio-telemetry information indicates 1) murrelets nesting in British Columbia forage in Washington waters during the breeding season (Bloxton and Raphael 2008) and could be counted during at-sea surveys; and 2) adult murrelets foraging in Washington during the early breeding season moved to British Columbia in mid-June and mid-July (Bloxton and Raphael 2008) and would not have been counted during the at-sea surveys. The movements of juvenile murrelets in Washington and southern British Columbia are unclear. Therefore, until further information is obtained regarding murrelet migration between British Columbia and Washington, we will continue to rely on the at-sea derived juvenile ratios to evaluate the population status in Conservation Zones 1 and 2.

Habitat Abundance

Estimates of the amount of available suitable nesting habitat vary as much as the methods used for estimating murrelet habitat. McShane et al. (2004) estimates murrelet habitat in Washington State at 1,022,695 acres, representing approximately 48 percent of the estimated 2,223,048 acres remaining suitable habitat in the listed range. McShane et al. (2004) caution about making direct comparisons between current and past estimates due to the evolving definition of suitable habitat and methods used to quantify habitat. As part of the ongoing pursuit to improve habitat estimates, information was collected and analyzed by the Service in 2005 resulting in an estimated 751,831 acres in Conservation Zone 1 and 585,821 acres in Conservation Zone 2 (Table 2).

Table 2. Estimated acres of suitable nesting habitat for the murrelet managed by the Federal and non-Federal land managers in Conservation Zones 1 and 2

Conservation Zone	Estimated acres of suitable murrelet habitat by land management category *				
	Federal	State	Private*	Tribal	Total
Puget Sound (Zone 1)	650,937	98,036	2,338	520	751,831
Western Washington Coast Range (Zone 2)	485,574	82,349	9,184	8,714	585,821
Total	1,136,511	180,385	11,522	9,234	1,337,652

*Estimated acres of private land represents occupied habitat. Additional suitable nesting habitat considered unoccupied by nesting murrelets is not included in this estimate.

Estimated acreages of suitable habitat on Federal lands in Table 2 are based on modeling and aerial photo interpretation and likely overestimate the actual acres of suitable murrelet habitat because 1) most acreages are based on models predicting spotted owl nesting habitat which include forested lands that do not have structures suitable for murrelet nesting, and 2) neither modeling or aerial photo interpretation can distinguish microhabitat features, such as nesting platforms or the presence of moss, that are necessary for murrelet nesting. The amount of high quality murrelet nesting habitat available in Washington, defined by the Service as large, old,

contiguously forested areas not subject to human influences (e.g., timber harvest or urbanization) is expected to be a small subset of the estimated acreages in Table 2. Murrelets nesting in high-quality nesting habitat are assumed to have a higher nesting success rate than murrelets nesting in fragmented habitat near humans.

Other Recent Assessments of Murrelet Habitat in Washington

Two recent assessments of murrelet potential nesting habitat were developed for monitoring the Northwest Forest Plan (Raphael et al. 2006). This study provides a provincial-scale analysis of murrelet habitat derived from vegetation base maps, and includes estimates of habitat on State and private lands in Washington for the period of 1994 to 1996. Using vegetation data derived from satellite imagery, Raphael et al. (2006) developed two different approaches to model habitat suitability. The first model, or the Expert Judgment Model, is based on the judgment of an expert panel that used existing forest structure classification criteria (e.g., percent conifer cover, canopy structure, quadratic mean diameter, forest patch size) to classify forests into four classes of habitat suitability, with Class 1 indicating the least suitable habitat and Class 4 indicating the most highly suitable habitat. Raphael et al. (2006) found that across the murrelet range, most habitat-capable land (52 percent) is classified as Class 1 (lowest suitability) habitat and 18 percent is classified as Class 4 (highest suitability) habitat. In Washington, they found that there were approximately 954,200 acres of Class 4 habitat in between 1994 and 1996 (Table 3). However, only 60 percent of known nest sites in their study area were located in Class 4 habitat.

The second habitat model developed by Raphael et al. (2006) used the Biomapper Ecological Niche-Factor Analysis model developed by Hirzel et al. (2002). The resulting murrelet habitat suitability maps are based on both the physical and vegetative attributes adjacent to known murrelet occupied polygons or nest locations for each Northwest Forest Plan province. The resulting raster maps are a grid of 269 ft^2-cells (25 m^2-cells) (0.15 acres per pixel). Each cell in the raster is assigned a value of 0 to 100. Values closer to 100 represent areas that match the murrelet nesting locations while values closer to 0 are likely unsuitable for nesting (Raphael et al. 2006). These maps do not provide absolute habitat estimates, but rather a range of habitat suitability values, which can be interpreted in various ways. Raphael et al. (2006) noted that the results from the Ecological Niche Factor Analysis (ENFA) are not easily compared to results from the Expert Judgment Model because it was not clear what threshold from the habitat suitability ranking to use. Raphael et al. (2006) elected to display habitat suitability scores greater than 60 (HS >60) as a “generous” portrayal of potential nesting habitat and a threshold greater than 80 (HS >80) as a more conservative estimate. In Washington, there were over 2.1 million acres of HS >60 habitat, but only 440,700 acres of HS >80 habitat (Table 3). It is important to note that HS >60 habitat map captures 82 percent of the occupied nests sites in Washington, whereas the HS >80 habitat map only captures 36 percent of the occupied nests in Washington.

Table 3. Comparison of different habitat modeling results for the Washington nearshore zone (0 to 40 mi inland or Northwest Forest Plan Murrelet Zone 1)

Murrelet Habitat Model	Habitat Acres on Federal Reserves (LSRs, Natl.Parks)	Habitat Acres on Federal, Non-Reserves (USFS Matrix)	Total Habitat Acres on Federal Lands	Total Habitat Acres on Non-Federal Lands (City, State, Private, Tribal)	Total Habitat Acres - All Ownerships	Percent of Total Habitat Acres on Non-Federal Lands	Percent of Known Murrelet Nest Sites in Study Area Occurring in this Habitat Classification
ENFA* HS >80	284,300	18,600	302,900	137,800	440,700	31%	36%
EJM* Class 4	659,200	40,700	699,900	254,300	954,200	11%	60%
EJM Class 3 and Class 4	770,600	54,700	825,300	535,200	1,360,500	16%	65%
ENFA HS >60	927,000	85,300	1,012,300	1,147,100	2,159,400	53%	82%

*ENFA = Ecological Niche Facto Analysis. EJM = Expert Judgment Model. Results were summarized directly from Tables 4 and 5 and Tables 9 and 10 in Raphael et al (2005). All habitat estimates represent 1994-1996 values.

Because the HS >60 model performed best for capturing known murrelet nest sites, Raphael et al. (2006) suggest that the ENFA HS >60 model yields a reasonable estimate of potential murrelet nesting habitat. However, we found that large areas in southwest Washington identified in the HS >60 model likely overestimates the actual suitable habitat in this landscape due to a known lack of old-forest in this landscape. Despite the uncertainties associated with interpreting the various map data developed by Raphael et al. (2006), it is apparent that there is a significant portion of suitable habitat acres located on non-Federal lands in Washington, suggesting that non-Federal lands may play a greater role in the conservation needs of the species than has previously been considered. Using the most conservative criteria developed by Raphael et al. (2006) the amount of high-quality murrelet nesting habitat on non-Federal lands in Washington varies from 11 percent to as high as 31 percent (Table 3).

Raphael et al. (2006) note that the spatial accuracy of the map data are limited and that the habitat maps are best used for provincial-scale analysis. Due to potential errors in vegetation mapping and other potential errors, these maps are not appropriate for fine-scale project mapping.

Conservation Zone 1

The majority of suitable murrelet habitat in Conservation Zone (Zone) 1 occurs in northwest Washington and is found on Forest Service and National Park Service lands, and to a lesser extent on State lands. The majority of the historic habitat along the eastern and southern shores of the Puget Sound has been replaced by urban development resulting in the remaining suitable habitat further inland from the marine environment (USFWS 1997b).

Conservation Zone 2

Murrelet nesting habitat north of Gray's Harbor in Zone 2 occurs largely on State, Forest Service, National Park Service, and Tribal lands, and to a lesser extent, on private lands. Alternatively, the majority of habitat in the southern portion of Zone 2 occurs primarily on State lands, with a small amount on private lands.

Threats

Murrelets remain subject to a variety of anthropogenic threats within the upland and marine environment. They also face threats from low population numbers, low immigration rates, high predation rates, and disease.

Threats in the Marine Environment

Threats to murrelets in the marine environment include declines in prey availability; mortality associated with exposure to oil spills, gill net and other fisheries; contaminants suspended in marine waters; and visual or sound disturbance from recreational or commercial watercrafts (57 FR 45328 [October 1, 1992]; (Ralph et al. 1995; USFWS 1997b; McShane et al. 2004). Activities, such as pile driving and underwater detonations, that result in elevated underwater sound pressure levels may also pose a threat to murrelets.

Prey Availability

Many fish populations have been depleted due to overfishing, reduction in the amount or quality of spawning habitat, and pollution. As of 2004, only 50 percent of the Puget Sound herring stocks were classified as healthy or moderately healthy, with north Puget Sound's stock being considered depressed and the Strait of Juan de Fuca's stocks being classified as critical (WDFW 2005d). Natural mortality in some of these stocks has increased (e.g. the mean estimated annual natural mortality rate for sampled stocks from 1987 through 2003 averaged 71 percent, up from 20 to 40 percent in the late 1970s) (WDFW 2005c). There is currently only one commercial herring fishery which operates primarily in south and central Puget Sound (WDFW 2005b) where herring stocks are healthier. Unfortunately, the decline of some herring stocks may be affecting the forage base for murrelets in Puget Sound. There is limited information available for the coastal herring populations, but these populations appear to have relatively high levels of abundance (WDFW 2005a). There are herring fisheries in Willapa Bay and Grays Harbor, but no direct harvest is allowed in the coastal waters.

While there are commercial and recreational fisheries for surf smelt, the amount of harvest does not appear to be impacting the surf smelt stocks (Bargmann 1998). There are no directed commercial fisheries for sand lance (Bargmann 1998). Anchovies are taken commercially within coastal and estuarine waters of Washington. While the current harvest level doesn't appear to be impacting anchovy stocks, there is no current abundance information (Bargmann 1998).

In addition to fishing pressure, oceanographic variation can influence prey availability. While the effects to murrelets from events such as El Niño have not been well documented, El Niño events are thought to reduce overall prey availability and several studies have found that El Niño events can influence the behavior of murrelets (McShane et al. 2004). Even though changes in prey availability may be due to natural and cyclic oceanographic variation, these changes may exacerbate other threats to murrelets in the marine environment.

Shoreline development has affected and will continue to effect coastal processes. Shipping, bulkheads, and other shoreline developments have contributed to the reduction in eelgrass beds and other spawning and rearing areas for forage species.

Oil Spills

Murrelet mortality from oil pollution is a conservation issue in Washington (USFWS 1997b). Most oil spills and chronic oil pollution that can affect murrelets occur in areas of high shipping traffic, such as the Strait of Juan de Fuca and Puget Sound. There have been at least 47 oil spills of 10,000 gal or more in Washington since 1964 (WDOE 2004). However, the number of oil spills has generally declined since passage of the U.S. Oil Pollution Act in 1990. The estimated annual mortality of murrelets from oil spills in Washington has decreased from 3 to 41 birds per year (between 1977 and 1992) to 1 to 2 birds per year (between 1993 and 2003) (McShane et al. 2004).

Since the murrelet was listed, the amount of oil tanker and shipping traffic has continued to increase (USFWS 1997b; Burger 2002). Large commercial ships, including oil tankers, cargo ships, fish processing ships, and cruise ships, enter Washington waters more than 7,000 times each year, bound for ports in Puget Sound, British Columbia, Grays Harbor, and the Columbia River (WDOE 2004). Additionally, 4,500 tank-barge transits, 160,000 ferry transits, and military vessel traffic occur in these same waters each year (WDOE 2004). Individually these vessels may carry up to 33 M gal of crude oil or refined petroleum products, but collectively, they carry about 15.1 B gal across Puget Sound waters each year (WDOE 2004). These numbers are expected to increase as the human population and commerce continues to grow. Currently, there are State and Federal requirements for tug escorts of laden oil tankers transiting the waters of Puget Sound east of Dungeness Spit. However, the Federal requirements do not apply to double-hulled tankers and will no longer be in effect once the single-hull tanker phase-out is complete (WDOE 2005). Washington State is considering revising their tug escort requirements (WDOE 2005); however, the current tug escort requirements remain in place until the Washington State Legislature makes a change.

The U.S. Coast Guard rated the Dungeness area in the Strait of Juan de Fuca as being in the top five high-risk areas of the United States for being impacted by oil spills (USFWS 2003b). Therefore, even though the threat from oil spills appears to have been reduced since the murrelet was listed, the risk of a catastrophic oil spill remains, and could severely impact adult and/or juvenile murrelets in Conservation Zones 1 and 2.

Gillnets

Murrelet mortality from gillnet fishing has been considered a conservation issue in Washington (USFWS 1997b; Melvin et al. 1999). Murrelets can also be killed by hooking with fishing lures and entanglement with fishing lines (Carter et al. 1995). There is little information available on murrelet mortality from net fishing prior to the 1990s, although it was known to occur (Carter et al. 1995). In the mid 1990s, a series of fisheries restrictions and changes were implemented to address mortality of all species of seabirds, resulting in a lower mortality rate of murrelets (McShane et al. 2004). Fishing effort has also decreased since the 1980s because of lower catches, fewer fishing vessels, and greater restrictions (McShane et al. 2004), although a regrowth in gill net fishing is likely to occur if salmon stocks increase. In most areas, the threat from gill net fishing has been reduced or eliminated since 1992, but threats to adult and juvenile murrelets are still present in Washington waters due to gill net mortality (McShane et al. 2004).

Entanglement in derelict fishing nets, which are nets that have been lost, abandoned or discarded in the marine environment, may also pose a threat. Derelict gear can persist in the environment for decades and poses a threat to marine mammals, seabirds, shellfish, and fish. A recent survey estimated 3,900 derelict nets need to be removed from Puget Sound annually (Northwest Straits Foundation 2007) and each year the number of new derelict nets increases faster than the number removed. Over 50 percent of the derelict nets in Puget Sound occur in waters where murrelet densities are the highest in Washington. Derelict fishing gear also occurs along the Washington coast and the outer Straits of Juan de Fuca. While this high energy environment may reduce the time a derelict net remains suspended compared to a lower energy environment like the inner Puget Sound where gear may persist for years (NRC 2007), the amount of time a derelict net poses a threat to marine species depends on the length and type of the net and cause of entanglement.

Marine Contaminants

The primary consequence from the exposure of murrelets to contaminants is reproductive impairment. Reproduction can be impacted by food web bioaccumulation of organochlorine pollutants and heavy metals discharged into marine areas where murrelets feed and prey species concentrate (Fry 1995). However, murrelet exposure is likely a rare event because murrelets have widely dispersed foraging areas and they feed extensively on transient juvenile and subadult midwater fish species that are expected to have low pollutant loads (McShane et al. 2004). The greatest exposure risk to murrelets may occur at regular feeding areas near major pollutant sources, such as those found in Puget Sound (McShane et al. 2004).

Disturbance

In coastal and offshore marine environments, vehicular disturbance (e.g., boats, airplanes, personal watercraft) is known to elicit behavioral responses in murrelets of all age classes (Kuletz 1996; Speckman 1996; Nelson 1997). Aircraft flying at low altitudes and boating activity, in particular motorized watercraft, are known to cause murrelets to dive and are thought to especially affect adults holding fish (Nelson 1997). It is unclear to what extent this kind of disturbance affects the distribution, movements, foraging efficiency, and overall fitness of

murrelets. However, it is unlikely this type of disturbance has decreased since 1992 because the shipping traffic and recreational boat use in the Puget Sound and Strait of Juan de Fuca has continued to increase.

Marine projects that include seismic exploration, pile driving, detonation of explosives and other activities that generate percussive sounds can expose murrelets to elevated underwater sound pressure levels (SPLs). High underwater SPLs can have adverse physiological and neurological effects on a wide variety of vertebrate species (Yelverton et al. 1973; Yelverton and Richmond 1981; Steevens et al. 1999; Fothergill et al. 2001; Cudahy and Ellison 2002; U.S. Department of Defense 2002; Popper 2003). High underwater SPLs are known to injure and/or kill fish by causing barotraumas (pathologies associated with high sound levels including hemorrhage and rupture of internal organs), as well as causing temporary stunning and alterations in behavior (Turnpenny and Nedwell 1994; Turnpenny et al. 1994; Popper 2003; Hastings and Popper 2005). During monitoring of seabird response to pile driving in Hood Canal, Washington, a pigeon guillemot (*Cepphus columba*) was observed having difficulty getting airborne after being exposed to underwater sound from impact pile driving (Entranco and Hamer Environmental 2005). In controlled experiments using underwater explosives, rapid change in SPLs caused internal hemorrhaging and mortality in submerged mallard ducks (*Anas platyrhnchos*) (Yelverton et al. 1973). Risk of injury appears related to the effect of rapid pressure changes, especially on gas filled spaces in the bodies of exposed organisms (Turnpenny et al. 1994). In studies on ducks (*Anas spp.*) and a variety of mammals, all species exposed to underwater blasts had injuries to gas filled organs including eardrums (Yelverton and Richmond 1981). These studies indicate that similar effects can be expected across taxonomical species groups.

