

Chapter 4

Environmental Impact Analysis

4.0 Introduction

Chapter 4 identifies the potential environmental effects of proposed management actions on natural, cultural and recreational resources within the Monument. For the analysis of environmental effects, Monument staff selected important resource issue areas on the basis of best available science and professional judgment. This selection process was aided by an exhaustive public scoping process; three public workshops; policy and requirements set forth in the NEPA and the Monument Proclamation; and advice from the FAC, cooperating agencies, and consulting tribal governments. More than ninety potential resource issue areas were identified through this process; however, it became apparent that analyzing potential environmental effects on so many individual issue areas was not possible, desirable, or necessary. Accordingly, the planning team consolidated public concerns, along with the Monument Proclamation and federally mandated concerns, into the general issues listed below.

- Sensitive indicator species and resources.
- Resources specifically mentioned in the Monument Proclamation as focus areas of management.
- “Big Six” activities.¹²⁰
- NEPA-mandated analyses.

The planning team then identified specific issue areas for analysis. It should be noted that development of this list necessitated the refinement of the much larger list of potential issues mentioned above. The planning team distilled these issues into the following impact topics.

- Geological and Paleontological Resources
- Shrub-Steppe and Other Upland Resources
 - Wildlife and Habitat
 - Microbiotic Crusts
 - Sensitive Plant Communities
 - Threatened, Endangered, and Sensitive Species
- Riverine and Other Aquatic/Wetland Resources
 - Wildlife and Habitat
 - Sensitive Plant Communities
 - Threatened, Endangered, and Sensitive Species

¹²⁰ Under the Improvement Act, when such activities are compatible, there are six priority public uses of national wildlife refuges—hunting, fishing, wildlife observation, wildlife photography, environmental education, and environmental interpretation. These are considered “wildlife-dependent” activities. Other public uses of national wildlife refuges are allowed, if appropriate and compatible with resource protection.

- Invasive Species
- Habitat Connectivity
- Cultural Resources
 - Pre-Contact
 - Post-Contact
 - Cultural Traditions
- Interpretation and Education
- Recreation and Public Use
 - Hunting
 - Fishing
 - Wildlife Observation and Photography
 - Other Recreational Activities
- Aesthetics and Solitude
- Special Area Designations
- Islands
- Population Management of Elk
- Social
 - Infrastructure
 - Transportation
 - Economics
- Cumulative, Long-term, and Irreversible Effects
 - Indirect and Cumulative Effects
 - Potential Irretrievable and Irreversible Commitments
 - Relationship between Short-Term Uses of the Human Environment and Enhancement of Long-Term Productivity

While the description of the environmental setting in Chapter 3 was developed to present the most comprehensive picture of existing conditions in the Monument, this impact analysis chapter has been organized to address the above list of issue areas.

As described in Chapter 2, this document addresses landscape-level management actions. Consequently, comprehensive analyses of specific effects on individual land areas, resources, or wildlife species are not presented here. Site-specific resource effects will be addressed in subsequent step-down plans as additional resource inventories are completed, facilities and public use improvements are designed and sited, and additional management actions are considered. Project-level NEPA analysis and documentation will be tiered to this EIS.

4.0.1 Assumptions and Best Management Practices

The alternatives described in this draft EIS have been developed using many assumptions and best management practices (BMPs) that are common to all alternatives and resource areas.¹²¹ These assumptions and BMPs mold the following analyses. Assumptions address both policy-level management decisions and the mechanisms of effects that are considered in the impact analyses. Assumptions that pertain only to specific resource areas are addressed in the appropriate section of this chapter. BMPs are specific management and policy decisions that the FWS has committed to incorporate into management actions, as appropriate, regardless of the alternative ultimately selected.

4.0.1.1 Assumptions

4.0.1.1.1 Landscape-level Planning

The Draft CCP/EIS has been developed using a landscape-level planning approach to develop broad short- and long-term management guidelines. Projects and developments proposed under the various alternatives have not been sited, but have been developed at a conceptual level. Future restoration efforts and infrastructure development and placement will be conducted in accordance with NEPA provisions. Step-down management plans will be developed for site-specific management actions; these plans may address such issues as wildlife habitat management, elk management, cultural resource protection, visitor use, infrastructure development, and transportation systems (see Section 1.4 for a detailed discussion). Step-down plans would require further analysis of the environmental effects of proposed site-specific projects.

4.0.1.1.2 Resource Protection

All alternatives would be protective of the Monument's natural and cultural resources, although to differing levels. Each would provide for varying levels of public use and access. However, in view of finite budget and staffing capabilities, tradeoffs would occur between management programs depending on the alternative selected. For example, Alternative B provides for fewer developed visitor facilities than Alternative D. Consequently, with fewer resources needed for operations and maintenance of visitor facilities and visitor use management, more resources

¹²¹ It should be noted that even though Alternative A—the “No-Action” Alternative—includes few new management actions, the assumptions and BMPs described below would still apply for management activities taking place in the future under Alternative A.

would be devoted to habitat restoration and improvement projects under alternative B. Alternative D would devote more resources to visitor facility maintenance and visitor use management.

4.0.1.1.3 Research Projects

Research projects will be allowed in the Monument in accordance with FWS policy guidelines and SUP provisions.

4.0.1.1.4 Increased Visitor Use

Visitor use in the Monument will increase at about the same rate as use on other public lands with similar outdoor recreational opportunities. Developing new facilities, such as parking lots, trails, interpretive signs, camping areas, and auto tour routes, would result in an increase in visitor use. Increased public access to, and use of, the Monument would increase the risk of wildland fire, the potential spread of non-native invasive species, and the costs of maintenance and law enforcement services. Furthermore, recreational use would entail some level of adverse effects on natural and cultural resources (Purdy et al. 1987; Cole 2004; Cline et al. 2005). On the basis of typical public use patterns and management emphasis, it is assumed that the primary effects of public use would be concentrated within 1/4-mile of facilities such as parking lots, trails, interpretive signs, camping areas, and auto tour routes.

4.0.1.1.5 Interpretation and Education

Interpretation and education programs, activities, facilities and materials will have beneficial effects on Monument resources by increasing public awareness of, and appreciation for, these resources; informing visitors about proper resource use; and instilling a sense of stewardship in both visitors and the regional public. An Interpretation and Education Plan (step-down plan) would develop specific themes to address the full spectrum of resource issue areas (e.g., wildlife, vegetation communities, habitat characteristics, microbiotic crust, wildland fire and its effects, habitat connectivity, non-native invasive species, cultural resources, and leave-no-trace ethics). Additionally, interpretation and education materials would be developed targeting groups engaging in specific recreational activities (e.g., hunting, fishing, wildlife observation and photography) to provide these users with useful and pertinent information, such as low-impact techniques, success rates, typical visitor use patterns, existing rules and regulations, annual and seasonal changes, access conditions, and other relevant communications.

4.0.1.1.6 Effects on Wildlife

Human activities affect animals through four primary mechanisms—exploitation or harvest, disturbance, habitat modification, and pollution (Knight and Cole 1995). It is assumed that effects specific to the Monument will occur primarily through disturbance and habitat modification, with additional effects anticipated from non-point source pollution such as litter, car exhaust, and marine engine emission.

A variety of animal behavior responses could result from human activity, depending on a range of variables associated with the activity. Examples of such variables include type, distance, direction of movement, speed, predictability, frequency, magnitude and location of the activity (Knight and Cole 1995). Wildlife disturbance can precipitate behavioral changes, such as avoidance, habituation, or attraction (Knight and Temple 1995). Disturbance of wildlife species that habituate to human use tends to be greater when recreational activities occur away from established use areas such as parking areas and trails (Gutzwiller et al. 1994; Riffell et al. 1996; Gutzwiller et al. 1997; MacArthur et al. 1982; Coles 2004). Conversely, disturbance effects may be somewhat minimized by establishing designated sites and routes for visitor activities in relation to such species (except for habituation, which is a disturbance response, and which would be exacerbated in established use areas). Physiological responses can include the “fight or flight” response, with elevated heart and respiratory rates, or the “freeze” response, with inhibition of activity and reduced heart and respiratory rates. The implications of disturbance are often heightened during sensitive life stages, such as breeding, overwintering and rearing of dependent young. Depending on the disturbance variables listed above, the long-term effects on individual animals can be altered behavior, reduced vigor, lower reproductive success, and/or death (Knight and Cole 1995).

Human activities can also alter the suitability of an area as wildlife habitat. For example, effects on soils can alter the presence and characteristics of vegetation, in turn influencing the suitability of the site to serve as habitat for wildlife species that are dependent on a particular assemblage of species or particular vegetative structure (Youmans 1999). Moreover, habitat suitability for prey animals affects the habitat’s suitability to support predators.

4.0.1.1.7 Effects on Vegetation

Effects on vegetation from visitor use occurs primarily through trampling. Trampling of vegetation bends, weakens and breaks leaves and branches and damages photosynthetic surfaces, seed production, and carbohydrate reserves, eventually killing some species (Douglass et al. 1999). Trampling and resultant soil compaction and erosion can expose roots and kill plants (Cole 2004), providing an opportunity for weed invasion. Depending on soil type, vegetation cover, topography and use intensity, effects on soils resulting from visitor use include compaction, reduced water infiltration, increased runoff and erosion potential, and inhibited seed

germination and plant growth (Douglass et al. 1995; Alessa and Earnhart 2000; Cole 2004). The greatest effects of trampling typically occur at the initial impact, even if it is of low intensity; these effects increase incrementally with levels of use (Leonard et al. 1985).

4.0.1.1.8 Spread of Non-native Invasive Species

The presence of non-native invasive plant species can alter ecosystem structure and function; disrupt food chains and other ecosystem characteristics vital to wildlife; and dramatically modify key ecosystem processes, such as hydrology, productivity, nutrient cycling, and fire regime (Mack et al. 2000; Brooks and Pyke 2001; Randall 2001). Such species can displace native species; reduce forage and cover for wildlife; and increase the rate, intensity and severity of wildfire.

Some weed species, such as yellow star-thistle, render large blocks of land unusable for many wildlife species. Due to the sharp needle-like spines that radiate from the plant, some animals avoid these areas or suffer physical injury when passing through infested sites (Callihan et al. 1989). Other habitats are lost through the spread of weed species, such as Russian knapweed, which expands through underground root systems, thereby altering native plant community structure and reducing forage availability. Some weed species (e.g., knapweed) contain allelopathic agents that sterilize the soils around them and do not let native species grow within their zone of influence (Beck 2003).

Recreational uses can spread invasive species by varied mechanisms—such as transport on recreational equipment, clothing and footwear—and through equestrian uses, either in fecal material or in feed. Vehicle undercarriages can rapidly collect and distribute weed seeds (Montana State University Extension Service 2002).

Successful management of noxious weeds requires the development of a long-term strategic plan, incorporating prevention programs; educational materials and activities; and sustainable, long-term, integrated approaches that improve degraded plant communities, enhance the integrity of the ecosystem, and prevent reinvasion or encroachment by other noxious weed species (DiTomaso 2000).

4.0.1.1.9 Wildland Fire and Fire Suppression Activities

Fire is a major disturbance component of the Monument's ecosystems. Although natural fires (e.g., lightning strikes) do occur in the area, the vast majority of fires are of human origin. Fire can affect native ecosystems by changing fuel properties, which in turn influences fire behavior and fire regime characteristics such as frequency, intensity, extent, type and seasonality (Brooks et al. 2004).

Fire in high-quality shrub-steppe habitats generally burns in a mosaic fashion. Historically, fires were smaller in size because there were large spaces between bunchgrass plants. These interspaces would naturally have been occupied by microbiotic crust or bare soil. Fires normally did not burn for long periods due to a lack of continuity in fine fuels. Following lightning fires, vegetation in these areas would quickly regrow, reestablishing habitat connectivity.

Present-day fire regimes, however, have changed, and the destruction or degradation of habitat connectivity often results from catastrophic wildfire events where non-native invasive species are prevalent in shrub-steppe plant communities. Species such as cheatgrass occupy the interspaces between native shrub and bunchgrass species; the presence of such invasive species contributes to the overall fuel loads in these communities, causing rapid fire spread, increased fire intensity, and prolonged duration (D'Antonio 1992). Such fire has a major adverse effect on habitat connectivity. These unnatural fire events threaten to degrade plant community structure and function (D'Antonio 1992), decrease ecotones and edge effect, diminish plant community connectivity, and increase the spread of non-native invasive species.

Fire suppression activities can have moderate to substantial direct effects on upland habitats through the creation of firelines and erosion. These effects can be mitigated through Burned Area Emergency Stabilization and Fire Rehabilitation (BAER) actions, but the effects take time to remedy, especially in arid climates such as the Monument's. Emergency use of equipment (e.g., disking) for fire suppression has the potential to affect upland habitats by clearing vegetation and microbiotic crust, in turn increasing the risk of erosion and the invasion of non-native species. Effects caused by fire suppression activities can be mitigated through pre-suppression planning, adherence to initial attack stipulations, use of existing firebreaks and roads to confine and contain wildland fire, and proper implementation of rehabilitation treatments.

4.0.1.1.10 Cooperative Agreements

Where possible and beneficial towards achieving Monument management goals and objectives, the FWS will develop partnerships and cooperative working agreements with other federal, state, county and/or private entities.

4.0.1.2 Best Management Practices

4.0.1.2.1 Avoidance of Sensitive Resources

Under all alternatives, visitor activity centers, visitor facilities, and both non-vehicular and vehicular travel routes will be sited to minimize effects by avoiding sensitive natural and cultural resources. Potential adverse effects from visitor use will be further minimized through closures

or special restrictions at sites with seasonal protection needs or sites vulnerable to or experiencing resource damage. Group size limitations may be used for specific sites or activities as needed to protect sensitive resources. Visitor use will be managed using informational signs, educational materials, trails, protective devices, and law enforcement patrols. Because many threatened, endangered and sensitive (TE&S) species migrate through the Monument, construction projects and public use patterns will be scheduled seasonally to avoid adverse effects.

4.0.1.2.2 Proper Use of Chemicals in Controlling Non-native Invasive Species

The use of chemicals to control non-native invasive species will be conducted in accordance with EPA laws and regulations, FWS policy, and label directions. Pesticide Use Proposals (PUPs) will be completed annually and approved at the local, regional, or national level as required by FWS policy.

4.0.1.2.3 Implementation of Integrated Pest Management Plan

An IPM plan for invasive plant species control, entitled *Invasive Plant Species Inventory and Management Plan for the Hanford Reach National Monument* (2003) (included on CD or available at hanfordreach.fws.gov/planning.html), prescribes a methodology for treatment that includes inventories and population mapping, assessments of risk, prioritization of treatments, integrated treatment implementation, and effective monitoring. This approach considers direct effects on soils, vegetation, watershed function, and biodiversity in all treatment recommendations. In sensitive plant communities, the use of multiple tools (e.g., chemical, biological, cultural, mechanical) may be necessary to prevent weed invasion and spread, as well as disturbance of soils and plant community structure and function. Use of biological control agents (e.g., insects, microorganisms, pathogens) for control of non-native invasive plant species will be implemented in accordance with FWS policies only after such organisms have been subjected to testing and evaluation by the USDA and approved for release.

Established populations of non-native invasive plants, such as yellow star-thistle, rush skeletonweed, and knapweed, will require extensive integrated treatments to control. Each weed treatment will be conducted in accordance with the IPM plan and in accordance with stipulations set forth in annual PUPs. Additionally, SUPs for activities, such as research projects and commercial tours, will include stipulations designed to prevent the spread of invasive species. Because many components of resource management incorporate methods of invasive species control, some of which are highly visible and potentially controversial (e.g., controlled burns, aerial spraying), information and education would be used to inform the public about the IPM program.

4.0.1.2.4 Restoration Activities

Native seeds and/or plants derived from the Columbia Basin will be used as a priority for all planting/restoration projects in the Monument.¹²² Providers of native seed or native plants to the Monument will provide documentation for the origin of seed or plants and will also, in the case of seed, provide certification that the seed provided to the Monument is free of noxious weed contamination. These requirements will be included in any scope of work prior to contracting the production and supply of plant materials. Plant materials may be refused if they do not meet these requirements. Occasionally, small amounts of seed will be collected from the Monument to be provided to plant nurseries and grown into seedling plants to be replanted onto the Monument. In these cases, Monument staff will supervise the selection of species for collection and the actual collection of seed from plants on the Monument. Seed collection needs for species and amounts will be based on annual restoration and rehabilitation needs. Seeds will be collected during the appropriate season as dictated by plant species phenology, and the parent plant will not be damaged or harmed in any way during seed collection. Seed will be collected from no more than 20% of individuals within a population, and no more than 50% of the total seed production from individual plants will be collected annually.

4.0.1.2.5 Natural Resource Data Collection, Monitoring, Adaptive Management

Inventories will be conducted to obtain data related to habitat conditions; wildlife populations and habitat requirements; restoration treatment locations, timing and effectiveness; resource protection measures; invasive species control; TE&S species; and other areas of management concern. Resource information will be collected using GPS technology, permanent monitoring plots, point counts, and pedestrian transect surveys. The information collected will be used to improve existing data sets, mapping and scientific knowledge concerning species, habitats, restoration needs, treatment effectiveness, land disturbance events, and other areas of concern.

Existing and new fish, wildlife, water and vegetation monitoring programs will be conducted by Monument staff, volunteers, or cooperators to support adaptive management. These programs will entail monitoring and evaluation of habitat management and restoration activities, TE&S species, and public uses. Periodic monitoring (every five–seven years) of priority sensitive plant communities will be conducted in permanent monitoring plots.

Adaptive management is an approach to resource management that emphasizes adjusting management practices in response to what has been learned. Adaptive management decisions are based on the best available science, common sense, experience, experimentation, new scientific discoveries, and monitoring. Where possible, Monument management projects will

¹²² Depending upon the amount of seed required and specific project needs, either seed or plants may be used in restoration activities.

be designed to contribute to the body of knowledge, as well as to meet specified resource objectives.

4.0.1.2.6 Cultural Resource Inventories

Prior to implementation of any ground-disturbing projects, the applicable cultural resource compliance investigation will be undertaken. This investigation may entail a literature review, records search, field survey, and tribal consultation. If cultural resources are present, appropriate procedures will be implemented to protect them as per federal laws and FWS policies and guidelines.

4.0.1.2.7 Fire Management

Fire management activities will conform to guidelines set forth in FWS policy and the approved Fire Management Plan for the Monument. Wildland fire will be suppressed when possible; suppression techniques will be designed to minimize surface disturbance in the vicinity of sensitive resources. Fire control policies will be implemented to reduce the risk of human-caused wildland fire.

4.0.1.2.8 Facility Design/Aesthetic Considerations

Landscape design standards will be developed to protect the Monument's natural beauty, scenic vistas, and cultural heritage and to ensure that all site developments and facility improvements contribute to, rather than detract from, aesthetic appeal. Facility design and placement will be carefully planned with landscape integrity in mind. Future interpretive sites and signs will be designed to have an unobtrusive profile, with framing and supports that blend with the environment. Visitors will be encouraged to use natural-colored equipment where appropriate.