Physical injury may not result in immediate mortality. If an animal is injured, death may occur several hours or days later, or injuries may be sublethal. Sublethal injuries can interfere with the ability of an organism to carry out essential life functions such as feeding and predator avoidance. Diving birds are able to detect and alter their behavior based on sound in the underwater environment (Ross et al. 2001) and elevated underwater SPLs may cause murrelets to alter normal behaviors, such as foraging. Disturbance related to elevated underwater SPLs may reduce foraging efficiency resulting in increased energetic costs to all murrelet age classes in the marine environment and may result in fewer deliveries or lower quality food being delivered to nestlings.

Threats in the Terrestrial Environment

Habitat

Extensive harvest of late-successional and old-growth forest was the primary reason for listing the murrelet as threatened. Due primarily to extensive timber cutting over the past 150 years, at least 82 percent of the old-growth forests existing in western Washington and Oregon prior to the 1840s have been harvested (Teensma et al. 1991; Booth 1991; Ripple 1994; Perry 1995). About 10 percent of pre-settlement old-growth forests remain in western Washington (Norse 1990; Booth 1991). Although the Northwest Forest Plan has reduced the rate of habitat loss on Federal lands, the threat of continued loss of suitable nesting habitat remains on Federal and non-Federal

lands through timber harvest and natural events such as wildfire, insect outbreaks, and windthrow.

Natural disturbance has the potential to affect the amount and quality of murrelet nesting habitat. Wildfire and windthrow result in immediate loss of habitat and can also influence the quality of adjacent habitat. Global warming, combined with long-term fire suppression on Federal lands, may result in higher incidences of stand-replacing fires in the future (McShane et al. 2004). As forest fragmentation increases, the threat of habitat loss due to windthrow is likely to increase. In addition, insects and disease can kill complete stands of habitat and can contribute to hazardous forest fire conditions.

Between 1992 and 2003, the loss of suitable murrelet habitat totaled 22,398 acres in Washington, Oregon, and California combined, of which 5,364 acres resulted from timber harvest and 17,034 acres resulted from natural events (McShane et al. 2004). The data presented by McShane represented losses primarily on Federal lands, and did not include data for most private lands within the murrelets' range. Habitat loss and fragmentation is expected to continue in the near future, but at an uncertain rate (McShane et al. 2004). Raphael et al. (2006) recently completed a change analysis for marbled murrelet habitat on both Federal and non-Federal lands for the period from 1992 to 2003, based on stand disturbance map data developed by Healey et al. (2003). Raphael et al. (2006) estimated that habitat loss ranging from 60,000 acres up to 278,000 acres has occurred across the listed range of the species, with approximately 10 percent of habitat loss occurring on Federal lands, and 90 percent occurring on non-Federal lands. The variation in the acreage estimates provided by Raphael et al. (2006) are dependant upon the habitat model used (Table 3) to evaluate habitat change over time.

Gains in suitable nesting habitat are expected to occur on Federal lands over the next 40 to 50 years, but due to the extensive historic habitat loss and the slow replacement rate of murrelets and their habitat, the species is potentially facing a severe reduction in numbers in the coming 20 to 100 years (USFS and USBLM 1994a; Beissinger 2002). In addition to direct habitat removal, forest management practices can fragment murrelet habitat; this reduces the amount and heterogeneous nature of the habitat, reduces the forest patch sizes, reduces the amount of interior or core habitat, increases the amount of forest edge, isolates remaining habitat patches, and creates "sink" habitats (McShane et al. 2004). There are no estimates available for the amount of suitable habitat that has been fragmented or degraded since 1992. However, the ecological consequences of these habitat changes to murrelets can include effects on population viability and size, local or regional extinctions, displacement, fewer nesting attempts, failure to breed, reduced fecundity, reduced nest abundance, lower nest success, increased predation and parasitism rates, crowding in remaining patches, and reductions in adult survival (Raphael et al. 2002).

Predation

Predation is expected to be the principal factor limiting murrelet reproductive success and nest site selection (Ralph et al. 1995; Nelson and Hamer 1995a). Murrelets are believed to be highly vulnerable to nest predation compared to other alcids and forest nesting birds (Nelson and Hamer 1995a; USFWS 1997b). Murrelets have no protection at nest sites other than the ability to

remain hidden. Nelson and Hamer (1995a) hypothesized that small increases in murrelet predation will have deleterious effects on murrelet population viability due to their low reproductive rate (one egg clutches).

Known predators of adult murrelets in the forest environment include the peregrine falcon (*Falco peregrinus*), sharp-shinned hawk (*Accipiter striatus*), common raven (*Corvus corax*), northern goshawk (*Accipiter gentilis*), and bald eagle (*Haliaeetus leucocephalus*). Common ravens and Stellar's jays (*Cyanocitta stelleri*) are known to take both eggs and chicks at the nest, while sharp-shinned hawks have been found to take chicks. Common ravens account for the majority of egg depredation, as they appear to be the only predator capable of flushing incubating or brooding adults from a nest (Nelson and Hamer 1995a). Suspected nest predators include great horned owls (*Bubo virginianus*), barred owls (*Strix varia*), Cooper's hawks (*Accipiter cooperi*), northwestern crows (*Corvus caurinus*), American crows (*Corvus brachyrhynchos*), and gray jays (*Perisoreus canadensis*) (Nelson and Hamer 1995a; Nelson 1997; Manley 1999). Predation by squirrels and mice has been documented at artificial nests and these animals cannot be discounted as potential predators on eggs and chicks (Luginbuhl et al. 2001; Raphael et al. 2002; Bradley and Marzluff 2003).

Losses of eggs and chicks to avian predators have been determined to be the most important cause of nest failure (Nelson and Hamer 1995a; McShane et al. 2004). The risk of predation by avian predators appears to be highest in complex structured landscapes in proximity to edges and human activity, where many of the corvid (e.g., crows, ravens) species are in high abundance. Predation rates are influenced mainly by habitat stand size, habitat quality, nest placement (on the edge of a stand versus the interior of a stand), and proximity of the stand to human activity centers. The quality of murrelet nest habitat decreases in smaller stands because forest edge increases in relation to the amount of interior forest, while forest stands near human activity centers (less than 0.62 mi or 1 km), regardless of size, are often exposed to a higher density of corvids due to their attraction to human food sources (Marzluff et al. 2000). The loss of nest contents to avian predators increases with habitat fragmentation and an increase in the ratio of forest edge to interior habitat (Nelson and Hamer 1995a; McShane et al. 2004). For example, Nelson and Hamer (1995a) found successful nests were farther from edges (greater than 55 m) and were better concealed than unsuccessful nests.

The abundance of several corvid species has increased dramatically in western North America as a result of forest fragmentation, increased agriculture, and urbanization (McShane et al. 2004). It is reasonable to infer that as predator abundance has increased, predation on murrelet chicks and eggs has also increased, and murrelet reproductive success has decreased. It is also reasonable to assume that this trend will not be interrupted or reversed in the near future, as forest fragmentation, agriculture, and urbanization continue to occur.

Other Threats

Murrelets are subject to additional threats from diseases, genetics, low population numbers, and low immigration rates. To date, inbreeding (mating between close genetic relatives) and/or hybridizing (breeding with a different species or subspecies) have not been identified as threats to murrelet populations. However, as abundance declines, a corresponding decrease in the

resilience of the population to disease, inbreeding or hybridization, and other perturbations may occur. Additionally, murrelets are considered to have low recolonization potential because their low immigration rate makes the species slow to recover from local disturbances (McShane et al. 2004).

The emergence of fungal, parasitic, bacterial, and viral diseases has affected populations of seabirds in recent years. West Nile virus disease has been reported in California which is known to be lethal to seabirds. While the amount of negative impact this disease may bring is unknown, researchers agree that it is only a matter of time before West Nile virus reaches the Washington seabird population. Effects for murrelets from West Nile virus and other diseases are expected to increase in the near future due to an accumulation of stressors such as oceanic temperature changes, overfishing, and habitat loss (McShane et al. 2004).

Murrelets may be sensitive to human-caused disturbance due to their secretive nature and their vulnerability to predation. There are little data concerning the murrelet's vulnerability to disturbance effects, except anecdotal researcher observations that indicate murrelets typically exhibit a limited, temporary behavioral response (if any) to noise disturbance at nest sites and are able to adapt to auditory stimuli (Long and Ralph 1998; Golightly et al. 2002; Singer et al. 1995 in McShane et al. 2004). In general, responses to auditory stimuli at nests sites have been modifications of posture and on-nest behaviors (Long and Ralph 1998). While the unique breeding biology of the murrelet is not conducive to comparison of the reproductive success of other species, studies on other alcid and seabird species have revealed detrimental effects of disturbance to breeding success and the maintenance of viable populations (Cairns 1980; Pierce and Simons 1986; Piatt et al. 1990; Beale and Monaghan 2004).

Research on a variety of other species, including other seabirds, indicate an animal's response to disturbance follows the same pattern as its response to encountering predators, and anti-predator behavior has a cost to other fitness enhancing activities, such as feeding and parental care (Frid and Dill 2002). Some authors indicate disturbance stimuli can directly affect the behavior of individuals and indirectly affect fitness and population dynamics through increased energetic costs (Carney and Sydeman 1999; Frid and Dill 2002). Responses by murrelet adults and chicks to calls from corvids and other potential predators include no response, alert posturing, aggressive attack, and temporarily leaving a nest (adults only) (McShane et al. 2004). However, the most typical behavior of chicks and adults in response to the presence of a potential predator is to flatten against a tree branch and remain motionless (Nelson and Hamer 1995a; McShane et al. 2004). Therefore, researcher's anecdotal observations of little or no physical response by murrelets are consistent with the behavior they will exhibit in response to a predator. In addition, there may have been physiological responses researchers cannot account for with visual observations. Corticosterone studies have not been conducted on murrelets, but studies on other avian species indicate chronic high levels of this stress hormone may have negative consequences on reproduction or physical condition (Wasser et al. 1997; Kitaysky et al. 2001; Marra and Holberton 1998 in McShane et al. 2004).

Although detecting effects of sub-lethal noise disturbance at the population level is hindered by the breeding biology of the murrelet, the effect of noise disturbance on murrelet fitness and reproductive success should not be completely discounted (McShane et al. 2004). In recently

completed analyses, the Service concluded the potential for injury associated with disturbance (visual and sound) to murrelets in the terrestrial environment includes flushing from the nest, aborted feeding, and postponed feedings (USFWS 2003a). These responses by individual murrelets to disturbance stimuli can reduce productivity of the nesting pair, as well as the entire population (USFWS 1997b).

Conservation Needs

The Recovery Plan outlines the conservation strategy for the species. In the short-term, specific actions necessary to stabilize the population include maintaining occupied habitat, maintaining large blocks of suitable habitat, maintaining and enhancing buffer habitat, decreasing risks of nesting habitat loss due to fire and windthrow, reducing predation, and minimizing disturbance.

Long-term conservation needs include increasing productivity (abundance, the ratio of juveniles to adults, and nest success) and population size; increasing the amount (stand size and number of stands), quality, and distribution of suitable nesting habitat; protecting and improving the quality of the marine environment; and reducing or eliminating threats to survivorship by reducing predation in the terrestrial environment and anthropogenic sources of mortality at sea. The Service estimates recovery of the murrelet will require at least 50 years (USFWS 1997b).

The Recovery Plan states that four of the six Conservation Zones (Zones) must be functional in order to effectively recover the murrelet in the short- and long-term; that is, to maintain viable populations that are well-distributed. However, based on the new population estimates, it appears only three of the Zones contain relatively robust numbers of murrelets (Zones 1, 3, and 4). Zones 1 and 4 contain the largest number of murrelets compared to the other four Zones. This alone would seem to indicate a better condition there, but areas of concern remain. For example, the population in Zone 4 was impacted when oil spills killed an estimated 10 percent of the population (Bentivoglio et al. 2002; Ford et al. 2002), small oil spills continue to occur in Zone 1, and the juvenile ratios in both of these Zones continue to be too low to establish stable or increasing populations (Beissinger and Peery, *in litt*., 2003).

Murrelets in Zones 3, 5, and 6 have suffered variously from past oil spills which killed a large number of murrelets (Zone 3) (Ford et al. 2001), extremely small population sizes (Zones 5 and 6), and alarmingly low reproductive rates (Zone 6) (Peery et al. 2002). These factors have brought the status of the species to a point where recovery in Zones 5 and 6 may be precluded (Beissinger 2002). The poor status of murrelet populations in the southern Zones emphasizes the importance of supporting murrelet populations in Zones 1 and 2 in order to preserve the opportunity to achieve murrelet recovery objectives.

Conservation Strategy

Marine Environment

Protection of marine habitat is a component of the recovery strategy. The main threat to murrelets in the marine environment is the loss of individuals through death or injury, generally associated with oil spills and gill-net entanglements. The recovery strategy recommends providing protection within marine waters in such a way as to reduce or eliminate murrelet mortality (USFWS 1997b). The recovery strategy specifically recommends protection within all waters of Puget Sound and Strait of Juan de Fuca, and within 1.2 mi of shore along the Pacific Coast from Cape Flattery to Willapa Bay. However, newer information indicates the majority of murrelet activity along the Washington Coast occurs within 5 mi (8 km) of shore (Raphael et al. 2007), suggesting that protections should be extended to encompass this area. Management strategies could include exclusion of vessels, stricter hull requirements, exclusion of net fisheries, or modification of fishing gear.

In Washington State, the Washington Fish and Game Commission requires the use of alternative gear (i.e., visual alerts within the upper 7 ft of a multifilament net), prohibits nocturnal and dawn fishing for all non-treaty gill-net fisheries, and closes areas to gill-net fishing in order to reduce by-catch of murrelets. The Olympic Coast National Marine Sanctuary was established in 1994 along the outer Washington coast from Cape Flattery south to approximately the Copalis River and extending between 25 mi and 40 mi offshore. Oil exploration and development are prohibited within this Sanctuary (NOAA 1993).

Terrestrial Habitat Management

The loss of nesting habitat (old-growth/mature forest) has generally been identified as the primary cause of the murrelet population decline and disappearance across portions of its range (Ralph et al. 1995). Logging, urbanization, and agricultural development have all contributed to the loss of habitat, especially at lower elevations.

The recovery strategy for the murrelet is contained within the Marbled Murrelet Recovery Plan (Recovery Plan) (USFWS 1997b) relies heavily on the Northwest Forest Plan (NWFP) to achieve recovery on Federal lands in Washington, Oregon, and California. However, the Recovery Plan also addresses the role of non-Federal lands in recovery, including Habitat Conservation Plans, State forest practices, and lands owned by Native American Tribes. The importance of non-Federal lands in the survival and recovery of murrelets is particularly high in Conservation Zones, where Federal lands, and privately held conservation lands (e.g., The Nature Conservancy Teal Slough, Ellsworth, Washington), within 50 mi of the coastline are sparse, such as the southern half of Conservation Zone 2.

Lands considered essential for the recovery of the murrelet within Conservation Zones 1 and 2 are 1) any suitable habitat in a Late Successional Reserve (LSR), 2) all suitable habitat located in the Olympic Adaptive Management Area, 3) large areas of suitable nesting habitat outside of LSRs on Federal lands, such as habitat located in the Olympic National Park, 4) suitable habitat

on State lands within 40 mi of the coast, and 5) habitat within occupied murrelet sites on private lands (USFWS 1997b).

Northwest Forest Plan

When the U.S. Forest Service (USFS) and Bureau of Land Management incorporated the NWFP as the management framework for public lands, a long-term habitat management strategy for murrelets (USFS and USBLM 1994a; USFS and USBLM 1994b) was established. The NWFP instituted pre-project surveys of murrelet habitat in areas planned for timber harvest and the protection of existing habitat at sites determined through surveys to be occupied by murrelets.

In the short-term, all known-occupied sites of murrelets occurring on USFS or Bureau of Land Management lands under the NWFP are to be managed as Late Successional Reserves (LSRs). In the long-term, unsuitable or marginally suitable habitat occurring in LSRs will be managed, overall, to develop late-successional forest conditions, thereby providing a larger long-term habitat base into which murrelets may eventually expand. Thus, the NWFP approach offers both short-term and long-term benefits to the murrelet.

Over 80 percent of murrelet habitat on Federal lands in Washington occurs within land management allocations that protect the habitat from removal or significant degradation. Scientists predicted implementation of the NWFP would result in an 80 percent likelihood of achieving a well-distributed murrelet population on Federal lands over the next 100 years (USFS and USBLM 1994a). Although the NWFP offers protection of known-occupied murrelet sites, concerns over the lingering effects of the historic widespread removal of suitable habitat will remain until the habitat recovers to late-successional characteristics. Habitat recovery will require over 100 years in many LSRs.