4.0.2 Effect Severity Ratings

The lands comprising the Monument served as a buffer zone around Central Hanford for more than sixty years, with extensive research and environmental monitoring conducted on lands directly associated with the DOE's mission. However, comprehensive inventories have in many cases not been completed to a level sufficient for intensive resource management. In-depth resource inventories for cultural resources, wildlife, vegetation, and public use activities are either underway or pending. The information used in this NEPA analysis was obtained from relevant scientific literature, existing databases and inventories, consultations with other professionals, and personal knowledge of resources based on field visits and experience.

The thresholds and severity ratings defined below were used to analyze the scope, scale and intensity of effects on natural, cultural and recreational resources.

Negligible: Resources would not be affected, or the effects would be at or near the lowest level of detection. Resource conditions would not change or would be so slight that there would not be any measurable or perceptible consequence to a population, plant community, cultural resource, recreation opportunity, or visitor experience.

Minor: Effects would be detectable but localized, small, and of little consequence to a population, plant community, cultural resource, recreation opportunity, or visitor experience. Mitigation, if needed to offset adverse effects, would be easily implemented and successful.

Moderate: Effects would be readily detectable and localized, with consequences to a population, plant community, cultural resource, recreation opportunity or visitor experience. Mitigation measures would be needed to offset adverse effects, would be extensive in nature, moderately complicated to implement, and would probably be successful.

Major: Effects would be obvious and would result in substantial consequences to cultural resources, populations, plant communities within the local area and region, recreation opportunities, or visitor experiences. Extensive mitigating measures would be needed to offset adverse effects, would be large-scale in nature and very complicated to implement, and would not have a guaranteed probability of success. In some instances, major effects would include the irretrievable loss of the resource.

Time and duration of effects have been defined as shown below.

Short-term: An effect that generally would last less than a single year or season.

Long-term: A change in a resource or its condition that would last longer than a single year or season.

4.0.3 Description of Management Actions

Management actions proposed in this document with the potential to impact natural, cultural and recreational resources are explained within each management program below. To avoid redundancy, the actions described below are referred to by section number throughout the rest of the chapter.

4.0.3.1 Biological Resource Management Actions

4.0.3.1.1 Control of Non-native Invasive Species

Non-native species pose a risk to the loss of biological integrity in shrub-steppe, riverine and riparian habitats. A generalized objective for ecologically based weed management is to develop and maintain a healthy plant community that is largely resistant to invasion (Sheley 2003). Under all alternatives, non-native invasive species will be treated in accordance with the procedures and guidelines set forth in the IPSIMP. The primary relevant management actions are the inventory, prioritization and treatment of weed populations based on an annual threats assessment and analysis. Due to the shortage of funds to treat known weed populations annually, the prioritization of treatments, accompanied by follow-up monitoring, is essential.

Table 4.1. Acres of Weed Infestation by Unit.*

Weed Species	Rattle-snake	Ringold	River Corridor	Saddle Mountain	Wahluke	Total
Russian knapweed	435	138	117	Trace	88	777
Camelthorn	0	0	0	Trace	0	Trace
Hoary cress	495	2	1	0	0	497
Diffuse knapweed	151	54	1,324	22	2128	3,679
Yellow star-thistle	0	69	0	Trace	244	313
Rush skeletonweed	659	0	26	0	2	687
Canada thistle	2	4	5	Trace	4	15
Field bindweed	47	0	36	0	0	83
Russian olive	0	**	**	**	579	579
Kochia	**	**	26	**	64	90
Common rye	472	4	0	0	0	476
Swainson's pea	3	0	0	0	35	38
Salt cedar	0	**	397	**	882	1,279
Puncturevine	1	**	**	**	**	1
Totals	2,589	272	1,969	22	4,026	8,879
<p>* About 30% of the Monument has been mapped to date. ** Weeds are present but not currently mapped.</p>						

Alternative A would entail the annual treatment of 5,000–9,000 acres. Weeds would be treated along major transportation corridors using IPM techniques to prevent the spread of non-native invasive species into adjacent upland plant communities. Spot spraying, hand pulling, and seeding with native species would be conducted annually on high-priority weed populations in off-road situations. With current staffing and funding, only a small portion of known weed infestations (the highest priorities) would be mapped, treated and monitored annually.

Alternatives B and F, C and E, and D would entail the annual mapping and treatment of 18,000, 13,000, and 11,000 acres, respectively, using IPM techniques. Under each alternative, weed populations would be prioritized and treated annually on the basis of threats analysis and the subject population's potential for offsite movement and infestation of adjacent lands.

4.0.3.1.2 Restoration Activities

Upland Restoration Activities

Alternative A would entail restoration activities on 0–10,000 acres annually, focusing primarily on lands disturbed by wildfire events, maintenance-related project work, Hanford Site mitigation, and noxious weed control efforts. For example, in 2005 two large wildfires required emergency stabilization and rehabilitation actions in the Saddle Mountain Unit (5,000 acres) and the Wahluke Unit (6,000 acres). The location and acreage to be treated varies from year to year, and the potential effects on specific resources would be assessed in individual NEPA documents for each project.

Alternatives B and F, C and E, and D would entail annual restoration activities on approximately 6,000, 4,000, and 2,000 acres, respectively, over fifteen years. Restoration methods would be used primarily to restore degraded habitats or disturbed areas to a natural spectrum of native plant associations, thus improving the condition of native vegetation. Treatments would consist of wildland fire BAER; additionally, prescribed fires would be followed by seeding, hand planting of nursery stock, drill or broadcast seeding, or broadcast/harrowing activities. Restoration may also include plowing, discing, mowing, or other seed bed preparation activities, followed by drill/broadcast seeding or broadcast/harrowing activities. Some restoration projects would be limited to planting activities.

Riparian and Wetland Restoration Activities

Under Alternatives B–F, riparian restoration activities would be undertaken on disturbed habitats in the river corridor. To date, no long-range restoration plans have been developed for the individual management units. Additional resource data will be necessary to determine restoration needs and priorities for each individual unit, and individual projects will be subject to additional environmental review and documentation prior to project initiation. Generally, in

areas where non-native plants are established, control and management of non-native species, followed by replacement with a diversity of native riparian and aquatic plants, would occur, primarily through active planting of native species.

Under Alternatives C, D and E, water control structures, dikes and ponds would be installed or repaired in selected areas surrounding irrigation waterways and artificial seeps on approximately 800 acres in the Wahluke Unit and approximately 320 acres of seasonal wetlands in the Ringold Unit. Water management in these areas would allow for greater control of wetland water levels and would allow for development of wetland habitats characteristic of plant communities of the Columbia River. Additional resource data would be necessary to determine restoration needs and priorities for each individual unit, and individual projects would be subject to additional environmental review and documentation prior to project initiation.

Rattlesnake Mountain

Several unnecessary buildings and structures on the crest of Rattlesnake Mountain would be removed through scheduled demolition and disposal actions associated with DOE remediation activities. Removal of structures on the crest of Rattlesnake Mountain would be a DOE action, and additional NEPA coverage would be provided through DOE remediation action plans. Buildings identified for demolition and cleanup would be removed, and upland and lithosol habitats would be restored. Some ground-disturbing activities to remove building materials, asphalt, gravel, roads and concrete foundations would be necessary. Clean-up work would also involve human and vehicle activity around the project area. Site stabilization through seeding with native species, control of noxious weeds, and rehabilitation treatments would occur following the removal of structures. These activities would attempt to return portions of the crest of Rattlesnake to pre-Manhattan Project conditions. However, structures associated with valid existing rights (communications, utilities, emergency services, climate monitoring, etc.) would remain in place.

The observatory on the crest of Rattlesnake Mountain would remain in place under Alternatives A, D and E. Under these alternatives, the observatory would be primarily operated remotely, thereby reducing the number of physical visits to the summit by the public. However, some maintenance and visitor traffic to the observatory would be expected. Under Alternatives B, C and F, in order to achieve habitat restoration and cultural objectives for the summit of Rattlesnake Mountain, the observatory would be proposed for removal, and the site restored as described above.

4.0.3.1.3 Wildlife Population Control

The objective of wildlife population control on the Monument is to manage, control, or remove populations that threaten or affect Monument resources, public safety, or private property.

Under all alternatives, control of wildlife populations would be conducted as needed on the basis of scientific resource management data. Wildlife population control efforts may use both non-lethal and lethal methods. Control methods would be used to reduce populations to a level consistent with species management objectives and in a manner that controls target populations without impairing Monument resources.

4.0.3.2 Visitor Service Management Actions—Interpretation and Education

4.0.3.2.1 Interpretive Site Development

No interpretive site developments are planned under Alternative A. Alternatives B and F, C and E, and D would establish ten, fifteen and twenty interpretive sites, respectively.

4.0.3.2.2 Interpretive Trail Development

Alternative A does not include the establishment of interpretive trails in the Monument. Up to two interpretive trails would be developed under Alternatives B and F, up to four interpretive trails would be developed under Alternatives C and E, and up to six interpretive trails would be developed under Alternative D.

4.0.3.3 Visitor Service Management Actions—Recreation

4.0.3.3.1 Hunting

Under all alternatives, the Monument would remain open to hunting in designated areas; however, the number of acres open to hunting would vary as shown below.

- Alternative A – 62,025 acres.
- Alternative B – 62,919 acres.
- Alternative C – 71,037 acres.
- Alternatives D and E – 74,079 acres.
- Alternative F – 92,555 acres.

Each alternative calls for developing a step-down Hunting Plan to address issues such as facility needs, access, public safety, and commercial guide requirements. Hunting in the Monument

would be subject to: 1) Washington State season and limit requirements; 2) FWS policy disallowing use of lead ammunition; and 3) DOE-imposed weaponry restrictions allowing only shotguns, muzzleloaders and archery equipment. Under all alternatives, the longstanding waterfowl sanctuary would be continued. The sanctuary area includes the Columbia River and lands within 1/4-mile of the river from the wooden power lines at river mile 362 to the Vernita Bridge. This sanctuary area would continue to be closed to all waterfowl hunting, and the White Bluffs Boat Launch would continue to be closed to motorboats during the winter to reduce waterfowl disturbance. In accordance with the FWS policy prohibiting the release of non-native species for sport hunting purposes, the pheasant release program would be discontinued.

4.0.3.3.2 Fishing

Under all alternatives, fishing would be allowed in the Monument in the Columbia River and WB-10 Ponds, with seasons and catch limits regulated by the WDFW. Under all alternatives, a step-down Fishing Plan would be developed to address issues such as facility needs, access, public safety, commercial guiding, and others.

4.0.3.3.3 Wildlife Observation and Photography

Under Alternative A, no wildlife observation and photography sites would be developed. Visitors seeking to observe wildlife would continue to use existing roads and access points. Alternatives B and F would entail development of up to six observation sites, Alternatives C and E would entail development of up to eight observation sites and two photography sites, and alternative D would entail development of up to twelve observation sites and three photography sites. Where feasible and desirable, sites would be designed as “blinds” to visually screen observers from wildlife. Some sites may be able to support both observation and photography activities, thus potentially lowering the total number of sites developed under any alternative.

4.0.3.3.4 Hiking

Under Alternative A, cross-country hiking would continue to occur on 58,858 acres. Under Alternatives B–F, visitors would be encouraged to stay on designated trails, although cross-country use would be allowed in most areas. Under Alternative B, 59,578 acres would be open to hiking, with approximately 30 miles of designated trails in the Ringold, Columbia River, and Wahluke Units. Under Alternative C, 101,675 acres would be open to hiking, with approximately 100 miles of designated trails in the Ringold, Columbia River, Wahluke and Rattlesnake Units. Under Alternative D, 101,675 acres would be open to hiking, with about 150 miles of designated trails in the same units specified under Alternative C. Under Alternative E, 101,132 acres would be open to hiking, with about 150 miles of designated trails in the same

units specified under Alternative C. Under Alternative F, 92,177 acres would be open to hiking, with about 30 miles of designated trails in the same units specified under Alternative B.

4.0.3.3.5 Equestrian Use

Under Alternative A, equestrian use would continue to occur in public use areas with few restrictions. Under Alternatives B–F, equestrian use would be limited to designated roads and trails. Many of the trails available for hiking (summarized above) would be open to equestrian use. Under Alternatives B–F, a step-down Equestrian Plan would be developed to address travel routes, infrastructure needs, and other related topics.

4.0.3.3.6 Boat Launches

Vernita Bridge

Under all alternatives, designated vehicle routes would be established in the Vernita Bridge boat launching area. Under Alternatives A B, and F, the Vernita Bridge area would continue to provide primitive opportunities for motorized and non-motorized boat launching. Under Alternatives C, D and E, a developed boat launch would be provided.

White Bluffs

Under Alternatives A, B and D, the White Bluffs Boat Launch would remain open; improvements would be made under Alternative D. Under Alternative C, once developed launches are established at the Ringold Fish Hatchery and Vernita Bridge areas, the White Bluffs Boat Launch and access road would be closed to vehicle use and the area would provide non-motorized recreation opportunities. Under Alternatives E and F, once a developed launch is established at the Ringold Fish Hatchery, the White Bluffs Boat Launch would be closed to motorized boats, remaining open for non-motorized boats.

Ringold Fish Hatchery

Under Alternative A, the FWS would not pursue partnerships to provide a developed boat launch at the WDFW Ringold Fish Hatchery. Under Alternatives B–F, the FWS would work with partners to develop a boat launch adjacent to the Monument boundary in the Ringold Fish Hatchery area.

South Shore

Under Alternatives A, B, C, E and F, boat launches would not be established on the south shore of the Columbia River (Benton County side) within the Monument boundaries. Under Alternative D, one to two existing boat launches that are located on the south shore and currently used for administrative purposes would be improved and opened for public use.

4.0.3.3.7 Camping

Vernita Bridge

Under Alternative A, the Vernita Bridge area would continue to provide primitive opportunities for camping. Under Alternatives B, C and F, overnight use would not be allowed. Under Alternatives D and E, a campground would be developed.

Non-Motorized Boat Camping

Under Alternatives A, B and F, non-motorized boat-in campsites would not be established. Under Alternatives C, D and E, three to six campsites would be established in the central river corridor for use by non-motorized boaters.

Saddle Mountain

Under Alternatives A, B, C, E and F, camping would not be allowed in the Saddle Mountain Unit. Under Alternative D, a campground would be developed in a previously disturbed area along State Route 24.

4.0.3.3.8 Modified Public Access

Columbia River Unit

Vernita Bridge, South Shore. Under Alternative A, current access and public uses would be continued in the Riverlands area. Under Alternative E, public access and uses would be allowed on designated roads and trails only, with use closures established as needed to protect sensitive resources. Under Alternatives B, C, D and F, the Riverlands area would be closed to public access except for permitted research or environmental education activities.

Sand Dunes. Under Alternatives A, B and F, the sand dunes would remain closed to public access except for permitted research or environmental education activities. Under Alternatives C, D and E, public access via non-motorized trails would be provided.

South Shore. Under Alternatives A, B and F, the south shore would remain closed to public access. Under Alternatives C, D and E, public access would be provided.

North Shore. Under Alternatives A, B, C and F, new access points would not be provided to the north shore. Under Alternatives D and E, new access points would be provided.

Ringold Unit

Parking. Under Alternative A, eight existing parking areas in the Ringold Unit would be maintained. Under Alternatives B–E, all parking areas would be evaluated; those with consistent visitor use would be maintained, and those that are rarely used would be closed. Management under Alternative F would be as described for Alternatives B–E, with the addition of closing existing Parking Lot 7.

Auto Tour. Under Alternatives A, B, C, E and F, an auto tour route would not be established in the Ringold Unit. Under Alternative D, an auto tour route would be established in this area.

Saddle Mountain Unit

Under Alternatives A and D, current access to and surrounding the Saddle Mountain summit area would be maintained. Under Alternative B, the Saddle Mountain Road and 2,643 acres encompassing the Saddle Mountain summit would be closed. Under Alternatives C and F, the Saddle Mountain Road would be closed to vehicles a short distance from State Route 24, and access to the summit would be by non-motorized means only. Under Alternative E, the Saddle Mountain road would remain open, with use limitations placed on 2,643 acres encompassing the summit.

Wahluke Unit

West Portion Access. Under Alternative A, there would be no public access provided in the western portion of the Wahluke Unit. Under Alternative B, one new public access point would be provided and 5,777 additional acres in the Wahluke Unit would be open to non-motorized use. Under Alternatives C, D and E, two new public access points would be provided and 28,313 additional acres in the Wahluke Unit would be open to non-motorized use. Under Alternative F, one new public access point would be provided and 28,313 additional acres in the Wahluke Unit would be open to non-motorized use.

Auto Tour. Under Alternatives A, B, C, E and F, an auto tour route would not be established near the Vernita Bridge in the Wahluke Unit. Under Alternative D, an auto tour route would be established in this area along existing administrative roadways.

4.0.3.3.9 Permit System

Under Alternatives A–E, public use areas would not require a permit for access. Under Alternative F, a permit system for all public use in the Monument would be implemented. Permits would be available from self-issue stations at Monument entrances, gateway areas, and administrative offices and from the Monument internet site. No fees or nominal fees would be charged for permits.

4.1 Effects on Geological/Paleontological Resources

The Monument Proclamation specifies protection and preservation of the Monument's unique geological and paleontological features. Many of the Monument's geological features, such as the Hanford sand dunes, glacial erratics, berg mounds, gravel bars, the White Bluffs, and the Ringold Formation, are well-known. The locations of paleontological resources, including fossils and petrified wood, are less well known.

4.1.1 Assumptions

Ground-disturbing activities, such as integrated pest management, restoration activities, visitor facility development, or general maintenance activities, would avoid sensitive geological and paleontological resources and would not adversely affect these sites or features.

Under all alternatives, highlighting these resources through interpretative and educational activities and materials will make a greater portion of the population aware of their existence. Once these resources become more widely known, they could be at heightened risk of damage from illegal activities. However, through careful implementation of education programs and law enforcement activities, adverse effects on these resources are anticipated to be negligible.

4.1.2 Effects Analysis—Geological Resources

4.1.2.1 Effects Common to All Alternatives

4.1.2.1.1 Control of Non-native Invasive Species

Activities to control non-native invasive species using IPM techniques in and around the White Bluffs area could result in minor to moderate beneficial effects. Currently, a variety of non-native species, such as salt cedar and Russian knapweed, occupy the seeps, springs and wetland areas in the sloughing portion of the bluffs. Removal of these species through chemical and mechanical control measures, combined with follow-up treatments of seeding and planting with native species, could contribute to stabilizing the bluffs. There is a potential that removing non-natives and replacing them with native plant species could reduce overall erosion rates; however, this conclusion remains speculative. Removing mature vegetation and replacing it with seeded or seedling species may temporarily increase erosion rates, as young plants would use less water than existing mature trees. However, it is expected that over time, areas would stabilize as vegetation matures. Although additional research is needed, implementation of an aggressive non-native invasive species control program with replanting of native trees and shrubs could result in minor to moderate positive effects on the White Bluffs through the stabilization of soils and by reducing erosion.

Alternatively, aggressive removal of non-native vegetation such as salt cedar may cause increased erosion rates, with resultant minor adverse effects on the geology of the White Bluffs. Salt cedar is known to have extensive root systems and to be a highly efficient plant for transpiring large amounts of water. Removing salt cedar may increase erosion as the water that is currently being used by these plants would then be released into the bluffs. This conclusion also remains speculative and requires further research; however, the large scale removal of these non-native plants without followup treatment to replace the mature vegetation has the potential to create minor adverse effects on the White Bluffs by increasing erosion rates.