Habitat Conservation Plans

Four Habitat Conservation Plans (HCP) addressing murrelets in Washington have been completed for private/corporate forest land managers within the range of the murrelet: West Fork Timber Corporation (Murray Pacific Corporation 1993; Murray Pacific Corporation 1995; USFWS 1995) (Mineral Tree Farm HCP); Plum Creek Timber Company (Plum Creek Timber Company, L.P. 1996; USFWS 1996a; Plum Creek Timber Company, L.P. 1999; USFWS 1999) (Cascades HCP; I-90 HCP); Port Blakely Tree Farms, L.P. (Port Blakely Tree Farms, L.P. 1996; USFWS 1996b) (R.B. Eddy Tree Farm HCP); and Simpson Timber Company (Simpson Timber Company 2000; USFWS 2000b) (Olympic Tree Farm HCP). Habitat Conservation Plans have also been completed for two municipal watersheds, City of Tacoma (USFWS 2001; Tacoma Public Utilities 2001) (Green River HCP) and City of Seattle (USFWS 2000a; City of Seattle 2001) (Cedar River HCP), and the Washington Department of Natural Resources (WDNR 1997; USFWS 1997a). The HCPs which address murrelets cover approximately 500,000 acres of non-Federal (private/corporate) lands, over 100,000 acres of municipal watershed, and over 1.6 million acres of State-managed lands. However, only a portion of these lands contain suitable murrelet habitat.

The WDNR HCP addresses murrelets in Conservation Zones 1 and 2. All of the others address murrelets in Conservation Zone 1. Most of the murrelet HCPs in Washington employ a consistent approach for murrelets by requiring the majority of habitat to be surveyed prior to timber management. Only poor-quality marginal habitat (with a low likelihood of occupancy) is released for harvest without survey. All known occupied habitat is protected to varying degrees, but a "safe-harbor-like" approach is used to address stands which may be retained as, or develop into, suitable habitat and become occupied in the future. This approach would allow future harvest of habitat which is not currently nesting habitat.

Washington State Forest Practices Regulations

Under Washington Forest Practices Rules, which apply to all non-Federal lands not covered by an HCP (WFPB 2005), surveys for murrelets are required prior to the harvest of suitable nesting habitat. These criteria vary depending on the location of the stand. For stands found to be occupied or known to be previously occupied, the WDNR makes a decision to issue the permit based upon a significance determination. If a determination of significance is made, preparation of a State Environmental Policy Act Environmental Impact Statement is required prior to proceeding. If a determination of non-significance or mitigated determination of non-significance is reached, the action can proceed without further environmental assessment.

Tribal Management

The management strategy of the Bureau of Indian Affairs for the murrelet focuses on working with Tribal governments on a government-to-government basis to develop management strategies for reservation lands and trust resources. The Bureau of Indian Affairs' management strategy typically focus on avoiding harm to murrelets when feasible, to facilitate the trust responsibilities of the United States. However, other factors must be considered. Strategies must foster Tribal self-determination, and must balance the needs of the species and the environmental, economic, and other objectives of Indian Tribes within the range of the murrelet (Renwald 1993). For example, one of the Bureau of Indian Affairs' main goals for murrelet protection includes assisting Native American Tribes in managing habitat consistent with tribal priorities, reserved Indian rights, and legislative mandates.

Summary

Demographic modeling results indicate murrelet populations are declining within each Conservation Zone and throughout the listed range. The juvenile to adult ratios observed at sea in the Conservation Zones are too low to obtain a stable population in any Conservation Zone, which indicates murrelet abundance in all Conservation Zones will continue to decline until reproductive success improves. In other words, there is insufficient recruitment of juveniles to sustain a murrelet population in the listed range of the species.

Some of the threats to the murrelet population may have been reduced as a result of the species' listing under the Act, such as the passage of the Oil Pollution Act and implementation of the NWFP. However, no threats have been reversed since listing and in some areas threats, such as predation and West Nile Virus, may be increasing or emerging. Threats continue to contribute to

murrelet population declines through adult and juvenile mortality and reduced reproduction. Therefore, given the current status of the species and background risks facing the species, it is reasonable to assume that murrelet populations in Conservation Zones 1 and 2 and throughout the listed range have little resilience to deleterious population-level effects and are at high risk of extirpation.

Considering the life history characteristics of the murrelet, with the aggregate effects of inland habitat loss and fragmentation and at-sea mortality, the species' capability to recover from lethal perturbations at the population or metapopulation (Conservation Zone) scale is extremely low. The low observed reproductive rates make the species highly susceptible to local extirpations when exposed to repeated perturbations at a frequency which exceeds the species' loss-replacement rate. Also troublesome is the ineffectiveness of recovery efforts at reversing the ongoing lethal consequences in all demographic classes from natural and anthropogenic sources. Despite the relatively long potential life span of adult murrelets, the annual metapopulation replacement rates needed for long-term metapopulation maintenance and stability is currently well below the annual rate of individuals being removed from each metapopulation. As a result, murrelet metapopulations are currently not self-sustaining or self-regulating.

Accordingly, the Service concludes the current environmental conditions for murrelets in the coterminous United States appear to be insufficient to support the long-term conservation needs of the species. Although information is not sufficient to determine whether murrelets are nesting at or near the carrying capacity in the remaining nest habitat, activities which degrade the existing conditions of occupied nest habitat or reduce adult survivorship and/or nest success of murrelets will be of greatest consequence to the species. Actions resulting in the further loss of occupied nesting habitat, mortality to breeding adults, eggs, or nestlings will reinforce the current murrelet population decline throughout the coterminous United States.

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STATUS OF DESIGNATED CRITICAL HABITAT: MARBLED MURRELET

Critical habitat is defined in section 3(5)(A) of the Act as "the specific area within the geographic area occupied by the species on which are found those physical and biological features essential to the conservation of the species, and that may require special management considerations or protection, and specific areas outside the geographical area occupied by a species at the time it is listed, upon determination that such areas are essential for the conservation of the species." The Act defines conservation as the procedures necessary to bring about the eventual recovery and delisting of a listed species.

Legal Status

The final rule designating critical habitat for the murrelet (61 FR 26256 [May 24, 1996]) became effective on June 24, 1996. Critical habitat was designation for the murrelet to addresses the objective of stabilizing population size. The principle factors affecting the murrelet and the main cause of its population decline has been the loss of older forests and associated nest sites and habitat fragmentation (57 FR 45328:45330 [October 1, 1992]). The selection criteria considered in choosing areas for inclusion in murrelet critical habitat included 1) suitable nesting habitat, 2) survey data, 3) proximity to marine foraging habitat, 4) large, contiguous blocks of nesting habitat, 5) opportunities to maintain current distribution, and 6) adequacy of existing protection and management.

Primary Constituent Elements

Primary constituent elements are the physical and biological features of critical habitat essential to a species' conservation. In the 1996 final rule designating critical habitat for the murrelet (61 FR 26255:26246 [May 24, 1996]), the Service identified two primary constituent elements (PCEs) essential to provide and support suitable nesting habitat for successful reproduction. These are 1) individual trees with potential nesting platforms (PCE 1), and 2) all forested areas, regardless of contiguity, within 0.5 mi of individual trees with potential nesting platforms and a canopy height of at least one-half the site-potential tree height (PCE 2). Areas with just PCE 1, or both PCE 1 and 2 are, by definition, considered to be critical habitat. These PCEs were deemed essential for providing suitable nesting habitat for successful reproduction of the murrelet, and thus its conservation. PCEs require special management considerations.

Conservation Role of Critical Habitat

CHUs for murrelets are intended to maintain a well-distributed population. Murrelet critical habitat was designated based on the identification of six criteria. These include 1) suitable nesting habitat, 2) survey data, 3) proximity to marine foraging habitat, 3) large contiguous blocks of nesting habitat, 5) rangewide distribution, and 6) adequacy of existing protection and management. In some areas, large blocks of Federal land can provide the necessary contribution for recovery of the species. However, in other areas, Federal ownership is limited and Federal lands alone cannot meet recovery needs to reverse the current population decline and maintain a well-distributed population.

Activities that May Affect PCEs

The final rule (61 FR 26255:26271[May 24, 1996]) states that "A variety of ongoing or proposed activities that disturb or remove primary constituent elements may adversely affect, though not necessarily 'adversely modify' murrelet critical habitat as that term is used in section 7 consultations. Examples of such activities include 1) forest management activities which greatly reduce stand canopy closure, appreciably alter the stand structure, or reduce the availability of nesting sites, 2) land disturbance activities such as mining, sand and gravel extraction, construction of hydroelectric facilities and road building, and 3) harvest of certain types of commercial forest products (e.g., moss and salal [*Gaultheria shallon*])." Ultimately, actions may alter PCEs if they remove or degrade forest habitat, or prevent or delay future attainment of suitable habitat.

Distribution of Critical Habitat

The designated CHUs are distributed more or less evenly across the range of the species in Washington and Oregon, and less so in California. At the time of listing, designated critical habitat lands included 695 of the over 807 known-occupied sites on Federal lands, and 218 of the 354 known-occupied sites on non-Federal lands. Sites in Redwood National Park in California had not been entered into the database at the time or listing. Further, the Service did not include the marine environment in critical habitat, but instead relied on other existing regulations for protection of this area.

Thirty-two critical habitat units (CHUs) totaling 3,887,800 acres were designated on Federal, state, county, city, and private lands in Washington, Oregon, and California (61 FR 26255:26269[May 24, 1996]) (Table 1). These individual units are coded by the state in which they occur and are individually numbered by unit and sub-unit (e.g., WA-01-a, OR-01-a, CA-01-a). The majority of these CHUs (78 percent) occur on Federal lands. In the selection of CHUs,

Table 1. Designated critical habitat by state, ownership, and land allocation.

State	Ownership	Land Allocation	Designated Critical Habitat (hectares)	Designated Critical Habitat (acres)
Washington	Federal Lands	Congressionally Withdrawn Lands	740	1,800
		Late Successional Reserves	485,680	1,200,200
		Federal Total	*486,240*	*1,202,000*
	Non-Federal Lands	State Lands	172,720	426,800
		Private Lands	1,020	2,500
		Non-Federal Total	*173,740*	*429,300*
		Washington's Overall Total	*659,980*	*1,631,300*
Oregon	Federal Lands	Late Successional Reserves	541,530	1,338,200
	Non-Federal Lands	State Lands	70,880	175,100
		County Lands	440	1,100
		Private Lands	350	900
California (Northern)	Federal Lands	Late Successional Reserves	193,150	477,300
	Non-Federal Lands	State Lands	71,040	175,500
		Private Lands	16,360	40,400
California (Central)	Non-Federal Lands	State Lands	14,080	34,800
		County Lands	3,200	8,000
		City Lands	400	1,000
		Private Lands	1,720	4,200
		Overall Total	*1,573,392*	*3,887,800*

there was a reliance on lands designated as Late Successional Reserves (LSRs) on Forest Service land. Most LSRs within the range of the murrelet in Washington, Oregon, and California were designated as critical habitat. LSRs, as described in the Northwest Forest Plan, are most likely to develop into large blocks of suitable murrelet nesting habitat given sufficient time.

Although most of the areas designated as murrelet critical habitat occur on Federal lands, the Service designated selected non-Federal lands that met the selection criteria. These lands occurred in areas where Federal lands were insufficient to provide suitable nesting habitat for the recovery of the species. On non-Federal lands, 21 percent of critical habitat acres occur on state lands, 1.2 percent on private lands, 0.2 percent on county lands, and 0.003 percent on city lands. CHUs do not include non-Federal lands covered by a legally operative incidental take permit for murrelets issued under section 10(a) of the Act (61 FR 26255:26278[May 24, 1996]). Therefore, critical habitat designations were excluded on state lands upon completion of the Habitat Conservation Plans that addresses conservation of the murrelet. State lands in Washington, Oregon and California currently operate under approved Habitat Conservation Plans.

Critical Habitat in Washington State

Washington contains 11 CHUs that total approximately 1,206,000 acres (Appendix A) (excluding 426,800 acres of State land managed under a WDNR HCP). The acreage of land protected by critical habitat and the WDNR HCP represents 42 percent of critical habitat within

the listed range. Each CHU is made up of between two and seven subunits that range from 191 acres to over 100,000 acres in size. Also, CHUs range between 9 to 53 percent potential nesting habitat.

In Washington State, there is a clear reliance on Federal lands to fulfill the functions for which critical habitat was designated. Eight CHUs contain exclusively Federal lands while one contains both Federal and private lands. These nine CHUs contain 78 percent of the total acreage of CHUs in Washington State. Critical habitat functions are also met by Federal lands not designated as critical habitat in National Parks, Wilderness Areas, and portions of Forest Service lands designated as Adaptive Management Areas and Matrix lands that were found to be occupied by murrelets.

Current Condition of Critical Habitat in Washington

The quality of forests occurring within the boundaries of the CHUs ranges from non-habitat (e.g., young plantations) to high-quality habitat (e.g., large blocks of old-growth forest). While significant amounts of high-quality murrelet habitat are present in some of the CHUs, much of the habitat in CHUs, particularly on non-Federal lands, is of lesser quality due to its occurrence in smaller, more fragmented blocks. Some of the highest quality murrelet habitat occurs in National Parks and designated Wilderness Areas where harvest historically has not occurred. Given the high quality of this habitat and reduced threat of habitat loss or modification due to management objectives, designation of critical habitat was deemed unnecessary in National Parks and Wilderness Areas.

We estimate that an insignificant amount of critical habitat has been removed or downgraded as a result of section 7 consultations. In Washington, there has been almost no loss of critical habitat due to timber harvest or major fires. The majority of critical habitat loss has been through landslides and blow-down. In Washington, section 7 consultations are based on the amounts of critical habitat addressed in the final rule. The Service is currently in the process of assessing the current condition of murrelet critical habitat in Oregon and California.

Summary

Murrelet critical habitat was designated in 1996 due to the high rate of nesting habitat loss and fragmentation. The objective of the designation was to stabilize the murrelet population size. Washington contains 11 CHUs and totals 1,204,000 acres, the majority of which is on Federal land. The Service identified two primary constituent elements for the CHU, specifically 1) individual trees with potential nesting platforms, and 2) forested areas within 0.5 mi of individual trees with potential nesting platforms and a canopy height of at least one-half the site-potential tree height. Most of the areas designated as murrelet critical habitat occur on Federal land. The highest quality critical habitat occurs on National Parks and Wilderness areas where harvest historically has not occurred. Designating critical habitat in these areas was deemed unnecessary.

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Appendix A

Murrelet Critical Habitat Units (CHU) and Sub-Units in Washington (excludes land under WDNR HCP).

CHU Name	Total Acres in CHU	Total Acres of Potential MAMU Nesting Habitat (2003)	Percent of CHU with Potential MAMU Habitat	Ownership
WA-01-a	60,454	20,286	34%	LSR
WA-01-b	8,200	3,687	45%	LSR
WA-02-a	15,941	8,373	53%	LSR
WA-02-b	1,982	803	40%	LSR
WA-02-c	46,342	21,821	47%	LSR
WA-02-d	412	125	30%	LSR
WA-03-a	97,834	35,045	36%	LSR
WA-03-b	64,993	18,734	29%	LSR
WA-05-b	401	111	28%	PRIVATE
WA-05-c	297	27	9%	PRIVATE
WA-05-d	327	42	13%	PRIVATE
WA-05-f	191	28	15%	PRIVATE
WA-05-g	218	50	23%	PRIVATE
WA-06-a	71,536	22,002	31%	LSR
WA-06-b	44,195	17,137	39%	LSR
WA-07-a	78,133	19,052	24%	LSR
WA-07-b	1,075	286	27%	PRIVATE
WA-07-c	88,699	35,592	40%	LSR
WA-07-d	24,112	9,290	39%	LSR
WA-08-a	85,202	28,082	33%	LSR
WA-08-b	20,399	7,757	38%	LSR
WA-09-a	1,826	761	42%	CWD (Navy)
WA-09-b	108,074	47,882	44%	LSR
WA-09-c	6,918	3,018	44%	LSR
WA-09-d	13,051	4,039	31%	LSR
WA-09-e	48,827	16,488	34%	LSR
WA-10-a	76,586	23,874	31%	LSR
WA-10-b	41,953	14,391	34%	LSR
WA-10-c	25,706	11,033	43%	LSR
WA-11-a	72,196	13,665	19%	LSR
WA-11-b	11,139	1,375	12%	LSR
WA-11-c	37,572	7,029	19%	LSR
WA-11-d	51,360	9,320	18%	LSR
Totals	**1,206,153**	**401,204**	**Average: 33%**	

STATUS OF THE NORTHERN SPOTTED OWL

Legal Status

The northern spotted owl *(Strix occidentalis caurina)* (spotted owl) was listed as federally threatened on June 26, 1990 under the ESA. It was listed due to widespread habitat loss across its entire range and the inadequacy of existing regulatory mechanisms to provide for its conservation (55 FR 26114-26194).