Implementation of IPM for non-native plants in the area of the White Bluffs will require careful monitoring of treatments to determine impacts to the soils, geology and vegetation within the slumping areas of the bluffs.

4.1.2.1.2 Restoration Activities

Activities associated with restoration of shrub-steppe and lithosol habitats are anticipated to have negligible effects on geological resources.

Riparian area restoration actions are expected to have minor direct effects on geological resources. Non-native invasive species control work that causes soil disturbance through the mechanical removal of vegetation (e.g., Russian olive removal) would have direct effects on geological resources through soil disturbance, exposure, or erosion. These effects would be mitigated through site stabilization, native seeding, and plantings. Overall, riparian/riverine restoration would directly benefit geological resources by improving plant community health, by increasing vegetative cover to stabilize soils, and by reducing erosion through streambank stabilization actions.

4.1.2.1.3 Wildland Fire and Fire Suppression Activities

In areas where annual weed species are prevalent, increased fire intensity and duration could lead to the destruction and degradation of geological resources. In many cases, geological resources are protected from severe fire effects by their position on the landscape. Direct effects of fire, such as the loss of vegetative cover (increasing susceptibility to erosion), weathering, spalling, discoloration from fire retardant and oxidation, and heat damage, would be minor. Because of the human tendency to explore previously vegetated areas on foot, by vehicle, or on horseback when vegetation is removed, indirect effects could result from disturbance associated with increased human activity. Increased visitor use around geological sites would exacerbate soil erosion and could contribute to resource degradation.

4.1.2.1.4 Public Use

Surface disturbance would result from development of visitor facilities such as trails, interpretive sites, boat launches, restrooms, and parking areas. Visitor use on and around facilities would result in soil compaction, vegetation disturbance, increased erosion, and exposure and degradation of geological resources. Increased visitor use would likely increase the occurrence of vandalism.

4.1.2.2 Effects of Biological Resource Management Actions

Restoration activities on the summit of Rattlesnake Mountain would attempt to return portions of the site to pre-Manhattan Project conditions. Restoration activities under all alternatives would affect geological resources through demolition and disposal actions associated with scheduled DOE remediation activities on top of Rattlesnake Mountain. Recontouring of the basalt soil following the removal of physical improvements would have a short-term effect, but would result in long-term beneficial effects on the stabilization of the area. Improved site stabilization and reduced erosion potential would be long-term beneficial effects.

4.1.2.3 Effects of Visitor Services Management Actions— Interpretation and Education

4.1.2.3.1 Interpretive Site Development

Under Alternative A, no interpretive sites would be established or planned that depict, explain, or interpret the Monument's geological resources. Several interpretive programs highlighting these resources would be offered annually in the Monument. These programs would be localized and managed and would cause negligible adverse effects.

Under Alternatives B–F, several interpretive sites would present subject matter pertinent to geological resources. Those sited away from geological resources would have negligible adverse effects. Those at or near geological resources would be sited to minimize adverse effects. Site inventories would be conducted prior to installation to facilitate avoidance of any important and significant resources. Visitor flow patterns, vehicle routes, and parking areas would be designed to minimize effects. It is anticipated that interpretive site development would have minor effects on geological resources.

4.1.2.3.2 Interpretive Trail Systems

Under Alternative A, no interpretive trail development would take place; consequently, negligible adverse effects on geological resources are expected.

Under Alternatives B–F, the purpose of interpretive trails would be to highlight Monument resources, including geological resources. Trails would be carefully planned to provide access to, and interpretation of, geological resources. Any sensitive resources would be avoided, or interpretation of the resource's sensitivity (e.g., erosion and slumping of the White Bluffs) would be presented. Trail routes would avoid hazards such as cliffs and rock outcroppings prone to landslides.

Each interpretive trail could have some element of interpretation discussing geological resources. Prior to construction of interpretive trails, site inventories would be conducted and significant resources would be located and identified. Trails would be carefully sited to avoid significant resources, and construction methods would employ measures to mitigate collateral damage from erosion and visitor activities. It is anticipated that each trail would have minor adverse effects on geological resources during development.

Interpretive signs along trails would highlight significant geological resources that are near to or visible from the trail. Information would be presented to educate visitors regarding the significance of the resources and any protective regulations that are in effect. The importance

of protecting fragile resources would be emphasized, and the ongoing efforts to study and preserve them would be explained. In areas of potential visitor effects, directional and regulatory signage would be installed. It is anticipated that these actions would have positive long-term effects associated with better control of pedestrian travel routes and reduction of off-trail travel. Adverse effects on geological resources from increased visitation would include the possibilities of vandalism, looting and destruction of fragile geological resources, although given the nature of the resource, the overall impacts would be slight.

4.1.2.4 Effects of Visitor Services Management Actions—Recreation

4.1.2.4.1 Hunting

Visitors pursuing big and upland game hunting activities in the Monument typically walk cross-country or follow game trails. These activities are dispersed across large areas that are open to hunting, the extent of which varies by alternative. Resulting adverse effects, such as increased erosion and degradation of geological resources, are anticipated to be negligible due to the seasonal use and dispersed nature of the activity (Cole 2004).

Visitors hunting waterfowl in the Monument typically walk from a parking area to a desirable location, set up a blind, and remain stationary. In the past, hunters dug waterfowl pass-shooting depressions along bluffs in the Wahluke Unit; however, this activity is no longer allowed. Most waterfowl hunters tend to use common footpaths between parking areas and hunting locations, resulting in localized soil compaction and vegetation disturbance along the Columbia River in the Ringold Unit and around the WB-10 Ponds and along bluffs above the Columbia River in the Wahluke Unit. In view of the localized nature of effects, and the lack of distinctive geological features in these areas, negligible effects on geological resources are anticipated.

4.1.2.4.2 Fishing

Wake-based erosion from motorboat-based fishing activities may exacerbate existing shoreline erosion that results from subsurface offsite irrigation drainage and water level fluctuations in the Columbia River. Shoreline erosion and slumping are presently causing major adverse effects on White Bluffs deposits near Locke Island at river mile 366. However, adverse effects caused by motorboat-based fishing are anticipated to be negligible compared to the effects of irrigation drainage and frequent water level fluctuations.

Bank fishing activities primarily occur in the Ringold and Columbia River Units. Visitors pursuing bank fishing activities typically walk from a parking area to one or more desirable locations along the Columbia River, resulting in localized soil compaction and vegetation

disturbance along these routes. In view of the localized nature of effects, and the lack of geological features in these areas, negligible effects on geological resources are anticipated.

4.1.2.4.3 Wildlife Observation and Photography

Under Alternative A, in the event that a wildlife observation or photography opportunity attracts repeated visitation to a sensitive area, minor, long-term, adverse effects could occur from foot traffic. Although they are possible, such effects have not been detected in the Monument. Under Alternatives B–F, minor, long-term, beneficial effects would result from concentrating activities in sites that are designed to provide a quality experience while minimizing adverse resource effects. Effects associated with site development and visitor use would still occur as described in Section 4.1.2.1.4. However, with implementation of BMPs described in Section 4.0.1.2, Alternatives B–F are anticipated to result in negligible adverse effects on geological resources.

4.1.2.4.4 Hiking

Alternative A would have minor, long-term, adverse effects on geological resources primarily as a result of erosion where hiking occurs through sensitive dune and bluff areas in the Wahluke and Ringold Units. Effects may increase in severity over time as hiking activity increases in the Monument. All action alternatives would result in minor, long-term, beneficial effects on geological resources by concentrating use on designated trail systems and reducing cross-country foot traffic. Because sensitive resources would be avoided under Alternatives B–F, negligible adverse effects are anticipated from trail development.

4.1.2.4.5 Equestrian Use

Alternative A would have minor, long-term, adverse effects on geological resources resulting from erosion where horses travel through sensitive dune and bluff areas in the Wahluke and Ringold Units. Effects may increase in severity over time as equestrian use increases in the Monument (Newsome et al. 2004). Alternatives B–F would result in minor, long-term, beneficial effects on geological resources by establishing designated roads and trails and eliminating cross-country equestrian use.

4.1.2.4.6 Boat Launches

With implementation of BMPs described in Section 4.0.1.2, the maintenance and/or development of boat launches is anticipated to have negligible effects on geological resources.

4.1.2.4.7 Camping

With implementation of the BMPs described in Section 4.0.1.2, campground development is anticipated to have negligible effects on geological resources. However, the availability of camping opportunities in the Monument would likely result in increased visitor use, which could have adverse effects as described in Section 4.1.2.1.4.

4.1.2.4.8 Modified Public Access

Columbia River Unit

Vernita Bridge, South Shore. Because no known sensitive geological resources occur in this area, negligible effects are anticipated under any alternative.

Sand Dunes. Under Alternatives C, D and E, adverse effects to the sand dunes may result from foot traffic and associated trampling and erosion along the trail corridor. However, in view of the relatively small area of potential effect, and with implementation of BMPs described in Section 4.0.1.2, these effects are anticipated to be minor.

South Shore. Under Alternatives C, D and E, with implementation of BMPs described in Section 4.0.1.2, the effects on geological resources are anticipated to be negligible.

North Shore. Under Alternatives D and E, with implementation of BMPs described in Section 4.0.1.2, effects on geological resources are anticipated to be negligible.

Ringold Unit

Parking Areas. Under all alternatives, negligible effects on geological resources are anticipated.

Auto Tour. Under Alternative D, visitors would gain improved access in the vicinity of fragile geological features (i.e., bluff features). Incidental public use within the travel corridor could result in effects as described in Section 4.1.2.1.4. With implementation of BMPs described in Section 4.0.1.2, including such restrictions as requiring visitors to remain on the roadway in fragile areas, adverse effects are anticipated to be minor.

Saddle Mountain Unit

Because no sensitive geological resources are known to occur in this area, negligible effects are anticipated under all alternatives.

Wahluke Unit

West Access. Alternatives B–F would provide public access to areas that have been closed to the public for more than sixty years. Adverse effects could occur as described in Section 4.1.2.1.4; however, with implementation of BMPs described in Section 4.0.1.2, these effects are anticipated to be negligible.

Auto Tour. Because sensitive geological features are not known in this area, an auto tour route under Alternative D is anticipated to have negligible effects.

4.1.2.4.9 Permit System

Under Alternative F, implementation of a permit system is anticipated to have negligible effects on geological resources.

4.1.3 Effects Analysis—Paleontological Resources

4.1.3.1 Effects Common to All Alternatives

4.1.3.1.1 Control of Non-native Invasive Species

Activities to control non-native invasive species that cause soil disturbance through the mechanical removal of vegetation (e.g., Russian olive removal) would have direct effects on paleontological resources through soil disturbance, exposure, or erosion. These effects would be mitigated through site stabilization, native seeding, and plantings. Such treatments would be expected to have moderate beneficial effects on paleontological resources through the reestablishment of native vegetation, soil stabilization, reduced soil erosion, and improved plant community health.

4.1.3.1.2 Restoration Activities

Restoration activities on the summit of Rattlesnake Mountain would attempt to return portions of the site to pre-Manhattan Project conditions. Under all alternatives, effects would have negligible effects on paleontological resources because there are no recorded occurrences of such resources in the basalt formations on Rattlesnake Mountain.

Riparian/riverine restoration would indirectly benefit paleontological resources by improving plant community health and by increasing vegetative cover to camouflage exposed sites, stabilize soils, and reduce erosion through streambank stabilization actions.

4.1.3.1.3 Wildland Fire and Fire Suppression Activities

In areas where annual weed species are prevalent, increased fire intensity and duration could lead to the destruction and degradation of paleontological resources. In many cases, paleontological resources are protected from severe fire effects by their position on the landscape. However, fire would have moderate direct effects on paleontological resources, such as the loss of vegetative cover (increasing exposure and susceptibility to erosion), weathering, spalling, discoloration from fire retardant, and heat damage. Because of the human tendency to explore previously vegetated areas on foot, by vehicle, or on horseback when vegetation is removed, fire events could lead to increased potential disturbance and looting of paleontological resources.

4.1.3.1.4 Public Use

Surface disturbance would result from development of visitor facilities such as trails, interpretive sites, boat launches, restrooms, and parking areas. Visitor use on and around facilities would result in soil compaction, vegetation disturbance, increased erosion, and exposure and degradation of paleontological resources. Illegal removal of fossil materials could occur with increased visitor use.

4.1.3.2 Effects of Biological Resource Management Actions

No direct effects on paleontological resources are anticipated to result from proposed upland and riparian restoration activities, integrated pest management activities, or inventory and monitoring procedures.

4.1.3.3 Effects of Visitor Services Management Actions— Interpretation and Education

4.1.3.3.1 Interpretive Site Development

Under Alternative A, no interpretive sites would be established or planned that depict, explain, or interpret any of the Monument's paleontological resources. Several interpretive programs highlighting these resources would be offered annually in the Monument, but they would result in negligible adverse effects.

The existence of fossil remains in the Ringold Formation is one of the distinctive features of the Monument. Under Alternatives B–F, several interpretive sites would present subject matter pertaining to paleontological resources. Prior to development, site inventories would be conducted to avoid any important and significant resources. Those sited away from such resources would have negligible adverse effects. Those at or near paleontological resources would be sited to minimize adverse effects. Visitor flow patterns, vehicle routes, and parking areas would be designed to minimize effects. Although heightened attention could potentially increase the level of attempts to vandalize and exploit these resources, the exact locations of fossil remains will not be disclosed. An increased law enforcement presence, along with educational materials, will help to mitigate any negative effects caused by the development of interpretive sites. It is anticipated that effects from interpretive site development would be minor.

4.1.3.3.2 Interpretive Trail Systems

Under Alternative A, no interpretive trail development would take place; consequently, no effects on paleontological resources are expected.

Under Alternatives B–F, interpretive trails would be sited to avoid any known paleontological sites and sites where resources could exist or become exposed in the future. Such sites are generally found in the exposed face of the White Bluffs; these areas would also be avoided because of visitor safety concerns. Certain interpretive trails would support some interpretation of paleontological resources. Before construction of interpretive trails, site inventories would be conducted, and all significant resources would be located and identified. Trails would be carefully sited to avoid significant resources and measures to mitigate collateral damage from erosion and visitor activities would be implemented. It is anticipated that each trail would have negligible effects on paleontological resources during development and that these effects would be of short duration.

Interpretive signage along trails would highlight unique and significant paleontological resources that are near to or visible from the trail. Information would be presented to educate visitors regarding the significance of the resources and any protective regulations that are in effect. The importance of protecting fragile resources would be emphasized, and the ongoing efforts to study and preserve them would be explained. In areas of potential visitor effects, directional and regulatory signs would be installed. It is anticipated that these actions would have beneficial long-term effects. Adverse effects on paleontological resources from increased visitation would be minimal; however, the possibility of vandalism, looting and destruction of fragile paleontological resources does exist if safeguards are not implemented (e.g., law enforcement patrols).

4.1.3.4 Effects of Visitor Services Management Actions—Recreation

4.1.3.4.1 Hunting

The effects of hunting activities on paleontological resources would be similar to those described for geological resources; negligible effects are anticipated.

4.1.3.4.2 Fishing

The effects of fishing activities on paleontological resources would be similar to those described for geological resources; negligible effects are anticipated.

4.1.3.4.3 Wildlife Observation and Photography

The effects on paleontological resources would be similar to those described for geological resources. Minor, long-term adverse effects are anticipated under Alternative A, and minor, long-term, beneficial effects are anticipated under Alternatives B–F.

4.1.3.4.4 Hiking

The effects of hiking on paleontological resources would be similar to those described for geological resources. Minor, long-term adverse effects are anticipated under Alternative A, and minor, long-term, beneficial effects from concentrating hiking activities on trails are anticipated under Alternatives B–F.

4.1.3.4.5 Equestrian Use

The effects of equestrian use on paleontological resources would be similar to those described for geological resources. Minor, long-term adverse effects are anticipated under Alternative A, and minor, long-term, beneficial effects from concentrating equestrian use on trails are anticipated under Alternatives B–F.

4.1.3.4.6 Boat Launches

With implementation of BMPs described in Section 4.0.1.2, the maintenance and/or development of boat launches is anticipated to have negligible effects on paleontological resources.

4.1.3.4.7 Camping

With implementation of the BMPs described in Section 4.0.1.2, campground development is anticipated to have negligible effects on paleontological resources. However, the availability of camping opportunities in the Monument would likely result in increased visitor use, which could result in long-term, adverse effects as described in Section 4.1.3.1.4.

4.1.3.4.8 Modified Public Access

Columbia River Unit

Vernita Bridge, South Shore. Because no known sensitive paleontological resources occur in this area, negligible effects are anticipated under any alternative.

Sand Dunes. Under Alternatives C, D and E, with implementation of BMPs described in Section 4.0.1.2, the effects on paleontological resources are anticipated to be negligible.

South Shore. Under Alternatives C, D and E, with implementation of BMPs described in Section 4.0.1.2, the effects on paleontological resources are anticipated to be negligible.

North Shore. Under Alternatives D and E, with implementation of BMPs described in Section 4.0.1.2, the effects on paleontological resources are anticipated to be negligible.

Ringold Unit

Parking Areas. Under all alternatives, negligible effects on paleontological resources are anticipated.

Auto Tour. Under Alternative D, visitors would gain improved access in the vicinity of paleontological resources. Incidental public use within the travel corridor could result in effects as described in Section 4.1.3.1.4. With implementation of BMPs described in Section 4.0.1.2, including such restrictions as requiring visitors to remain on the roadway in sensitive areas, adverse effects are anticipated to be minor.

Saddle Mountain Unit

Under Alternatives A, D and E, access to the Saddle Mountain summit could result in adverse effects as described in Section 4.1.3.1.4. However, with implementation of BMPs described in Section 4.0.1.2, these effects would be minor. Alternative B would result in a minor beneficial effect by removing the sources of disturbance described above. Although Alternatives C and F are expected to result in reduced visitation to the summit, effects would be similar to those described for Alternatives A, D and E.

Wahluke Unit

West Access. Alternatives B–F would provide public access to areas that have been closed to the public for more than sixty years. Adverse effects could occur as described in Section 4.1.3.1.4; however, with implementation of BMPs described in Section 4.0.1.2, these effects are anticipated to be negligible.

Auto Tour. Because sensitive paleontological features are not known in this area, an auto tour route under Alternative D is anticipated to have negligible effects.

4.1.3.4.9 Permit System

Under Alternative F, implementation of a permit system is anticipated to have negligible effects on paleontological resources.

4.2 Effects on Shrub-Steppe, Other Upland Resources

The Proclamation establishing the Monument states: “The monument contains one of the last remaining large blocks of shrub-steppe ecosystems in the Columbia River Basin, supporting an

unusually high diversity of native plant and animal species.” Because they are important habitat for resident and migratory wildlife species, these large, intact plant communities are regionally and globally significant. These biological resources, which encompass large, interconnected natural systems, are among those the FWS has been given responsibility to manage and protect.

Upland shrub-steppe plant communities constitute a fundamental and vitally important element of the Monument’s biological resources. More than 350 unique plant associations have been mapped to date; distinctive variations of each community type are shaped by soil type, aspect, slope and microclimate.