Life History

Taxonomy

The northern spotted owl is one of three subspecies of spotted owls currently recognized by the American Ornithologists' Union. The taxonomic separation of these three subspecies is supported by genetic (Barrowclough and Gutiérrez 1990; Barrowclough et al. 1999; Haig et al. 2004), morphological (Gutiérrez et al. 1995), and biogeographic information (Barrowclough and Gutiérrez 1990). The distribution of the Mexican subspecies (*S. o. lucida*) is separate from those of the northern and California (*S. o. occidentalis*) subspecies (Gutiérrez et al. 1995). Recent studies analyzing mitochondrial DNA sequences (Chi et al. 2004; Gutierrez and Barrowclough 2005; Haig et al. 2004) and microsatellites (Henke et al. 2005) confirmed the validity of the current subspecies designations for northern and California spotted owls. The narrow hybrid zone between these two subspecies, which is located in the southern Cascades and northern Sierra Nevadas, appears to be stable (Gutierrez and Barrowclough 2005).

Physical Description

The spotted owl is a medium-sized owl, approximately 18-19 in (46-48 cm) in length and approximately 1.1-1.9 lbs (490-850 gm) in weight (Gutiérrez et al. 1995), and is the largest of the three subspecies (Gutiérrez et al. 1995). It is dark brown with a barred tail and white spots on the head and breast, and has dark brown eyes that are surrounded by prominent facial disks. Three age classes can be distinguished on the basis of plumage characteristics (Forsman 1981; Moen et al. 1991). The spotted owl superficially resembles the barred owl (*Strix varia*), a species with which it occasionally hybridizes (Kelly et al. 2003). Hybrids exhibit characteristics of both species (Hamer et al. 1994).

Current and Historical Range

The current range and distribution of the spotted owl extends from southern British Columbia through western Washington, Oregon, and California as far south as Marin County (USFWS 1990). The southeastern boundary of its range is the Pit River area of Shasta County, California. The range of the spotted owl is partitioned into 12 physiographic provinces (provinces), based upon recognized landscape subdivisions exhibiting different physical and environmental features (Thomas et al. 1993a). These provinces are distributed across the range as follows:

- Four provinces in Washington: Eastern Washington Cascades, Olympic Peninsula, Western Washington Cascades, Western Washington Lowlands

- Five provinces in Oregon: Oregon Coast Range, Willamette Valley, Western Oregon Cascades, Eastern Oregon Cascades, Oregon Klamath

- Three provinces in California: California Coast, California Klamath, California Cascades

The current range of the spotted owl is similar to its historical range where forested habitat still exists. The distribution of habitat is influenced by the natural and human-caused fragmentation of vegetation and natural topography. The spotted owl has been extirpated or is uncommon in certain areas. For instance, there have only been a few nesting pairs in southwestern Washington for a number of years, although they have persisted there for the past decade. Timber harvest activities have eliminated, reduced, or fragmented spotted owl habitat and decreased overall population densities across its range, particularly within the coastal provinces where habitat reduction has been concentrated (Thomas et al. 1993b).

Behavior

Spotted owls are territorial. However, home ranges of adjacent pairs overlap (Forsman et al. 1984; Solis and Gutiérrez 1990)) suggesting that the area defended is smaller than the area used for foraging. Territorial defense is primarily effected by hooting, barking and whistle type calls. Some spotted owls are not territorial but either remain as residents within the territory of a pair or move among territories (Gutiérrez 1996). These birds are referred to as "floaters." Floaters have special significance in spotted owl populations because they may buffer the territorial population from decline (Franklin 1992). Little is known about floaters other than that they exist and typically do not respond to calls as vigorously as territorial birds (Gutiérrez 1996).

Spotted owls are monogamous and usually form long-term pair bonds. "Divorces" occur but are relatively uncommon. There are no known examples of polygyny in this owl, although associations of three or more birds have been reported (Gutiérrez et al. 1995).

<u>Habitat Relationships</u>

Home Range

Spotted owl home range size varies by province. Home range size generally increases from south to north, which is likely in response to differences in habitat quality (USFWS 1990). Home range size has been linked to habitat type, availability, and abundance of prey (Zabel et al. 1995).

Based on available radio-telemetry data (Thomas et al. 1990), the FWS estimated median annual home range size for the spotted owl by province throughout its range. Because the actual configuration of the home range is rarely known, the estimated home range of a spotted owl pair is represented by a circle centered upon a spotted owl activity center, with an area approximating the provincial median annual home range. For example, estimated home range area varies from

3,340 acres (based on a 1.3-mile radius area) in California to 14,271 acres (based on a 2.7-mile radius circle) in Washington. The FWS uses a 0.7-mile radius circle (984 acres) to delineate the area most heavily used (core area) by spotted owls during the nesting season. Variation in the size of the actual core area also varies geographically. For example, spotted owls in northern California focused their activities in core areas that ranged from about 167 to 454 acres, with a mean of about 409 acres; approximately half the area of the 0.7-mile radius circle (Bingham and Noon 1997). Spotted owls maintain smaller home ranges during the breeding season and often dramatically increase their home range size during fall and winter (Forsman et al. 1984; Sisco 1990).

Although differences exist in natural stand characteristics that influence provincial home range size, habitat loss and forest fragmentation effectively reduce habitat quality in the home range. A reduction in the amount of suitable habitat reduces spotted owl abundance and nesting success (Bart 1995; Bart and Forsman 1992).

Habitat Use

Forsman et al. (1984) reported that spotted owls have been observed in the following forest types: Douglas-fir (*Pseudotsuga menziesii*), western hemlock (*Tsuga heterophylla*), grand fir (*Abies grandi*s), white fir (*Abies concolor*), ponderosa pine (*Pinus ponderosa*), Shasta red fir (*Abies magnifica shastensis*), mixed evergreen, mixed conifer hardwood (Klamath montane), and redwood (*Sequoia sempervirens*). In parts of the Oregon Coast Range, spotted owls have been recorded in pure hardwood stands (Glenn et al. 2004). In California, spotted owls are found from near sea level in coastal forests to approximately 6,988 ft (2,130 m) in the Cascades (Gutiérrez 1996). The upper elevation limit at which spotted owls occur decreases gradually with increasing latitude in Oregon and Washington (Lint 2005). In all areas, the upper elevation limit at which spotted owls occur corresponds to the transition to subalpine forest, which is characterized by relatively simple structure and severe winter weather (Gutiérrez 1996).

Roost sites selected by spotted owls have more complex vegetation structure than forests generally available to them (Barrows and Barrows 1978; Forsman et al. 1984; Solis and Gutiérrez 1990). These habitats are usually multi-layered forests having high canopy closure and large diameter trees in the overstory.

Spotted owls nest almost exclusively in trees. Like roosts, nest sites are found in forests having complex structure dominated by large diameter trees (Forsman et al. 1984; Hershey et al. 1998). Even in forests that have been previously logged, spotted owls select forests having a structure (i.e., larger trees, greater canopy closure) different than forests generally available to them (Buchanan et al. 1995; Folliard 1993; Hershey et al. 1998).

Foraging habitat is the most variable of all habitats used by territorial spotted owls (Thomas et al. 1990). Descriptions of foraging habitat have ranged from complex structure (Solis and Gutiérrez 1990) to forests with lower canopy closure and smaller trees than forests containing nests or roosts (Gutiérrez 1996).

Dispersal habitat, at a minimum, consists of stands with adequate tree size and canopy closure to provide protection from avian predators and at least minimal foraging opportunities (USFWS 1992). Although Forsman et al. (2002) found that spotted owls could disperse through highly fragmented forest landscapes, the stand-level and landscape-level attributes of forests needed to facilitate successful dispersal have not been thoroughly evaluated (Buchanan 2004).

Habitat Selection

Spotted owls generally rely on older forested habitats because they contain the structures and characteristics required for nesting, roosting, foraging, and dispersal. These characteristics include the following: 1) a multi-layered, multi-species canopy dominated by large overstory trees, 2) moderate to high canopy closure, 3) a high incidence of trees with large cavities and other types of deformities, especially dwarf mistletoe brooms, 4) numerous large snags, 5) an abundance of large, dead wood on the ground, and 6) open space within and below the upper canopy for spotted owls to fly (Thomas et al. 1990; USFWS 1990). Forested stands with high canopy closure also provide thermal cover (Weathers et al. 2001), as well as protection from predation. Recent landscape-level analyses in portions of the Klamath Province suggest that a mosaic of late-successional habitat interspersed with other vegetation types may benefit spotted owls more than large, homogeneous expanses of older forests (Franklin et al. 2000; Meyer et al. 1998; Zabel et al. 2003).

Spotted owls may be found in younger forest stands that have the structural characteristics of older forests or retained structural elements from the previous forest. In redwood forests along the coast range of California, spotted owls may be found in younger forest stands with structural characteristics of older forests (Thomas et al. 1990). However, spotted owls do not generally appear to select for stands of intermediate or younger ages (Solis and Gutiérrez 1990; Thomas et al. 1990). Where spotted owls have been found nesting in young forest, such occurrences have been attributed to the presence of large residual trees with cavities (Buchanan et al. 1993), climatic conditions conducive to the use of platform nests (Forsman and Giese 1997), and/or alternate sources of prey that do not rely on cavities for reproduction (Zabel et al. 1995). In Washington, foraging occurs in nesting and roosting habitat, as well as in coniferous forest with smaller trees and less structural diversity, if prey such as the northern flying squirrel are present (Hanson et al. 1993).

In mixed conifer forests of the Eastern Cascade Mountains, Washington, 27 percent of nest sites were in old-growth forests, 57 percent in the understory reinitiation phase of forest stand development, and 17 percent in the stem exclusion phase of forest stand development (Buchanan et al. 1995). In the Western Cascade Mountains, Oregon, 50 percent of spotted owl nests were in late-seral/old-growth stands (greater than 80-years-old) and none were found in stands less than 40-years-old (Irwin et al. 2000).

In the Western Washington Cascade Mountains, spotted owls used mature/old forests dominated by trees greater than 20 in (50 cm) diameter-at-breast height with greater than 60 percent canopy closure more often than expected for roosting during the non-breeding season and used young forest trees 8 to 20 in (20 to 50 cm) diameter-at-breast height with greater than 60 percent canopy closure) less often than expected based on availability (Herter et al. 2002).

Habitat use is influenced by prey availability. Ward (1990) found that spotted owls foraged in areas that had lower variance in prey densities (prey were more predictable in occurrence) within older forests and near ecotones of old forest and brush seral stages. Zabel et al. (1995) showed that spotted owl home ranges are larger where flying squirrels are the predominant prey and, conversely, are smaller where woodrats (*Neotoma* spp.) are the predominant prey.

Recent landscape-level analyses in portions of Oregon Coast and California Klamath provinces suggest that a mosaic of late-successional habitat interspersed with other seral conditions may benefit spotted owls more than large, homogeneous expanses of older forests (Franklin et al. 2000; Meyer et al. 1998; Zabel et al. 2003). In Oregon Klamath and Western Oregon Cascade provinces, Dugger et al. (2005) found that apparent survival and reproduction was positively associated with the proportion of older forest near the territory center (within 730 meters) (2,395 feet). Survival decreased dramatically when the amount of non-habitat (non-forest areas, sapling stands, etc.) exceeded approximately 50 percent of the home range (Dugger et al. 2005). The authors concluded that they found no support for either a positive or negative direct effect of intermediate-aged forest—that is, all forest stages between sapling and mature, with total canopy cover greater than 40 percent—on either the survival or reproduction of spotted owls. It is unknown how these results were affected by the low habitat fitness potential in their study area, which Dugger et al. (2005) stated was generally much lower than those in Franklin et al. (2000) and Olson et al. (2004), and the low reproductive rate and survival in their study area, which they reported were generally lower than those studied by Anthony et al. (2006). Olson et al. (2004) found that reproductive rates fluctuated biennially and were positively related to the amount of edge between late-seral and mid-seral forests and other habitat classes in the central Oregon Coast Range. Olson et al. (2004) concluded that their results indicate that while mid-seral and late-seral forests are important to spotted owls, a mixture of these forest types with younger forest and non-forest may be best for spotted owl survival and reproduction in their study area.

Reproductive Biology

Spotted owls exhibit high adult annual survival rates and are relatively long-lived (Anthony et al. 2006). Spotted owls do not typically reach sexual maturity until after two years of age (Miller et al. 1985; Thomas et al. 1990). Adult females lay an average of 2 eggs per clutch with a range of 1 to 4 eggs. Spotted owl pairs do not typically nest every year, nor are nesting pairs successful every year (USFWS 1990). The small clutch size, temporal variability in nesting success, and somewhat delayed maturation all contribute to the relatively low reproductive rate of this species (Gutiérrez 1996).

Nest sites are usually located within stands of old-growth and late-successional forest dominated by Douglas-fir (*Pseudotsuga menziesii*), and they contain structures such as cavities, broken tree tops, or mistletoe (*Arceuthobium* spp.) brooms (Blakesley et al. 1992; Forsman et al. 1984; LaHaye and Gutiérrez 1999). Spotted owls do not build their own nests. Most nesting occurs within naturally formed cavities in live trees or snags, but abandoned platform nests of the northern goshawk (*Accipiter gentilis*) and common raven (*Corvus corax*) have also been used (Buchanan et al. 1993). In general, courtship and nesting behavior begins in February to March with nesting occurring from March to June; however, timing of nesting and fledging varies with

latitude and elevation (Forsman et al. 1984). After young fledge from the nest, they depend on their parents until they are able to fly and hunt on their own. Parental care continues post-fledging into September, and sometimes into October (Forsman et al. 1984). During this time the adults may not roost with their young during the day, but they respond to begging vocalizations by bringing food to the young (Forsman et al. 1984).

Dispersal Biology

Natal dispersal of spotted owls typically occurs in September and October with a few individuals dispersing in November and December (Forsman et al. 2002; Miller et al. 1997). Natal dispersal occurs in stages, with juveniles settling in temporary home ranges between bouts of dispersal (Forsman et al. 2002; Miller et al. 1997). The median natal dispersal distance is about 10 miles for males and 15.5 miles for females (Forsman et al. 2002). Dispersing juvenile spotted owls experience high mortality rates, exceeding 70 percent in some studies (Miller 1989; USFWS 1990). Known or suspected causes of mortality during dispersal include starvation, predation, and accidents (Forsman et al. 2002; Miller 1989; USFWS 1990). Parasitic infection may contribute to these causes of mortality, but the relationship between parasite loads and survival is poorly understood (Forsman et al. 2002; Gutiérrez 1989; Hoberg et al. 1989). Successful dispersal of juvenile spotted owls may depend on their ability to locate unoccupied suitable habitat in close proximity to other occupied sites (LaHaye et al. 2001).

There is little evidence that small openings in forest habitat influence the dispersal of spotted owls, but large, non-forested valleys such as the Willamette Valley apparently are barriers to both natal and breeding dispersal (Forsman et al. 2002). The degree to which water bodies, such as the Columbia River and Puget Sound, function as barriers to dispersal is unclear. Analysis of genetic structure of spotted owl populations suggests adequate rates of gene flow may occur across the Puget Trough between the Olympic Mountains and Washington Cascades and across the Columbia River between the Olympic Mountains and the Coast Range of Oregon (Haig et al. 2001). Both telemetry and genetic studies indicate inbreeding is rare.

In a study on habitat use by dispersing juvenile spotted owls in the Oregon Coast Range, Klamath and Western Oregon Cascades Provinces (Miller et al. 1997), mature and old-growth forest were used slightly more than expected based on availability during the transient phase and nearly twice its availability during the colonization phase. Closed pole-sapling-sawtimber habitat was used roughly in proportion to availability in both phases; open sapling and clearcuts were used less than expected based on availability during colonization.

Breeding dispersal occurs among a small proportion of adult spotted owls; these movements were more frequent among females and unmated individuals (Forsman et al. 2002). Breeding dispersal distances were shorter than natal dispersal distances and also apparently random in direction (Forsman et al. 2002).

Food Habits

Spotted owls are mostly nocturnal, although they also forage opportunistically during the day (Forsman et al. 1984; Sovern et al. 1994). The composition of the spotted owl's diet varies

geographically and by forest type. Generally, flying squirrels (*Glaucomys sabrinus*) are the most prominent prey for spotted owls in Douglas-fir and western hemlock (*Tsuga heterophylla*) forests (Forsman et al. 1984) in Washington and Oregon, while dusky-footed wood rats (*Neotoma fuscipes*) are a major part of the diet in the Oregon Klamath, California Klamath, and California Coastal provinces (Forsman et al. 2004; Forsman et al. 1984; Forsman et al. 2001; Hamer et al. 2001; Ward et al. 1998). Depending on location, other important prey include deer mice (*Peromyscus maniculatus*), tree voles (*Arborimus longicaudus, A. pomo*), red-backed voles (*Clethrionomys* spp.), gophers (*Thomomys* spp.), snowshoe hare (*Lepus americanus*), bushy-tailed wood rats (*Neotoma cinerea*), birds, and insects, although these species comprise a small portion of the spotted owl diet (Forsman et al. 1984) (Forsman et al. 2004; Hamer et al. 2001; Ward et al. 1998).

Other prey species such as the red tree vole (*Arborimus longicaudus*), red-backed voles (*Clethrionomys gapperi*), mice, rabbits and hares, birds, and insects) may be seasonally or locally important (reviewed by Courtney et al. 2004). For example, Rosenberg et al. (2003) showed a strong correlation between annual reproductive success of spotted owls (number of young per territory) and abundance of deer mice (*Peromyscus maniculatus*) (r2 = 0.68), despite the fact they only made up 1.6±0.5 percent of the biomass consumed. However, it is unclear if the causative factor behind this correlation was prey abundance or a synergistic response to weather (Rosenberg et al. 2003). Ward (1990) also noted that mice were more abundant in areas selected for foraging by owls. Nonetheless, spotted owls deliver larger prey to the nest and eat smaller food items to reduce foraging energy costs; therefore, the importance of smaller prey items, like *Peromyscus*, in the spotted owl diet should not be underestimated (Forsman et al. 2004; Forsman et al. 1984; Forsman et al. 2001).

Population Dynamics

The spotted owl is relatively long-lived, has a long reproductive life span, invests significantly in parental care, and exhibits high adult survivorship relative to other North American owls (Forsman et al. 1984; Gutiérrez et al. 1995). The spotted owl's long reproductive life span allows for some eventual recruitment of offspring, even if recruitment does not occur each year (Franklin et al. 2000).

Annual variation in population parameters for spotted owls has been linked to environmental influences at various life history stages (Franklin et al. 2000). In coniferous forests, mean fledgling production of the California spotted owl (Strix occidentalis occidentalis), a closely related subspecies, was higher when minimum spring temperatures were higher (North et al. 2000), a relationship that may be a function of increased prey availability. Across their range, spotted owls have previously shown an unexplained pattern of alternating years of high and low reproduction, with highest reproduction occurring during even-numbered years (e.g., Franklin et al. 1999). Annual variation in breeding may be related to weather (i.e., temperature and precipitation) (Forsman et al. 1996; Wagner et al. 1996; Zabel et al. 1996) and fluctuation in prey abundance (Zabel et al. 1996).

A variety of factors may regulate spotted owl population levels. These factors may be density-dependent (e.g., habitat quality, habitat abundance) or density-independent (e.g., climate).

Interactions may occur among factors. For example, as habitat quality decreases, density-independent factors may have more influence on survival and reproduction, which tends to increase variation in the rate of growth (Franklin et al. 2000). Specifically, weather could have increased negative effects on spotted owl fitness for those owls occurring in relatively lower quality habitat (Franklin et al. 2000). A consequence of this pattern is that at some point, lower habitat quality may cause the population to be unregulated (have negative growth) and decline to extinction (Franklin et al. 2000).

Olson et al. (2005) used open population modeling of site occupancy that incorporated imperfect and variable detectability of spotted owls and allowed modeling of temporal variation in site occupancy, extinction, and colonization probabilities (at the site scale). The authors found that visit detection probabilities average less than 0.70 and were highly variable among study years and among their three study areas in Oregon. Pair site occupancy probabilities declined greatly on one study area and slightly on the other two areas. However, for all owls, including singles and pairs, site occupancy was mostly stable through time. Barred owl presence had a negative effect on these parameters (see barred owl discussion in the New Threats section below). However, there was enough temporal and spatial variability in detection rates to indicate that more visits would be needed in some years and in some areas, especially if establishing pair occupancy was the primary goal.

Threats

Reasons for Listing

The spotted owl was listed as threatened throughout its range "due to loss and adverse modification of suitable habitat as a result of timber harvesting and exacerbated by catastrophic events such as fire, volcanic eruption, and wind storms" (55 FR 26114-26194). More specifically, significant threats to the spotted owl included the following: 1) low populations, 2) declining populations, 3) limited habitat, 4) declining habitat, 5) distribution of habitat or populations, 6) isolation of provinces, 7) predation and competition, 8) lack of coordinated conservation measures; and (9) vulnerability to natural disturbance (57 FR 1796-1838). These threats were characterized for each province as severe, moderate, low, or unknown. Declining habitat was recognized as a severe or moderate threat to the spotted owl in all 12 provinces, isolation of provinces within 11 provinces, and declining populations in 10 provinces. Consequently, these three factors represented the greatest concern range-wide to the conservation of the spotted owl. Limited habitat was considered a severe or moderate threat in nine provinces, and low populations a severe or moderate concern in eight provinces, suggesting that these factors are a concern throughout the majority of the range. Vulnerability to natural disturbances was rated as low in five provinces.

The degree to which predation and competition might pose a threat to the spotted owl was unknown in more provinces than any of the other threats, indicating a need for additional information. Few empirical studies exist to confirm that habitat fragmentation contributes to increased levels of predation on spotted owls (Courtney et al. 2004). However, great horned owls (*Bubo virginianus*), an effective predator on spotted owls, are closely associated with fragmented forests, openings, and clearcuts (Johnson 1992; Laidig and Dobkin 1995). As mature

forests are harvested, great horned owls may colonize fragmented forests, thereby increasing spotted owl vulnerability to predation.

New Threats

The Service conducted a 5-year review of the spotted owl in 1994 (USFWS 2004), for which the Service prepared a scientific evaluation of the status of the spotted owl (Courtney et al. 2004). An analysis was conducted assessing how the threats described in 1990 might have changed by 2004. Some of the key threats identified in 2004 are:

- "Although we are certain that current harvest effects are reduced, and that past harvest is also probably having a reduced effect now as compared to 1990, we are still unable to fully evaluate the current levels of threat posed by harvest because of the potential for lag effects…In their questionnaire responses…6 of 8 panel member identified past habitat loss due to timber harvest as a current threat, but only 4 viewed current harvest as a present threat" (Courtney et al. 2004: 11-7).

- "Currently the primary source of habitat loss is catastrophic wildfire, although the total amount of habitat affected by wildfires has been small (a total of 2.3% of the range-wide habitat base over a 10-year period)" (Courtney et al. 2004:11-8).

- "Although the panel had strong differences of opinion on the conclusiveness of some of the evidence suggesting [barred owl] displacement of [spotted owls], and the mechanisms by which this might be occurring, there was no disagreement that [barred owls] represented an operational threat. In the questionnaire, all 8 panel members identified [barred owls] as a current threat, and also expressed concern about future trends in [barred owl] populations." (Courtney et al. 2004:11-8)

Barred Owls

With its recent expansion to as far south as Marin County, California (Gutiérrez et al. 2004), the barred owl's range now completely overlaps that of the spotted owl. Barred owls may be competing with spotted owls for prey (Hamer et al. 2001) or habitat (Dunbar et al. 1991; Hamer et al. 1989; Herter and Hicks 2000; Pearson and Livezey 2003). In addition, barred owls physically attack spotted owls (Pearson and Livezey 2003), and circumstantial evidence strongly indicated that a barred owl killed a spotted owl (Leskiw and Gutiérrez 1998). Evidence that barred owls are causing negative effects on spotted owls is largely indirect, based primarily on retrospective examination of long-term data collected on spotted owls (Kelly et al. 2003; Olson et al. 2005; Pearson and Livezey 2003). It is widely believed, but not conclusively confirmed, that the two species of owls are competing for resources. However, given that the presence of barred owls has been identified as a negative effect while using methods designed to detect a different species (spotted owls), it seems safe to presume that the effects are stronger than estimated. Because there has been no research to quantitatively evaluate the strength of different types of competitive interactions, such as resource partitioning and competitive interference, the particular mechanism by which the two owl species may be competing is unknown.

Barred owls were initially thought to be more closely associated with early successional forests than spotted owls, based on studies conducted on the west slope of the Cascades in Washington (Hamer 1988; Iverson 1993). However, recent studies conducted in the Pacific Northwest show that barred owls frequently use mature and old-growth forests (Gremel 2005; Pearson and Livezey 2003; Schmidt 2006). In the fire prone forests of eastern Washington, a telemetry study conducted on barred owls showed that barred owl home ranges were located on lower slopes or valley bottoms, in closed canopy, mature, Douglas-fir forest, while spotted owl sites were located on mid-elevation areas with southern or western exposure, characterized by closed canopy, mature, ponderosa pine or Douglas-fir forest (Singleton et al. 2005).

The only study comparing spotted owl and barred owl food habits in the Pacific Northwest indicated that barred owl diets overlap strongly (76 percent) with spotted owl diets (Hamer et al. 2001). However, barred owl diets are more diverse than spotted owl diets and include species associated with riparian and other moist habitats, along with more terrestrial and diurnal species (Hamer et al. 2001).

The presence of barred owls has been reported to reduce spotted owl detectability, site occupancy, reproduction, and survival. Olson et al. (2005) found that the presence of barred owls had a significant negative effect on the detectability of spotted owls, and that the magnitude of this effect did not vary among years. The occupancy of historical territories by spotted owls in Washington and Oregon was significantly lower ($p < 0.001$) after barred owls were detected within 0.8 kilometer (0.5 miles) of the territory center but was "only marginally lower" ($p = 0.06$) if barred owls were located more than 0.8 kilometer (0.5 miles) from the spotted owl territory center (Kelly et al. 2003:51). Pearson and Livezey (2003) found that there were significantly more barred owl site-centers in unoccupied spotted owl circles than occupied spotted owl circles (centered on historical spotted owl site-centers) with radii of 0.8 kilometer (0.5 miles) ($p = 0.001$), 1.6 kilometer (1 mile) ($p = 0.049$), and 2.9 kilometer (1.8 miles) ($p = 0.005$) in Gifford Pinchot National Forest. In Olympic National Park, Gremel (2005) found a significant decline ($p = 0.01$) in spotted owl pair occupancy at sites where barred owls had been detected, while pair occupancy remained stable at spotted owl sites without barred owls. Olson et al. (2005) found that the annual probability that a spotted owl territory would be occupied by a pair of spotted owls after barred owls were detected at the site declined by 5 percent in the HJ Andrews study area, 12 percent in the Coast Range study area, and 15 percent in the Tyee study area.

Olson et al. (2004) found that the presence of barred owls had a significant negative effect on the reproduction of spotted owls in the central Coast Range of Oregon (in the Roseburg study area). The conclusion that barred owls had no significant effect on the reproduction of spotted owls in one study (Iverson 2004) was unfounded because of small sample sizes (Livezey 2005). It is likely that all of the above analyses underestimated the effects of barred owls on the reproduction of spotted owls because spotted owls often cannot be relocated after they are displaced by barred owls (E. Forsman,pers. comm., cited in USFWS 2008). Anthony et al. (2006) found significant evidence for negative effects of barred owls on apparent survival of spotted owls in two of 14 study areas (Olympic and Wenatchee). They attributed the equivocal results for most of their study areas to the coarse nature of their barred owl covariate.

In a recent analysis of more than 9,000 banded spotted owls throughout their range, only 47 hybrids were detected (Kelly and Forsman 2004). Consequently, hybridization with the barred owl is considered to be "an interesting biological phenomenon that is probably inconsequential, compared with the real threat—direct competition between the two species for food and space" (Kelly and Forsman 2004:808).

The preponderance of evidence suggests that barred owls are exacerbating the spotted owl population decline, particularly in Washington, portions of Oregon, and the northern coast of California (Gutiérrez et al. 2004; Olson et al. 2005). There is no evidence that the increasing trend in barred owls has stabilized in any portion of the spotted owl's range in the western United States, and "there are no grounds for optimistic views suggesting that barred owl impacts on spotted owls have been already fully realized" (Gutiérrez et al. 2004:7-38).

Wildfire

Studies indicate that the effects of wildfire on spotted owls and their habitat are variable, depending on fire intensity, severity and size. Within the fire-adapted forests of the spotted owl's range, spotted owls likely have adapted to withstand fires of variable sizes and severities. Bond et al. (2002) examined the demography of the three spotted owl subspecies after wildfires, in which wildfire burned through spotted owl nest and roost sites in varying degrees of severity. Post-fire demography parameters for the three subspecies were similar or better than long-term demographic parameters for each of the three subspecies in those same areas (Bond et al. 2002). In a preliminary study conducted by Anthony and Andrews (2004) in the Oregon Klamath Province, their sample of spotted owls appeared to be using a variety of habitats within the area of the Timbered Rock fire, including areas where burning had been moderate. In 1994, the Hatchery Complex fire burned 17,603 hectares in the Wenatchee National Forest in Washington's eastern Cascades, affecting six spotted owl activity centers (Gaines et al. 1997).

Spotted owl habitat within a 2.9-kilometer (1.8-mile) radius of the activity centers was reduced by 8 to 45 percent (mean = 31 percent) as a result of the direct effects of the fire and by 10 to 85 percent (mean = 55 percent) as a result of delayed mortality of fire-damaged trees and insects. Direct mortality of spotted owls was assumed to have occurred at one site, and spotted owls were present at only one of the six sites 1 year after the fire. In 1994, two wildfires burned in the Yakama Indian Reservation in Washington's eastern Cascades, affecting the home ranges of two radio-tagged spotted owls (King et al. 1997). Although the amount of home ranges burned was not quantified, spotted owls were observed using areas that burned at low and medium intensities. No direct mortality of spotted owls was observed, even though thick smoke covered several spotted owl site-centers for a week. It appears that, at least in the short term, spotted owls may be resilient to the effects of wildfire—a process with which they have evolved. More research is needed to further understand the relationship between fire and spotted owl habitat use.

At the time of listing there was recognition that large-scale wildfire posed a threat to the spotted owl and its habitat (USFWS 1990). New information suggests fire may be more of a threat than previously thought. In particular, the rate of habitat loss in the relatively dry East Cascades and Klamath provinces has been greater than expected (see "Habitat Trends" below). Moeur et al. (2005) suggested that 12 percent of late-successional forest rangewide would likely be negatively

impacted by wildfire during the first 5 decades of the Northwest Forest Plan. Currently, the overall total amount of habitat affected by wildfires has been relatively small (Lint 2005). It may be possible to influence through silvicultural management how fire prone forests will burn and the extent of the fire when it occurs. Silvicultural management of forest fuels are currently being implemented throughout the spotted owl's range, in an attempt to reduce the levels of fuels that have accumulated during nearly 100 years of effective fire suppression. However, our ability to protect spotted owl habitat and viable populations of spotted owls from large fires through risk-reduction endeavors is uncertain (Courtney et al. 2004). The NWFP recognized wildfire as an inherent part of managing spotted owl habitat in certain portions of the range. The distribution and size of reserve blocks as part of the NWFP design may help mitigate the risks associated with large-scale fire (Lint 2005).

West Nile Virus

West Nile Virus (WNV) has killed millions of wild birds in North America since it arrived in 1999 (Caffrey 2003; Marra et al. 2004; McLean et al. 2001). Mosquitoes are the primary carriers (vectors) of the virus that causes encephalitis in humans, horses, and birds. Mammalian prey may also play a role in spreading WNV among predators, like spotted owls. Owls and other predators of mice can contract the disease by eating infected prey (Garmendia et al. 2000; Komar et al. 2001). Recent tests of tree squirrels, including flying squirrels, from Los Angeles County, California, found over 70 percent were positive for WNV (R. Carney, Personal Communication, 2004, as cited in Courtney et al. 2004). One captive spotted owl in Ontario, Canada, is known to have contracted WNV and died.

Health officials expect that WNV will eventually spread throughout the range of the spotted owl (Courtney et al. 2004), but it is unknown how WNV will ultimately affect owl populations. Susceptibility to infection and mortality rates of infected individuals vary among bird species, even within groups (Courtney et al. 2004). Owls appear to be quite susceptible. For example, breeding screech owls (*Megascops asio*) in Ohio experienced 100 percent mortality (T. Grubb, Personal Communication, as cited in Courtney et al. 2004). Barred owls, in contrast, showed lower susceptibility (B. Hunter, Personal Communication, as cited in Courtney et al. 2004). Some level of innate resistance may occur (Fitzgerald et al. 2003), which could explain observations in several species of markedly lower mortality in the second year of exposure to WNV (Caffrey and Peterson 2003). Wild birds also develop resistance to WNV through immune responses (Deubel et al. 2001). The effects of WNV on bird populations at a regional scale have not been large, even for susceptible species (Caffrey and Peterson 2003), perhaps due to the short-term (a few years) and patchy distribution of mortality (K. McGowan, pers. comm., cited in Courtney et al. 2004) or annual changes in vector abundance and distribution.

Courtney et al. (2004) offer competing propositions for the likely outcome of spotted owl populations being infected by WNV. One proposition is that spotted owls can tolerate severe, short-term population reductions due to WNV, because spotted owl populations are widely distributed and number in the several hundreds to thousands. An alternative proposition is that WNV will cause unsustainable mortality, due to the frequency and/or magnitude of infection, thereby resulting in long-term population declines and extirpation from parts of the spotted owl's current range.

Habitat restoration for spotted owls will take decades to be realized. As such, it is too early to evaluate the long-term effectiveness of conservation efforts under the NWFP (USFWS 2004). Thus far, no mortality in wild, spotted owls has been recorded from WNV (Courtney et al. 2004). However, the potential threats to the spotted owl, like WNV, may not respond to or be affected by habitat management or improvement (USFWS 2004) including conservation efforts under the NWFP.