Foundation shrub-steppe plant communities of the Columbia Basin have diminished significantly throughout their range as a result of past and present management actions and the consequences of those actions (e.g., grazing, agricultural development, urbanization, wildfire). The loss of sagebrush habitats and concern for sagebrush-dependent species were detailed more than twenty-five years ago by the Conservation Committee of the Wilson Ornithological Society (Braun 1976).

Although it has been protected since 1943, many areas of the Monument have experienced both small- and large-scale disturbances. These have commonly been caused by wildfire or by past grazing, homesteading, and farming activities. Such disturbance and the associated loss of biodiversity can often result in indirect effects on other resources. Where effects on vegetation lead to soil erosion, that erosion has the potential to damage or degrade archeological, paleontological and historical resources, as well as water quality and air quality.

Various factors have contributed to the diversity and distinctive character of the Monument’s flora. Geological processes that created the Columbia Basin; historic land use, land withdrawals, and isolation created by the Manhattan Project; and the presence of relict plant communities provide opportunities for biologically unique plant species. Two endemic species (i.e., species that occur nowhere else in the world) that are new to science—Umtanum Ridge desert buckwheat (*Eriogonum codium*) and White Bluffs bladderpod (*Lesquerella tuplashensis*)—are now considered by the FWS as Candidates for listing under the ESA. Approximately 112 populations/occurrences of twenty-eight rare plant taxa are known to occur in riparian and upland areas of the Monument (TNC 2003).

4.2.1 Assumptions

A variety of management actions and controls would provide protection for upland habitats in the Monument. These include restrictions on surface-disturbing activities; controls on visitor access points and vehicle use; mechanisms to control visitor use (e.g., allocations, group size restrictions); monitoring of vegetation condition; NEPA analysis prior to restoration and revegetation actions; and an active program to control non-native invasive species.

4.2.2 Effects Analysis—Wildlife and Habitat

4.2.2.1 Effects Common to All Alternatives

4.2.2.1.1 Habitat Modification

Effects on upland habitats and wildlife populations result directly from the modification of plant community structure and function. A variety of activities and conditions contribute to successional processes in native plant communities. These include vegetation modification resulting from the construction of facilities; trampling by visitors; establishment and spread of non-native invasive species; Hanford Site remediation activities; wildland fire effects; and wildlife effects.

4.2.2.1.2 Public Use

Wildlife disturbance would result from the visible and audible presence of people, vehicles, watercraft and domestic animals such as horses and dogs. Grassland birds in Colorado were found to be less likely to nest near recreational trails; they also experienced higher nest predation rates near trails (Miller et al. 1998). A single pedestrian moving through a bird's territory was found to reduce the occurrence and consistency of song in breeding subalpine birds (Gutzwiller et al. 1994). Because singing plays an important role in territorial defense and mate attraction, altered singing behavior may influence a bird's reproduction success (Gutzwiller et al. 1997).

Trampling at levels lower than those required to alter the structure and composition of the plant community has been found to reduce numbers and diversity of invertebrates (e.g., beetles, spiders, snails, earthworms) found in grassland litter (Duffey 1975). Thus, trampling may have effects on the abundance and availability of invertebrate prey for birds.

Wildlife injury and mortality may result from the harvest of game fish and wildlife species, as well as from collisions between vehicles and wildlife (Ashley and Robinson 1996; Jones 2000).

Direct effects on wildlife resulting from these activities include disruption of behavioral patterns and cycles (nesting, foraging, roosting) and increased disturbance and stress.

4.2.2.1.3 Wildland Fire and Fire Suppression Activities

Fire danger and/or wildland fire would have minor to major short-term and long-term adverse effects on upland shrub-steppe habitats by removing vegetation; damaging long-term study plots; disturbing surface areas through suppression activities (e.g., bulldozer lines, hand lines, staging areas); and stimulating post-fire expansion of non-native invasive species. Vegetation recovery within burned areas is a slow process, with native grasses taking three to five years to resemble pre-fire conditions, depending on weather and moisture conditions (Evans and Lih 2005). Further shrub recovery in burned area may require decades to resemble pre-fire conditions (Evans and Lih, 2005). The effects of wildland fire on upland shrub-steppe wildlife and habitat depends on the size, timing, duration and location of the fire.

4.2.2.1.4 Wildlife Population Control Activities

Under all alternatives, wildlife population control actions, such as herding animals into trap corrals with aircraft, net gunning and helicopter transport of ungulates, government culling, controlled hunting, and hazing, would create some disturbance to upland habitats. Minor direct effects on upland habitats would include disturbed and crushed vegetation; increased short-term wildlife disturbance in capture areas; increased human activity involving vehicles; public access into controlled access areas; construction of trails and corrals; and disturbed soils and microbiotic crust. However, these effects would be minimized through an integrated application of population control management options as described in Section 2.10.1.5 and the implementation of BMPs as described in Section 4.0.1.2. Minor indirect effects would include erosion and the potential for non-native species introduction and encroachment into upland plant communities from disturbed areas. These effects would be reduced through activity/site planning and the rehabilitation of affected sites with native species following operations. Direct effects on wildlife resulting from population control activities include increased disturbance and stress, and disruption of behavioral patterns and cycles (nesting, foraging, roosting) of both the wildlife targeted for control and other wildlife within or adjacent to the areas where control activities are taking place.

4.2.2.1.5 Visitor Facility Development

Indirect effects on wildlife from visitor use and facility development would occur from loss or modification of habitat, including soil compaction; increased soil erosion; changes in structure and composition of vegetation communities; spread of invasive species such as cheatgrass, yellow star-thistle, Russian thistle, rush skeletonweed, knapweed, and others; and increased potential of human-caused wildfire.

Minor direct effects on wildlife may occur, including localized disturbance and modification of behavior (e.g., movement and foraging patterns) associated with avoidance of developed areas. Because some species readily habituate to interpretive sites and some species do not, localized disturbance and behavior modification may constitute both short- and long-term effects. Indirect effects could include use of developed sites as roosting areas or thermal cover (shade). Species that become habituated to visitors could create nuisance or conflict situations, depending on the level of visitor use, the species involved, and the character of contact in interpretive areas.

Because the goal of interpretive sites and trails is to provide visitors with a chance to see and learn about unique and notable resources, care would be taken during site planning to protect sensitive habitat. The initial development of interpretive sites and trails is expected to have a moderate level of adverse short-term effects on localized areas. Adverse effects on shrub-steppe habitat and other upland resources would include site alteration, soil disturbance, habitat disturbance, and trampling of areas of approximately 0.25–0.5 acre per site. Effects of site development would be mitigated by the planting of native species and landscaping appropriate to the surroundings. Visitors would be strongly encouraged to refrain from leaving the trails and traversing undisturbed lands. Nevertheless, an estimated fifty-foot corridor on either side of the trails would experience minor adverse effects on soil and flora from visitors venturing off trail.

4.2.2.2 Effects of Biological Resource Management Actions

Treatments of non-native invasive plant populations along road corridors would have moderate effects on soils and vegetation within ten feet of the edge of road systems but would have negligible effects on upland habitats.

Spot spraying, hand pulling, and seeding with native species would be conducted on an annual basis on high-priority weed populations in off-road situations. Under Alternative A (i.e., under current staffing and funding conditions), only a small portion of known weed infestations (the highest priorities) would be mapped, treated and monitored annually. The treatment of isolated weed infestations away from established road systems would result in minor disturbance effects on soils and vegetation but would not affect plant community composition and function. Direct effects on wildlife include short-term displacement and disturbance in mechanical treatment and chemical application areas. Indirect effects include long-term major beneficial effects on native habitat through the early treatment of small weed populations and site restoration with native species, protecting associated plant communities and wildlife habitat from further degradation.

Under Alternatives B–F, potential impacts to soils, vegetation, watershed function, and biodiversity would be considered in all treatment recommendations. In sensitive plant communities, where soil disturbance and the spread of non-native invasive species would adversely affect upland habitats, the use of multiple tools (chemical, biological, mechanical, cultural) may be required. Moderate effects on upland habitats would be expected to result from

mechanical and cultural treatments. Mechanical treatments (hand pulling, discing, mowing) and cultural treatments (reseeding of native species) would potentially disturb soils. Moderate direct effects include short-term disturbance of wildlife and localized soil disturbance. Moderate to major beneficial indirect effects include the reduction or elimination of invasive species in native plant communities, leading to improved resource conditions, wildlife habitat, and plant community stability and connectivity.

Because plant communities dominated by native species provide superior wildlife habitat, alternatives that entail more extensive programs to control non-native invasive species would be expected to have more extensive beneficial effects on wildlife and habitat than alternatives treating lesser areas. For a description of non-native invasive species control actions under each alternative, see Section 4.0.3.1.1 and the included IPSIMP.

Shrub-steppe restoration is a high priority for the protection of Monument resources and upland habitats under all alternatives. Vegetation restoration methods have the potential to cause surface disturbance on approximately 90,000 acres over the fifteen-year planning horizon. Seeding and planting with native species would be used to restore native plant communities, primarily in areas disturbed or adversely affected by past management activities or by wildfire. Restoration efforts include control of non-native invasive species, native shrub plantings, and seeding (broadcast, broadcast/harrow, drill seeding) with native species.

Under Alternative A, moderate direct effects on wildlife would include: 1) short-term disturbance that may move wildlife temporarily out of specific project areas; 2) potential effects associated with soil disturbance; and 3) soil compaction during drill seeding and harrowing operations. Indirect effects would include reestablishment of native plant communities, improved biological diversity, improved hydrologic processes, increased site health, and enhanced plant community structure and function.