Sudden Oak Death

Sudden oak death was recently identified as a potential threat to the spotted owl (Courtney et al. 2004). This disease is caused by the fungus-like pathogen, *Phytopthora ramorum*, that was recently introduced from Europe and is rapidly spreading in northern California. At the present time, sudden oak death is found in natural stands from Monterey to Humboldt Counties, California, and has reached epidemic proportions in oak (*Quercus* spp.) and tanoak (*Lithocarpus densiflorus*) forests along approximately 186 mi (300 km) of the central and northern California coast (Rizzo et al. 2002). It has also been found near Brookings, Oregon, killing tanoak and causing dieback of closely associated wild rhododendron (*Rhododendron* spp.) and evergreen huckleberry (*Vaccinium ovatum*) (Goheen et al. 2002). It has been found in several different forest types and at elevations from sea level to over 2625 ft (800 m). Sudden oak death poses a threat of uncertain proportion because of its potential impact on forest dynamics and alteration of key prey and spotted owl habitat components (e.g., hardwood trees - canopy closure and nest tree mortality); especially in the southern portion of the spotted owl's range (Courtney et al. 2004). However, uncertainty about the likely scale of habitat effects and the potential for management to address the additive effects of sudden oak death on habitat availability mediated against placing too much weight on this factor in the FWS's Five-Year Review Evaluation of the spotted owl (USFWS 2004).

Inbreeding Depression, Genetic Isolation, and Reduced Genetic Diversity

Inbreeding and other genetic problems due to small population sizes were not considered an imminent threat to the spotted owl at the time of listing. Recent studies show no indication of reduced genetic variation and past bottlenecks in Washington, Oregon, or California (Barrowclough et al. 1999; Haig et al. 2004; Henke et al. 2005). However, in Canada, the breeding population is estimated to be less than 33 pairs and annual population decline may be as high as 35 percent (Harestad et al. 2004). Canadian populations may be more adversely affected by issues related to small population size including inbreeding depression, genetic isolation, and reduced genetic diversity (Courtney et al. 2004). Low and persistently declining populations throughout the northern portion of the species range (see "Population Trends" below) may be at increased risk of losing genetic diversity.

Climate change

Climate change, a potential additional threat to spotted owl populations, is not explicitly addressed in the NWFP. Climate change could have direct and indirect impacts on spotted owls and their prey. However, the emphasis on maintenance of seral stage complexity and related biological diversity in Matrix Lands under the NWFP should contribute to the resiliency of the Federal forest landscape related to impacts of climate change (Courtney et al. 2004).

Based upon a global meta-analysis of climate change data, Parmesan and Yohe (2003) discussed several potential implications of global climate change to biological systems, including terrestrial plants and animals. Results indicated that 62 percent of species exhibited trends indicative of advancement of spring conditions. In bird species, climate change trends were manifested in earlier nesting activities. Because the spotted owl exhibits a limited tolerance to heat relative to other bird species (Weathers et al. 2001), subtle changes in climate have the potential to affect spotted owls. However, the specific impacts to the species are unknown.

Disturbance-Related Effects

The effects of noise on NSOs are largely unknown, and whether noise is a concern has been a controversial issue. The effect of noise on birds is extremely difficult to determine due to the inability of most studies to quantify one or more of the following variables: 1) timing of the disturbance in relation to nesting chronology; 2) type, frequency, and proximity of human disturbance; 3) clutch size; 4) health of individual birds; 5) food supply; and 6) outcome of previous interactions between birds and humans (Knight and Skagen 1988). Additional factors that confound the issue of disturbance include the individual bird's tolerance level, ambient sound levels, physical parameters of sound and how it reacts with topographic characteristics and vegetation, and differences in how species perceive noise.

Although information specific to behavioral responses of NSOs to disturbance is limited, research indicates that recreational activity can cause Mexican spotted owls (S. o. lucida) to vacate otherwise suitable habitat (Swarthout and Steidl 2001) and helicopter overflights can reduce prey delivery rates to nests (Delaney et al. 1999). Additional effects from disturbance, including altered foraging behavior and decreases in nest attendance and reproductive success, have been reported for other raptors (Andersen et al. 1989; McGarigal et al. 1991; White and Thurow 1985).

Spotted owls may also respond physiologically to a disturbance without exhibiting a significant behavioral response. In response to environmental stressors, vertebrates secrete stress hormones called corticosteroids (Campbell 1990). Although these hormones are essential for survival, extended periods with elevated stress hormone levels may have negative effects on reproductive function, disease resistance, or physical condition (Carsia and Harvey 2000; Sapolsky et al.). In avian species, the secretion of corticosterone is the primary non-specific stress response (Carsia and Harvey 2000). The quantity of this hormone in feces can be used as a measure of physiological stress (Wasser et al. 1997). Recent studies of fecal corticosterone levels of spotted owls indicate that low intensity noise of short duration and minimal repetition does not elicit a physiological stress response (Tempel and Gutiérrez 2003; Tempel and Gutiérrez 2004). However, prolonged activities, such as those associated with timber harvest, may increase fecal corticosterone levels depending on their proximity to spotted owl core areas (Tempel and Gutiérrez 2004; Wasser et al. 1997) .

Conservation Needs of the Spotted Owl

Based on the above assessment of threats, the spotted owl has the following habitat-specific and habitat-independent conservation (i.e., survival and recovery) needs (adapted from Courtney et al. 2004):

Habitat-specific Needs

1. Large blocks of suitable habitat to support clusters or local population centers of spotted owls (e.g., 15 to 20 breeding pairs) throughout the owl's range;

2. Suitable habitat conditions and spacing between local spotted owl populations throughout its range to facilitate survival and movement;

3. Suitable habitat distributed across a variety of ecological conditions within the spotted owl's range to reduce risk of local or widespread extirpation;

4. A coordinated, adaptive management effort to reduce the loss of habitat due to catastrophic wildfire throughout the spotted owl's range, and a monitoring program to clarify whether these risk reduction methods are effective and to determine how owls use habitat treated to reduce fuels; and

5. In areas of significant population decline, sustain the full range of survival and recovery options for this species in light of significant uncertainty.

Habitat-independent Needs

1. A coordinated, research and adaptive management effort to better understand and manage competitive interactions between spotted and barred owls; and

2. Monitoring to better understand the risk that West Nile Virus and sudden oak death pose to spotted owls and, for West Nile Virus, research into methods that may reduce the likelihood or severity of outbreaks in spotted owl populations.

<u>Conservation Strategy</u>

Since 1990, various efforts have addressed the conservation needs of the spotted owl and attempted to formulate conservation strategies based upon these needs. The various efforts began with the Interagency Scientific Committee's Conservation Strategy (Thomas et al. 1990). The efforts continued with the designation of critical habitat (57 FR 1796-1838, the Draft Recovery Plan (USFWS 1992); the Scientific Analysis Team report (Thomas et al. 1993a); and the report of the Forest Ecosystem Management Assessment Team (Thomas et al. 1993b). The efforts culminated with the NWFP (USFS and USBLM 1994b). Each conservation strategy was based upon the reserve design principles first articulated in the Interagency Scientific Committee's report, which are summarized as follows:

- Species that are well distributed across their range are less prone to extinction than species confined to small portions of their range.

- Large blocks of habitat, containing multiple pairs of the species, are superior to small blocks of habitat with only one to a few pairs.

- Blocks of habitat that are close together are better than blocks far apart. Habitat that occurs in contiguous blocks is better than habitat that is more fragmented.

- Habitat between blocks is more effective as dispersal habitat if it resembles suitable habitat.

Conservation and Recovery Efforts on Federal Lands

The NWFP is the current conservation strategy for the spotted owl on Federal lands. It is designed around the conservation needs of the spotted owl and based upon the designation of a variety of land-use allocations whose objectives are either to provide for population clusters (i.e., demographic support) or to maintain connectivity between population clusters. Several land-use allocations are intended to contribute primarily to supporting population clusters: Late-Successional Reserves, Managed Late-Successional Areas, Congressionally Reserved Areas, Managed Pair Areas, and Reserve Pair Areas. The remaining land-use allocations (Matrix, Adaptive Management Areas, Riparian Reserves, Connectivity Blocks, and Administratively Withdrawn Areas) provide connectivity between habitat blocks intended for demographic support.

The range-wide system of Late-Successional Reserves set up under the NWFP captures the variety of ecological conditions within the 12 different provinces to which spotted owls are adapted. This design reduces the potential for extinction due to large catastrophic events in a single province. Multiple, large Late-Successional Reserves in each province reduce the potential that spotted owls will be extirpated in any individual province and reduce the potential that large wildfires or other events will eliminate all habitat within a Late-Successional Reserve. In addition, Late-Successional Reserves are generally arranged and spaced so that spotted owls may disperse to two or more adjacent Late-Successional Reserves. This network of reserves reduces the likelihood that catastrophic events will impact habitat connectivity and population dynamics within and between provinces.

FEMAT scientists predicted that spotted owl populations would decline in the Matrix over time, while populations were expected to stabilize and eventually increase within Late-Successional Reserves, as habitat conditions improve over the next 50 to 100 years (Thomas et al. 1993b) (USFS and USBLM 1994a; USFS and USBLM 1994b). Based on the results of the first decade of monitoring, the NWFP's authors cannot determine if the declining population trend will be reversed because not enough time has passed to provide the necessary measure of certainty (Lint 2005). However, the results from the first decade of monitoring do not provide any reason to depart from the objective of habitat maintenance and restoration as described under the NWFP (Lint 2005). Other stressors that operate in intact suitable habitat, such as barred owls (already in action) and WNV (yet to occur) may complicate the conservation of the spotted owl. Recent

reports about the status of the spotted owl offer few management recommendations to deal with the emerging threats. The arrangement and distribution and resilience of the NWFP land use allocation system may prove to be the most appropriate strategy in responding to these unexpected challenges (Courtney et al. 2004).

Under the NWFP, the agencies involved (FWS, U.S. Forest Service, Bureau of Land Management, and the National Park Service) anticipated a decline of spotted owl populations during the first decade of implementation. Recent reports (Anthony et al. 2006; Courtney et al. 2004) identified greater than expected spotted owl declines in Washington and northern portions of Oregon, and more stationary populations in southern Oregon and northern California. The reports did not find a direct correlation between habitat conditions and changes in vital rates of spotted owls at the meta-population scale. However, at the territory scale, there is evidence of negative effects to spotted owl fitness due to reduced habitat quantity and quality. Also, there is no evidence to suggest that dispersal habitat is currently limiting (Courtney et al. 2004; Lint 2005). Even with the population decline, Courtney et al (2004) noted that there is little reason to doubt the effectiveness of the core principles underpinning the NWFP conservation strategy.

The current scientific information, including information showing spotted owl population declines, indicates that the spotted owl continues to meet the definition of a threatened species (USFWS 2004). That is, populations are still relatively numerous over most of its historic range, which suggests that the threat of extinction is not imminent, and that the subspecies is not endangered; even though, in the northern part of its range population trend estimates are showing a decline.

Northern Spotted Owl Recovery Plan

In May, 2008, the Service published the 2008 Final Recovery Plan for the Northern Spotted Owl (USFWS 2008). The recovery plan identifies that competition with barred owls, ongoing loss of suitable habitat as a result of timber harvest and catastrophic fire, and loss of amount and distribution of suitable habitat as a result of past activities and disturbances are the most important range-wide threats to the spotted owl (USFWS 2008). To address these threats, the present recovery strategy has the following three essential elements: barred owl control, dry-forest landscape management strategy, and managed owl conservation areas (MOCAs) (USFWS 2008). The recovery plan lists recovery actions that address research of the competition between spotted and barred owls, experimental control of barred owls to better understand the impact the species is having on spotted owls, and, if recommended by research, management of barred owls (USFWS 2008).

The foundation of the plan for managing forest habitat in the western Provinces of Washington and Oregon is the MOCA network on Federal lands, which are intended to support stable and well-distributed populations of spotted owls over time and allow for movement of spotted owls across the network (USFWS 2008). On the fire-dominated east side of the Cascade Mountains in Washington and Oregon, and the California Cascades, the dry-forest habitat management strategy is intended to maintain spotted owl habitat in an environment of frequent natural disturbances (USFWS 2008). Additionally, the recovery plan identifies Conservation Support Areas (CSAs) in Washington, the west side of the Cascades in Oregon, and in California.

The CSAs are located on private, State, and Federal lands and are expected to support the MOCA network and the dry-forest landscape management approach (USFWS 2008). In addition, the recovery plan recommends a research and monitoring program be implemented to track progress toward recovery, inform changes in recovery strategy by a process of adaptive management, and ultimately determine when delisting is appropriate (USFWS 2008). The three primary elements of this program include 1) the monitoring of spotted owl population trends, 2) an inventory of spotted owl distribution, and 3) a comprehensive program of barred owl research and monitoring (USFWS 2008). The recovery plan estimates that recovery of the spotted owl could be achieved in approximately 30 years (USFWS 2008).

Conservation Efforts on Non-Federal Lands

FEMAT noted that limited Federal ownership in some areas constrained the ability to form an extensive reserve network to meet conservation needs of the spotted owl. Thus, non-Federal lands were determined to be an important contribution to the range-wide goal of achieving conservation and recovery of the spotted owl. The FWS's main expectations for private lands are for their contributions to demographic support (pair or cluster protection) and/or connectivity with lands. In addition, timber harvest within each state is governed by rules that may provide protection of spotted owls and/or their habitat to varying degrees.

There are 16 current or completed Habitat Conservation Plans (HCPs) with incidental take permits issued for spotted owls, eight in Washington, four in Oregon, and four in California. They range in size from 40 acres to over 1.6 million acres, though not all acres are included in the mitigation for spotted owls. In total, the HCPs cover approximately 2.9 million of the 32 million acres of non-Federal forestlands in the range of the spotted owl. Most HCPs are fairly long in duration, though they range from only five years up to 100 years. While each HCP is unique, there are several general approaches to mitigation of incidental take of spotted owls, including: 1) reserves of various sizes, some associated with adjacent Federal reserves, 2) forest harvest that maintains or develops suitable habitat, 3) forest management that maintains or develops dispersal habitat, and 4) deferral of harvest near specific sites. Individual HCPs may employ one or more of these mitigation measures. Similarly the conservation objectives of individual HCPs vary from specified numbers of breeding spotted owls, with specified levels of reproductive success, to management objectives for nesting/roosting/foraging habitat or dispersal habitat (Courtney et al. 2004).

Washington

In 1996, the Washington Forest Practices Board adopted rules (WFPB 1996) that would "contribute to conserving the spotted owl and its habitat on non-Federal lands" based on recommendations from a Science Advisory Group which identified important non-Federal lands and recommended roles for those lands in spotted owl conservation (Buchanan et al. 1994; Hanson et al. 1993). The 1996 rules designated 10 Spotted Owl Special Emphasis Areas (SOSEAs) in Washington that comprise over 1.5 million acres of State and private lands where owl protections on non-Federal lands would be emphasized. At all sites within SOSEAs, any proposed harvest of suitable spotted owl habitat within a territorial owl circle is considered a "Class-IV special" and would trigger State Environmental Policy Act (SEPA) review. Within SOSEAs, all suitable habitat within 0.7 mile of spotted owl activity centers, and 40 percent of

suitable habitat within the provincial median home range circle surrounding an occupied activity center is generally protected from timber harvest. Proposed harvest that would reduce habitat amounts below these levels are considered to have a significant probable adverse affect on the environment with respect to SEPA. If a determination of significance is made, preparation of a SEPA Environmental Impact Statement is required prior to proceeding. If a determination of non-significance or mitigated determination of non-significance is reached, the action can proceed without further environmental assessment. Until recently, these habitat protections could be lifted if a spotted owl activity center was determined to be unoccupied (Buchanan and Sweeden 2005). In 2005, the Forest Practices Board adopted emergency rules to further protect suitable habitat in spotted owl circles within SOSEAs (WFPB 2005). Under the 1996 Washington Forest Practices Rules, suitable spotted owl habitat located on non-Federal lands outside of owl management circles or located outside of a SOSEA boundary was not protected from timber harvest, unless the habitat was protected by an approved HCP. Spotted owl-related HCPs in Washington cover over 1.92 million acres and generally provide both demographic and connectivity support as recommended in the 1992 draft spotted owl recovery plan (USFWS 1992).

Oregon

The Oregon Forest Practices Act provides for protection of 70-acre core areas around known spotted owl nest sites, but does not provide for protection of spotted owl habitat beyond these areas (ODF 2006). In general, no large-scale spotted owl habitat protection strategy or mechanism currently exists for non-Federal lands in Oregon. The four spotted owl-related HCPs currently in effect in Oregon cover over 300,000 acres of non-Federal lands. These HCP's have provided, and will continue to provide, some nesting habitat and connectivity over the next few decades.

California

In 1990, the California Forest Practice Rules, which govern timber harvest on private lands, were amended to require surveys for spotted owls in suitable habitat and to provide protection around activity centers (CDF 2005). Under the California Forest Practices Rules, no timber harvest plan can be approved if it is likely to result in incidental take of federally listed species, unless authorized by a Federal HCP. The California Department of Fish and Game initially reviewed all timber harvest plans to ensure that take was not likely to occur; the FWS took over that review function in 2000. Several large industrial owners operate under Spotted Owl Management Plans that have been reviewed by the FWS; the plans specify basic measures for spotted owl protection. Four HCPs authorizing take of spotted owls have been approved covering over 669,000 acres of non-Federal lands. Implementation of these HCPs has provided, and will continue to provide, for spotted owl demographic and connectivity support to NWFP lands.

Current Condition of the Spotted Owl

The current condition of a species incorporates the effects of all past human and natural activities or events that have led to the present-day status of the species and its habitat (USFWS and NMFS 1998).

Range-wide Habitat Trends

Habitat Trends
The FWS has used information provided by the U.S. Forest Service, Bureau of Land Management, and National Park Service to update the habitat baseline conditions on Federal lands for spotted owls on several occasions since the spotted owl was listed in 1990. The estimate of 7.4 million acres used for the NWFP in 1994 (USFS and USBLM 1994b) was determined to be representative of the general amount of spotted owl habitat on these lands. This baseline was used to track relative changes over time in subsequent analyses.

In 2005, a new map depicting suitable spotted owl habitat throughout their range was produced as a result of the NWFP's effectiveness monitoring program (Lint 2005). However, the spatial resolution of this new habitat map currently makes it unsuitable for tracking habitat effects at the scale of individual projects. The FWS is evaluating the map for future use in tracking habitat trends. Additionally, there are no reliable estimates of spotted owl habitat on other land ownerships; consequently, acres that have undergone ESA section 7 consultation can be tracked, but not evaluated in the context of change with respect to a reference condition on non-Federal lands. The production of the NWFP monitoring program habitat map does, however, provide an opportunity for future evaluations of trends in non-Federal habitat.

Range-wide Analysis 1994 – 2001
In 2001, the FWS conducted an assessment of habitat baseline conditions, the first since implementation of the NWFP (USFWS 2001). This range-wide evaluation of habitat, compared to the Final Supplemental Environmental Impact Statement, was necessary to determine if the rate of potential change to spotted owl habitat was consistent with the change anticipated in the NWFP. In particular, the FWS considered habitat effects that were documented through the ESA section 7 consultation process since 1994. In general, the analytical framework of these consultations focused on the reserve and connectivity goals established by the NWFP land-use allocations (USFS and USBLM 1994b), with effects expressed in terms of changes in suitable spotted owl habitat within those land-use allocations. The FWS determined that actions and effects were consistent with the expectations for implementation of the NWFP from 1994 to June, 2001 (USFWS 2001).

During the 2001 assessment, the FWS developed an intranet database for compiling and tracking habitat losses anticipated through ESA section 7 consultations and other habitat effects (e.g., wildfire effects, though this data is incomplete). Information in the database is updated with each new consultation across the range of the species. The total acres of habitat loss changes over time as additional consultations are completed. As projects are implemented, Federal agencies report the actual acres implemented, and in some cases, the implemented acres are substantially less than the acres that were analyzed in the consultation. The FWS uses these reports to update the database and add or subtract habitat acres. For each ESA section 7 consultation, the FWS uses the current information in the consultation database to track the effects across the range of the spotted owl and update the information on the status of the spotted owl. As a result, the acres from ESA section consultation reported in this Opinion may vary from previous consultations due to updated information in the consultation database. Copies of

the summary tables from the database used for this Opinion are filed in the administrative record for this Opinion.

Range-wide Analysis 1994 – Present (February 26, 2008).
This section updates the information considered in U.S. Fish and Wildlife Service (2001), relying particularly on information in documents the Service produced pursuant to section 7 of the Act and information provided by NWFP agencies on habitat loss resulting from natural events (e.g., fires, windthrow, insect and disease).

In 1994, about 7.4 million acres of suitable spotted owl habitat were estimated to exist on Federal lands managed under the NWFP. As of August 6, 2009, the Service had consulted on the proposed removal of approximately 222,619 acres (Table 1) or 3 percent of 7.4 million acres (Table 2) of spotted owl suitable habitat on Federal lands. Of the total Federal acres consulted on for removal, approximately 189,727 acres or 2.5 percent of 7.4 million acres of spotted owl habitat were removed as a result of timber harvest. These changes in suitable spotted owl habitat are consistent with the expectations for implementation of the NWFP (USFS and USBLM 1994b).

April 13, 2004 marked the start of the second decade of the NWFP. Decade specific baselines and summaries of effects by State, physiographic province and land use function from proposed management activities and natural events are not provided here, but can be calculated using the Service's Consultation Effects Tracking system.

Habitat loss from Federal lands due to management activities has varied among the individual provinces with most of the impacts concentrated within the Non-Reserve relative to the Reserve land-use allocations (Table 2). When habitat loss is evaluated as a proportion of the affected acres range-wide, the most pronounced losses have occurred within Oregon (83%), especially within its Klamath Mountains (43%) and Cascades (East and West) (40%) Provinces, followed by much smaller habitat losses in Washington (10%) and California (7%) (Table 2).

From 1994 through August 6, 2009, habitat lost due to natural events was estimated at approximately 167,894 acres range-wide (Table 2). About two-thirds of this loss was attributed to the Biscuit Fire that burned over 500,000 acres in southwest Oregon (Rogue River basin) and northern California in 2002. This fire resulted in a loss of approximately 113,451 acres of spotted owl habitat, including habitat within five LSRs (Table 2). Approximately 18,630 acres of spotted owl habitat were lost due to the B&B Complex and Davis Fires in the East Cascades Province of Oregon (Table 2). When habitat loss from natural events and timber harvest is evaluated as a proportion of provincial baselines, the Oregon Klamath Mountains (25%), Cascades East (7.8%), and the California Cascades (5.4%) all have proportional losses greater than the range-wide mean (5.3%) (Table 2).

Because there is no comprehensive spotted owl habitat baseline for non-Federal lands, there is little available information regarding spotted owl habitat trends on non-Federal lands. Yet, we do know that internal Service consultations conducted since 1992 have documented the eventual loss of 405,770 acres (Table 1) of habitat on non-Federal lands. Most of these losses have yet to be realized because they are part of large-scale, long-term HCPs. Combining effects on Federal

and non-Federal lands, the Service had consulted on the proposed removal of approximately 642,803 acres of spotted owl habitat range-wide, resulting from all management activities, as of August 6, 2009 (Table 1).

Table 1. Changes to NRF[1] habitat acres from activities subject to ESA section 7 consultations and other causes range-wide from May 1994 to present (August 6, 2009).

Northwest Forest Plan Group/Ownership		ESA Section 7 Consultation Habitat Changes[2]		Other Habitat Changes[3]	
		Removed/ Downgraded	Degraded	Removed/ Downgraded	Degraded
Federal - Northwest Forest Plan	Bureau of Land Management	100,215	56,166	760	0
	Forest Service	114,665	471,008	36,911	5,481
	National Park Service	3,916	4,855	3	0
	Multi-agency[4]	3,823	23,314	130,220	0
	NWFP Subtotal	222,619	555,343	167,894	5,481
Other Management and Conservation Plans (OMCP)	Bureau of Indian Affairs and Tribes	109,881	28,398	2,398	0
	Habitat Conservation Plans	295,889	14,430	0	0
	OMCP Subtotal	405,770	42,828	2,398	0
Other Federal Agencies & Lands[5]		241	466	28	70
Other Public & Private Lands[6]		14,173	880	30,240	20,949
TOTAL Changes		642,803	599,517	200,560	26,500

Source: Tables A and B from the FWS Northern Spotted Owl Consultation Effects Tracker (web application and database) Aug. 6, 2009.

[1] Nesting, roosting, foraging habitat. In California, suitable habitat is divided into two components; nesting – roosting (NR) habitat, and foraging (F) habitat. The NR component most closely resembles NRF habitat in Oregon and Washington. Due to differences in reporting methods, effects to suitable habitat compiled in this, and all subsequent tables include effects for nesting, roosting, and foraging (NRF) for 1994-June 6, 2001. After June 26, 2001, suitable habitat includes NRF for Washington and Oregon but only nesting and roosting (NR) for California.

[2] Includes both effects reported by U.S. Fish and Wildlife Service (2001) and subsequent effects compiled in the Northern Spotted Owl Consultation Effects Tracker (web application and database).

[3] Includes effects to NRF habitat (as documented through technical assistance) resulting from wildfires (not from suppression efforts), insect and disease outbreaks, and other natural causes, private timber harvest, and land exchanges not associated with consultation.

[4] The 'Multi-agency' grouping is used to lump a variety of NWFP mixed agency or admin unit consultations that were reported together prior to June 26, 2001, and cannot be separated out.

[5] Includes lands that are owned or managed by other Federal agencies not included in the NWFP.

[6] Includes lands not covered by Habitat Conservation Plans that are owned or managed by states, counties, municipalities, and private entities. Effects that occurred on private lands from right-of-way permits across U.S. Forest Service and Bureau of Land Management lands are included.

Table 2. Aggregate results of all adjusted, suitable habitat (NRF[1]) acres affected by ESA section 7 consultation for the spotted owl; baseline and summary of effects by state, physiographic province, and land use function from 1994 to present for lands managed under the NWFP (August 6, 2009).

Physiographic Province[4]		Evaluation Baseline[2]			Habitat Removed/Downgraded[3]				% Provincial Baseline Affected	% Range-wide Affected
		Reserves[5]	Non-Reserves[6]	Total	Reserves[5]	Non-Reserves[6]	Habitat Loss to Natural Events[7]	Total		
WA	**Olympic Peninsula**	548,483	11,734	560,217	867	24	299	1,190	-0.21%	0.30%
	Eastern Cascades	506,340	200,509	706,849	4219	5,748	5,754	15,721	-2.22%	4.03%
	Western Cascades	864,683	247,797	1,112,480	1,681	10,804	0	12,485	-1.12%	3.20%
	Western Lowlands	0	0	0	0	0	0	0	-0.00%	0.00%
OR	**Coast Range**	422,387	94,190	516,577	730	3,863	66	4,659	-0.90%	1.19%
	Klamath Mountains	448,509	337,080	785,589	23,402	71,479	101,676	196,557	-25.02%	50.33%
	Cascades East	247,624	196,035	443,659	2,343	12,758	19,547	34,648	-7.81%	8.87%
	Cascades West	1,012,426	1,034,046	2,046,472	4,020	64,683	24,583	93,286	-4.56%	23.89%
	Willamette Valley	593	5,065	5,658	0	0	0	0	-0.00%	0.00%
CA	**Coast**	47,566	3,928	51,494	455	69	100	624	-1.21%	0.16%
	Cascades	61,852	26,385	88,237	0	4,808	0	4,808	-5.45%	1.23%
	Klamath	734,103	345,763	1,079,866	1,492	9,174	15,869	26,535	-2.46%	6.79%
Total		4,894,566	2,502,532	7,397,098	39,209	183,410	167,894	390,513	-5.28%	100.00%

Source: Table B from the FWS Northern Spotted Owl Consultation Effects Tracker (web application and database) August 6, 2009.

[1] Nesting, roosting, foraging habitat. In California, suitable habitat is divided into two components; nesting – roosting (NR) habitat, and foraging (F) habitat. The NR component most closely resembles NRF habitat in Oregon and Washington. Due to differences in reporting methods, effects to suitable habitat compiled in this, and all subsequent tables include effects for nesting, roosting, and foraging (NRF) for 1994-June 26, 2001. After June 26, 2001, suitable habitat includes NRF for Washington and Oregon but only nesting and roosting (NR) for California. [2] 1994 FSEIS baseline (USFS and USBLM 1994a). [3] Includes both effects reported by USFWS (2001) and subsequent effects compiled in the Northern Spotted Owl Consultation Effects Tracking System (web application and database). [4] Defined by the NWFP as the twelve physiographic provinces, as presented in Figure 3 and 4-1 on page 3 and 4-16 of the Final Supplemental Environmental Impact Statement. [5] Land-use allocations intended to provide large blocks of habitat to support clusters of breeding pairs. [6] Land-use allocations intended to provide habitat to support movement of spotted owls among reserves. [7] Acres estimated from various database fields and other GIS databases.

Other Habitat Trend Assessments
In 2005, the Washington Department of Wildlife released the report, "An Assessment of Spotted Owl Habitat on Non-Federal Lands in Washington between 1996 and 2004" (Pierce et al. 2005). This study estimates the amount of spotted owl habitat in 2004 on lands affected by state and private forest practices. The study area is a subset of the total Washington forest practice lands, and statistically-based estimates of existing habitat and habitat loss due to fire and timber harvest are provided. In the 3.2-million acre study area, Pierce et al. (2005) estimated there was 816,000 acres of suitable spotted owl habitat in 2004, or about 25 percent of their study area. Based on their results, Pierce and others (2005) estimated there were less than 2.8 million acres of spotted owl habitat in Washington on all ownerships in 2004. Most of the suitable owl habitat in 2004 (56%) occurred on Federal lands, and lesser amounts were present on state-local lands (21%), private lands (22%) and tribal lands (1%). Most of the harvested spotted owl habitat was on private (77%) and state-local (15%) lands. A total of 172,000 acres of timber harvest occurred in the 3.2 million-acre study area, including harvest of 56,400 acres of suitable spotted owl habitat. This represented a loss of about 6 percent of the owl habitat in the study area distributed across all ownerships (Pierce et al. 2005). Approximately 77 percent of the harvested habitat occurred on private lands and about 15 percent occurred on State lands. Pierce and others (2005) also evaluated suitable habitat levels in 450 spotted owl management circles (based on the provincial annual median spotted owl home range). Across their study area, they found that owl circles averaged about 26 percent suitable habitat in the circle across all landscapes. Values in the study ranged from an average of 7 percent in southwest Washington to an average of 31 percent in the east Cascades, suggesting that many owl territories in Washington are significantly below the 40 percent suitable habitat threshold used by the State as a viability indicator for spotted owl territories (Pierce et al. 2005).

Moeur et al. (2005) estimated an increase of approximately 1.25 to 1.5 million acres of medium and large older forest (greater than 20 inches dbh, single and multi-storied canopies) on Federal lands in the Northwest Forest Plan area between 1994 and 2003. The increase occurred primarily in the lower end of the diameter range for older forest. The net area in the greater than 30 inch dbh size class increased by only an estimated 102,000 to 127,000 acres. The estimates were based on change-detection layers for losses due to harvest and fire and remeasured inventory plot data for increases due to ingrowth. Transition into and out of medium and large older forest over the 10-year period was extrapolated from inventory plot data on a subset of Forest Service land types and applied to all Federal lands. Because size class and general canopy layer descriptions do not necessarily account for the complex forest structure often associated with spotted owl habitat, the significance of these acres to spotted owl conservation remains unknown.

<u>Spotted Owl Numbers, Distribution, and Reproduction Trends</u>

There are no estimates of the historical population size and distribution of spotted owls, although they are believed to have inhabited most old-growth forests throughout the Pacific Northwest prior to modern settlement (mid-1800s), including northwestern California (USFWS 1989). The final rule listing the spotted owl as threatened (55 FR 26114-26194), estimated that approximately 90 percent of the roughly 2,000 known spotted owl breeding pairs were located on federally managed lands, 1.4 percent on State lands, and 6.2 percent on private lands; the

percent of spotted owls on private lands in northern California was slightly higher (Forsman et al. 1984; Thomas et al. 1990; USFWS 1989).

At the time the NWFP was initiated (July 1, 1994), there were 5,431 known locations of, or site centers of spotted owl pairs or resident singles: 851 sites (16 percent) in Washington, 2,893 (53 percent) in Oregon, and 1,687 (31 percent) in California (60 FR 9484-9495). By June 2004, the number of territorial spotted owl sites recognized by Washington Department of Fish and Wildlife was 1,044 (Buchanan and Sweeden 2005). The actual number of currently occupied spotted owl locations across the range is unknown because many areas remain unsurveyed (57 FR 1796-1838)(Thomas et al. 1993a). In addition, many historical sites are no longer occupied because spotted owls have been displaced by barred owls, timber harvest, or severe fires, and it is possible that some new sites have been established due to reduced timber harvest on Federal lands since 1994. The number of owl locations reported in 60 FR 9484-9495 represents the cumulative number of locations recorded in the three states at that time, and does not represent a population estimate.

Because existing survey coverage and effort are insufficient to produce reliable range-wide estimates of population size, researchers use other indices, such as demographic data, to evaluate trends in spotted owl populations. Analysis of demographic data can provide an estimate of the rate and direction of population growth [i.e., lambda (λ)]. A λ of 1.0 indicates a stationary population (i.e., neither increasing nor decreasing), a λ less than 1.0 indicates a declining population, and a λ greater than 1.0 indicates a growing population. Demographic data, derived from studies initiated as early as 1985, have been analyzed periodically (Anderson and Burnham 1992; Anthony et al. 2006; Burnham et al. 1994; Forsman et al. 1996) to estimate trends in the populations of the spotted owl.

In January 2004, Anthony et al. (2006) completed two meta-analyses that modeled rates of population change [i.e., lambda (λ)], for up to 18 years using the re-parameterized Jolly-Seber method (λRJS). One meta-analysis modeled all 13 long-term study areas excluding the Marin study area (Table 3), while the other modeled the eight study areas that are part of the effectiveness monitoring program of the NWFP (Anthony et al. 2006). Data were analyzed separately for individual study areas, as well as across all study areas in a meta-analysis.

Table 3. Spotted owl demographic study areas (adapted from Anthony et al. 2004).

Area	Fecundity	Survival	$^{\lambda}$RJS	Population Change
Wenatchee	Declining	Declining	0.917	Declining
Cle Elum	Declining	Declining?	0.938	Declining
Rainier	Stable	Declining	0.896	Declining
Olympic	Stable	Declining	0.956	Declining
Coast Ranges	Declining?	Stable	0.968	Declining
HJ Andrews	Stable?	Stable	0.978	Declining
Warm Springs	Stable	Stable	0.908	Declining
Tyee	Increasing	Stable	1.005	Stationary
Klamath	Stable	Stable	0.997	Stationary
S. Cascades	Declining	Stable	0.974	Stationary
NW California	Declining	Declining	0.985	Declining?
Hoopa	Increasing	Stable	0.98	Stationary
Simpson	Declining	Stable	0.97	Declining
Marin	Stable	Stable	NA	NA

Point estimates of λRJS ranged from 0.896 to 1.005 for the 13 long-term study areas, and in all study areas but one—the Tyee study area—these estimates were less than 1.0 (Anthony et al. 2006) (Table 3). There was strong evidence that populations in the Wenatchee, Cle Elum, Warm Springs, and Simpson study areas decreased during the period of study. There also was evidence that populations in the Rainier, Olympic, Oregon Coast Range, and HJ Andrews study areas were decreasing. The precision of the λRJS estimates for Rainier and Olympic study areas was poor and not sufficient to detect a statistically significant difference from 1.00; however, the estimate of λRJS for the Rainier study area (0.896) was the lowest of all of the areas. Populations in the Tyee, Klamath, South Oregon Cascades, Northwest California, and Hoopa study areas appeared to be stationary during the study, but there was some evidence that the spotted owl population in the Northwest California study area was decreasing (λRJS = 0.959 to 1.011).

The weighted mean λRJS for all of the study areas was 0.963 (standard error [SE] = 0.009, 95 percent confidence interval [CI] = 0.945 to 0.981), suggesting that populations over all of the study areas decreased by about 3.7 percent per year from 1985 to 2003. Anthony et al. (2006) explains that the indication populations were declining was based on the fact that the 95 percent confidence intervals around the estimate of the mean lambda did not overlap 1.0 (stable) or barely included 1.0.

The mean λRJS for the eight demographic monitoring areas that are part of the effectiveness monitoring program of the NWFP was 0.976 (SE = 0.007, 95 percent CI = 0.962 to 0.990), and the mean λRJS for the other five study areas was 0.942 (SE = 0.016, 95 percent CI = 0.910 to 0.974), yielding average declines of 2.4 and 5.8 percent per year, respectively. These data suggest that demographic rates for spotted owl populations on Federal lands were better than elsewhere; however, both the interspersion of non-Federal land in study areas, and the likelihood

that spotted owls use habitat on multiple ownerships in some demography study landscapes, confound this comparison.

The number of populations that declined and the rate at which they have declined are noteworthy, particularly the precipitous declines in the Wenatchee, Cle Elum, and Rainier study areas in Washington and the Warm Springs study area in Oregon. Estimates of population declines in these areas ranged from 40 to 60 percent during the study period of 1990 to 2003 (Anthony et al. 2006). Decreases in apparent adult survival rates were an important factor contributing to decreasing population trends. Survival rates decreased over time in five of the 14 study areas: four study areas in Washington, which showed the sharpest declines, and one study area in the California Klamath Province of northwest California (Anthony et al. 2006). In Oregon, there were no time trends in apparent survival for four of six study areas, and remaining areas had weak, non-linear trends. In California, three study areas showed no trend and one showed a significant linear decrease (Anthony et al. 2006). Like the trends in annual rate of population change, trends in the rate of adult survival showed clear decreases in some areas but not in others.

Loehle et al. (2005a) sampled a small portion of the range of the species and questioned the accuracy of lambda estimates computed in Anthony et al. (Anthony et al. 2004, subsequently published as Anthony et al. 2006), suggesting that the estimates were biased low by 3 to 4 percentage points. Loehle et al. (2005a) contended the lambda estimates in Anthony et al. (2004) did not accurately account for spotted owl emigration. Therefore, more of the spotted owl demography study areas would have a lambda closer to 1.0, a stationary population. Loehle et al. then published an erratum (Loehle et al. 2005b) acknowledging that the more recent analysis methods used in Anthony et al. (2006) did not cause them concern regarding potentially miscalculated permanent emigration rates. Subsequently, Franklin et al. (2006) published a comment indicating the Loehle et al. (2005a) survival estimates were inappropriate for comparison because they introduced a positive bias to the measure of population change, were not valid for evaluating bias, and their study areas were too different from the demography study areas to allow for comparison.

There are few spotted owls remaining in British Columbia. Chutter et al. (2004) suggested immediate action was required to improve the likelihood of recovering the spotted owl population in British Columbia. In 2007, personnel in British Columbia captured and brought into captivity the remaining 16 known wild spotted owls. Prior to initiating the captive-breeding program, the population of spotted owls in Canada was declining by as much as 35 percent per year (Chutter et al. 2004). The amount of previous interaction between spotted owls in Canada and the United States is unknown (Chutter et al. 2004).

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STATUS OF SPOTTED OWL CRITICAL HABITAT

This BO does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02. Instead, we have relied upon the statutory provisions of the Act and the August 6, 2004, Ninth Circuit Court of Appeals decision in Gifford Pinchot Task Force v. U.S. Fish and Wildlife Service (No. 03-35279) to complete the following analysis with respect to critical habitat.

Legal Status

On January 15, 1992, the Service designated northern spotted owl (spotted owl) critical habitat within 190 critical habitat units (CHUs) which encompassed nearly 6.9 million acres of Federal lands in California, Oregon, and Washington (57 FR 1796-1838). On August 13, 2008, the Service revised spotted owl critical habitat into 29 units, comprised of 174 subunits, on approximately 5,312,300 acres of Federal lands in California, Oregon, and Washington (73 FR 47326-47522).

Primary Constituent Elements

Primary constituent elements (PCEs) are the physical and biological features of critical habitat essential to a species' conservation. PCEs identified in the spotted owl critical habitat final rule include forest types that support the spotted owl across its geographic range when they occur in concert with a) nesting, roosting, foraging, and/or dispersal habitat, or b) lands capable of developing one or more of these habitats in the future (73 FR 47347-47348).

Forests. Forest types that support the spotted owl across its geographic range. These forest types are primarily Sitka spruce, western hemlock, mixed conifer and mixed evergreen, grand fir, Pacific silver fir, Douglas-fir, white fir, Shasta red fir, redwood/Douglas-fir (in coastal California and southwestern Oregon), and the moist end of the ponderosa pine coniferous forests zones at elevations up to approximately 3, 000 ft (914m) near the northern edge of the range and up to approximately 6, 000 ft (1, 828 m) at the southern edge. These forest types may be in early-, mid-, or late-seral stages. This PCE is essential to the conservation of the species because it provides the biotic communities that are known to be necessary for the northern spotted owl. This PCE must occur in concert with at least one of the PCEs below (73 FR 47347).

Nesting, roosting, and foraging habitat. The forest types described above that contain one or more of the habitat types described below to meet the home range needs of territorial pairs of spotted owls throughout the year or that are habitat-capable of developing one or more of these habitat types. (As used in this entry, areas that are ''habitat capable'' of developing an essential habitat component are those forest types described above, excluding serpentine soil areas, and that provide the requisite ecological conditions (e.g., moisture regime, soils, aspect, slope, potential vegetative community) for growing and sustaining the structural conditions required for that habitat component.) A home range provides the habitat components essential for the survival and successful reproduction of a resident breeding pair of spotted owls. The amount, quality, and configuration of these habitat types required for a home range varies according to local conditions and factors such as the degree of habitat fragmentation, proportion of available

nesting habitat, and primary prey species. The core area of the home range is used most intensively and usually includes the nesting area. The remainder of the home range is used for foraging and roosting. The size of home ranges extend from approximately 2, 955 ac (1, 196 ha) in the Oregon Cascades to approximately 14, 271 ac (5, 775 ha) on the Olympic Peninsula of Washington. The size of core areas extends from approximately 500 ac (202 ha) in the southern part of the species' range to approximately 4, 057 ac (1, 642 ha) in the northern part of the range (73 FR 47347). The three habitat types within the home range of a spotted owl are:

Nesting habitat. Nesting habitat is essential to provide structural features for nesting, protection from adverse weather conditions, and cover to reduce predation risks. It includes a moderate to high canopy closure (60 to 80 percent); a multi-layered, multi-species canopy with large (generally greater than 30 inches (in) (76 centimeters (cm) diameter at breast height (dbh)) overstory trees; a high incidence of large trees with various deformities (e.g., large cavities, broken tops, mistletoe infections, and other platforms); large snags; large accumulations of fallen trees and other woody debris on the ground; and sufficient open space below the canopy for northern spotted owls to fly. Patches of nesting habitat, in combination with roosting habitat must be sufficiently large and contiguous to maintain northern spotted owl core areas and home ranges, and must be proximate to foraging habitat. Nesting habitat can also function as roosting, foraging, and dispersal habitat (73 FR 47347).

Roosting habitat. Roosting habitat is essential to provide for thermoregulation, shelter, and cover to reduce predation risk while resting or foraging. It differs from nesting habitat in that it need not contain those specific structural features used for nesting (such as trees with cavities, broken tops, and mistletoe platforms), but does contain moderate to high canopy closure (60 to 80 percent); a multi-layered, multi- species canopy; large accumulations of fallen trees and other woody debris on the ground; and open space below the canopy for northern spotted owls to fly. Roosting habitat will also function as foraging and dispersal habitat, but not as nesting habitat due to lack of nesting structures (73 FR 47347).

Foraging habitat. Foraging habitat is essential to provide a food supply for survival and reproduction. It contains some roosting habitat attributes but can consist of more open and fragmented forests or, especially in the southern portion of the range where some younger stands may have high prey abundance and structural attributes similar to those of older forests, such as moderate tree density, subcanopy perches at multiple levels, multi-layered vegetation, or residual older trees. Foraging habitat can also function as dispersal habitat (73 FR 47348).

Dispersal habitat. Forest types described above that provide one or both of the habitat components described below that are essential to the dispersal of juvenile and non-territorial spotted owls, or that are capable of developing one or both of these components. Dispersal habitat can occur in intervening areas between larger blocks of nesting, foraging, and roosting habitat or within blocks of nesting, roosting, and foraging habitat. Dispersal habitat is essential to maintaining stable populations by supporting transient spotted owls which can fill territorial vacancies when resident spotted owls die or leave their territories, and to providing adequate gene flow across the range of the species (73 FR 47348). The two types of dispersal habitat are:

(A) Habitat supporting the transience phase of spotted owl dispersal contains stands with adequate tree size and canopy closure to provide protection from avian predators and minimal foraging opportunities. This may include younger and less diverse forest stands than foraging habitat, such as even-aged, pole-sized stands, but such stands should contain some roosting structures and foraging habitat to allow for temporary resting and feeding during the movement phase.

(B) Habitat supporting the colonization phase of spotted owl dispersal is generally equivalent to roosting and foraging habitat described above, although it may be in smaller amounts than that needed to support nesting pairs.

The critical habitat designation describes the PCEs essential to support the life history functions of the northern spotted owl in the amount and configuration required for the species' conservation. Because not all life history functions require all of the PCEs, not all of the critical habitat will contain all of the PCEs. Some units contain all PCEs and support multiple life processes, while some units contain only a portion of the PCEs necessary to support the species' particular use of that habitat. However, all of the critical habitat units in the designation support at least the first PCE described (forest-type) in conjunction with at least one of the other PCEs described above (73 FR 47348).

Conservation Role of Critical Habitat

The conservation role of spotted owl critical habitat is to identify those lands that are essential to the recovery of the species that may require special management considerations or protections (73 FR 47344). Generally, the conservation role of spotted owl critical habitat is to support a viable owl population at the rangewide scale by providing a network of functional units within each physiographic province (73 FR 47358). For a wide-ranging species such as the spotted owl, where multiple CHUs are designated, each unit has a provincial and rangewide role in contributing to the conservation of the species. The size and distribution of the CHUs is the based on the "managed owl conservation areas (MOCAs) recommended in the 2008 *Final Recovery Plan for the Northern Spotted Owl* (USFWS 2008) in the western portion of the species range, and on proposed MOCAs recommended under Option 1 in the *Draft Recovery Plan for the Northern Spotted Owl* (USFWS 2007) in the eastern portion of the species range (73 FR 47330).

The MOCAs comprise a network of both large habitat blocks (capable of supporting 20 or more breeding pairs of owls (MOCA 1s)), and small habitat blocks (capable of supporting up to 19 breeding pairs of owls (MOCA 2s)). The MOCAs (and subsequent CHUs) form a habitat network designed to support stable and well-distributed populations of spotted owls over time and allow for movement of spotted owls across the landscape (USFWS 2008, p. 13). The Federal lands comprising the MOCA network of the final recovery plan include areas of congressionally reserved lands, such as designated wilderness areas; these areas were therefore included in the recovery plan's assessment that the MOCA network is sufficient to achieve the recovery of the spotted owl. As in the 1992 designation of critical habitat, congressionally-reserved lands such as wilderness areas and national parks are not included within the boundaries of the critical habitat designation. However, the contribution of these congressionally-reserved

areas must be considered in any evaluation of the sufficiency of the overall conservation habitat network for the recovery of the spotted owl (73 FR 47328).

Current Condition of Critical Habitat

Summary of Range-wide Conditions

We designated 29 units as critical habitat for the spotted owl on federal lands in Washington, Oregon, and California. These areas encompass over 5.3 million acres. Currently we estimate that approximately 98 percent of these lands are "habitat capable" (i.e., lands that are capable of supporting forest types that spotted owls use). Within the CHUs, many habitat areas are currently fragmented primarily due to past timber harvest, wildfire, disease, and wind-throw. Based on the spotted owl habitat data developed for monitoring the Northwest Forest Plan (Davis and Lint 2005), we estimate that approximately 50 percent of the lands within CHUs currently contain owl habitat (2.6 million acres). Given natural events such as fire, windstorms, and insect damage, not all habitat capable lands in a CHU are likely to be high quality habitat at any one time. However, these lands retain the physical and biological features necessary to allow for the regrowth of the habitat characteristics required by spotted owls and are essential to achieving the area, quality, and configuration of habitat blocks required for recovery of the owl (USFWS 2008, p. 13).

Section 7 analyses of activities affecting spotted owl critical habitat consider the effects of proposed actions on the ability of the critical habitat to support a viable spotted owl population at the scale of individual CHUs, the physiographic province, and the rangewide scales (73 FR 47358). Following the revision of critical habitat in August, 2008, the Service has completed section 7 consultations on the removal of approximately 877 acres of suitable spotted owl habitat within critical habitat units in the Oregon Cascades provinces (Table 1). The Service concluded that the effect of this habitat loss is not likely to destroy or adversely modify designated critical habitat.

Table 1. Changes in spotted owl suitable habitat within critical habitat from August 13, 2008 to present (August 7, 2009), resulting from Federal management actions and natural events by physiographic province.

Physiographic Province[4]		Evaluation Baseline[1]	Suitable[2] Critical Habitat Removed/Downgraded[3]			Percent Provincial Baseline Affected	Percent of Total Effects
		Acres of suitable habitat	Habitat loss to management activities	Habitat loss to natural events	Total		
WA	Olympic Peninsula	149,090	0	0	0	0	0
	Eastern Cascades	188,720	0	0	0	0	0
	Western Cascades	415,620	0	0	0	0	0
	Western Lowlands	0	0	0	0	0	0
OR	Coast Range	303,680	0	0	0	0	0
	Klamath Mountains	210,430	0	0	0	0	0
	Cascades East	109,140	873	0	873	0.8%	0
	Cascades West	498,020	4	0	4	0	0
	Willamette Valley	0	0	0	0	0	0
CA	Coast	53,480	0	0	0	0	0
	Cascades	137,010	0	0	0	0	0
	Klamath	583,690	0	0	0	0	0
Total		2,648,880	877	0	877	0	0

1. Revised critical habitat baseline is based on range-wide habitat maps developed by Davis and Lint (2005).
2. Nesting, roosting, foraging (NRF) habitat.
3. Includes effects reported by each field office.
4. Defined by the Northwest Forest Plan as the twelve physiographic provinces, as presented in Figure 3&4-1 on page 3&4-16 of the FSEIS.

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