Under Alternatives B–F, restoration activities would have short-term adverse effects on upland habitats through soil and vegetation disturbance, but they would have long-term beneficial effects on wildlife through habitat improvement. Under Alternatives B and F, 6,000 acres of upland habitat restoration would be undertaken annually; 4,000 acres would be treated under Alternatives C and E; and 2,000 acres would be treated under Alternative D. The degree of disturbance to wildlife would be related to the extent and characteristics of the areas to be treated annually. For example, restoration actions are needed in each of the proposed management units to achieve a biologically diverse landscape that would benefit the more than 1,500 species that occupy the Monument. The Wahluke Unit supports mature sagebrush plant communities with understory composed primarily of cheatgrass, short grass communities that benefit wildlife such as long-billed curlews and burrowing owls, and riparian habitat important to waterfowl and raptors such as bald eagles. Actions to restore these communities to an ecological state in which the understories are dominated by native bunchgrass species would vary depending on the long-term habitat objectives for each plant community type and the target species that utilize them. Ultimately, it would be the goal of restoration actions to reduce non-native invasive species,

stabilize and improve ecological conditions, and improve habitat connectivity. The amount of disturbance in each of these plant community associations would vary depending on the extent of treatments that were required. For example, higher levels of ground disturbance would be expected to result from restoration activities in plant communities that are dominated by non-native species (e.g., abandoned farm fields that are dominated by cheatgrass). Mature sagebrush communities would potentially require less ground disturbance to achieve native forb and grass reestablishment in the understory. Monitoring of restoration activities would be conducted through the installation of monitoring plots to document the success of treatment and the direct and indirect effects on upland habitat biodiversity, health and function. Monitoring efforts and the establishment of monitoring plots would have negligible effects.

Restoration activities on the summit of Rattlesnake Mountain would attempt to return portions of the site to pre-Manhattan Project conditions. Under all alternatives, upland habitat would be improved through the demolition and disposal actions associated with scheduled DOE remediation activities on top of Rattlesnake Mountain. Buildings identified for cleanup would be removed and upland habitats would be restored. Minor direct effects on wildlife associated with clean-up work would include short-term displacement or disturbance as a result of human and vehicle activity around the project area. Moderate direct effects on upland habitats would result from ground-disturbing activities to remove building materials, asphalt, gravel, roadways and concrete foundations. Removal of the structures would have long-term beneficial effects through site stabilization by seeding with native species, reduced establishment of noxious weeds, a reduction in problem wildlife species, reduced avian and bat mortality from guy wire strikes, and improved upland habitat and connectivity.

Under alternatives B, C and F, restoration activities would include the removal of the observatory, along with the other buildings and structures, the effects of which would be similar to those described above. Under alternatives A, D and E, the observatory building and associated utilities would be retained. Vehicle traffic and visitation to the observatory would continue for maintenance, calibration and repairs. Minor adverse effects would include provision of an artificial perch for raptors, thereby increasing predation of rodent populations; wildlife disturbance through maintenance activities; and an increased risk of introduction of non-native invasive species into rehabilitated plant communities.

The effectiveness of restoration treatments is directly related to the quantity and quality of native plant materials that can be obtained. Currently, one year of lead time is required to collect native seed from the Columbia Basin and contract with government or privately operated nurseries to grow native plants. Alternatives B, C and E provide for the proactive collection of native seed from the Monument to ensure ecological compatibility of native plantings and to multiply and expand native seed stocks through commercial production contracts with local native seed growers. Short-term disturbance of wildlife would occur as seed is harvested for various native species from June through December each year in all units of the Monument. However, native seed collection would have negligible effects on wildlife or wildlife habitat through the implementation of BMPs for seed collection, as described at 4.0.1.2.

Alternatives B–F would provide for the development of a native plant nursery in cooperation with other partners to supply native plant materials for restoration actions. These actions could be accomplished on Monument lands, such as the eighty irrigated agricultural acres in the Ringold Unit, or could be developed at off-Monument sites in the Columbia Basin. Development of a native plant nursery would have negligible direct effects on Monument lands but would have major beneficial indirect effects on shrub-steppe and riparian habitats by providing locally grown, ecologically compatible, and genetically suitable plant materials for restoration efforts.

4.2.2.3 Effects of Visitor Services Management Actions— Interpretation and Education

4.2.2.3.1 Interpretive Site Development

Alternative A would have negligible effects on upland habitats. Existing and potential interpretive signs and kiosks are placed at major entry points and along travel routes in the Monument that have been previously disturbed. Under Alternative D, the potential construction of twenty new interpretive sites would have the greatest amount of short-term effects; site development would result in direct effects on approximately thirty acres of areas open to the public. Effects would be less under all other alternatives. In addition to the direct effects of site development, visitor exploration of areas of shrub-steppe habitat is predicted to have minor long-term effects within a 1/4-mile radius of each interpretive site.

Indirect effects on upland habitats could include vegetation trampling, disturbance of microbiotic crust, soil disturbance, erosion, establishment of non-native invasive species, and potential displacement, disturbance or habituation of wildlife to human visitors.

4.2.2.3.2 Interpretive Trail Systems

No interpretive trails are planned under Alternative A; accordingly, negligible environmental effects on upland habitats are anticipated.

Under Alternatives B–F, creation of trail systems would entail direct impacts to upland habitats. These effects would be greatest under Alternative D. Localized, moderate, short-term direct effects of trail construction would include microbiotic crust disturbance, soil disturbance, and vegetation loss. Indirect effects would include soil erosion, establishment and spread of non-native invasive species, and an increased risk of wildland fire. Beneficial long-term effects would include the reduction of effects on sensitive upland habitats from trampling by allowing access through established trail systems and improved interpretation/education opportunities.

The establishment of interpretive trails would facilitate easier access to upland habitats and an associated increase in visitation. Increase visitation could lead to increased wildfire occurrence. These effects would be mitigated by informational signage educating visitors on the danger of wildfire, the adverse effects of wildfire on the shrub-steppe habitat, and how visitors can contribute to fire prevention. Seasonal closure of interpretive trails through high-risk areas would be established and enforced to mitigate the potential of visitor-caused wildfire.

Proposed interpretive trail systems would have long-term effects on wildlife and their shrub-steppe, riverine and aquatic habitats. Research suggests that trail systems typically alter wildlife movement, habitat use, and foraging patterns. Direct effects on wildlife would include disturbance, displacement and altered habitat utilization. Beneficial effects of developing a trail system (as opposed to permitting uncontrolled cross-country travel) would include the reduction of effects on sensitive wildlife habitats by managing access through established trail systems.

No proposed trails have been developed. Future trails would be designed and sited only when an interpretive plan and resource inventories have been completed. Development of interpretive facilities in the Monument would require project-level inventories prior to construction to determine the presence of sensitive species and habitat. Trail systems would not be allowed where they would affect T&E species or sensitive cultural or natural resources. Trails may be closed during critical breeding and nesting seasons if necessary.

4.2.2.4 Effects of Visitor Services Management Actions—Recreation

4.2.2.4.1 Hunting

Hunting activity in the Monument results in mortality of individual game animals, including waterfowl, upland birds, deer and elk. Based upon annual game population and harvest surveys conducted by the FWS and WDFW, effects are anticipated to be negligible at a population level. During hunting seasons, activities such as game stalking and firearm discharge result in wildlife disturbance of both game and non-game species. Because of the limited hunting seasons and the dispersed nature of such disturbance, minor adverse effects on individual animals and negligible effects on wildlife populations are anticipated. Hunting activities may indirectly benefit wildlife through fostering increased appreciation and support for conservation of wildlife habitat.

4.2.2.4.2 Fishing

Effects related to fishing are discussed in Section 4.3.2.5.2.

4.2.2.4.3 Wildlife Observation and Photography

Under Alternatives B–F, a number of sites would be developed to provide wildlife observation and photography opportunities. It is anticipated that disturbance from site development activities would result in short-term adverse effects. In addition, intensified visitor use patterns near developed sites would result in long-term adverse effects through increased wildlife disturbance, vegetation trampling, soil compaction, introduction of noxious weeds, and increased risk of human-caused wildfire. However, with implementation of BMPs described in Section 4.0.1.2, adverse effects are anticipated to be minor.¹²³ Minor beneficial effects of this action would result from concentrating wildlife observation and photography activities in sites specifically designed to provide a quality experience while shielding wildlife from observers and minimizing potential effects on wildlife and habitat.

4.2.2.4.4 Hiking

Hiking activities under Alternative A would continue to have minor adverse effects on wildlife and habitat associated with disturbance, vegetation trampling, soil compaction, and introduction of invasive plant species. If cross-country hiking activities increase in the Monument under Alternative A, the severity of adverse effects would also increase. Alternatives B–F could result in minor beneficial effects on wildlife by concentrating use on designated trail systems and reducing cross-country hiking and the associated effects described above. However, developed trail systems would likely result in increased hiking activity in the Monument, with concomitant increased wildlife and habitat disturbance as described in Section 4.2.2.1.4. Short-term disturbance of wildlife would occur during trail development activities. Intensified visitor use within 1/4-mile of trailheads and increased use along trail corridors would result in adverse effects as described in Section 4.2.2.1.5. However, with implementation of BMPs described in Section 4.0.1.2, adverse effects are anticipated to be minor.

4.2.2.4.5 Equestrian Use

Under Alternative A, cross-country equestrian travel is currently permitted in the Wahluke, Ringold and Columbia River Units. Equestrian activities can result in adverse effects on wildlife and habitat through disturbance; vegetation trampling and loss of plant cover; soil compaction (McClaran and Cole 1993); trampling of underground burrows and surface runways of small animals; crushing of bird, amphibian and reptile eggs (Grassland Conservation Council of British Columbia 2004); and introduction of noxious weeds (Pickering 2003). The extent of these effects on the Monument is unknown, but it is anticipated to be minor due to the low

¹²³ For example, research indicates that birds are less sensitive to disturbance if they are visually shielded from observers (Knight and Temple 1995).

amount of use. Under Alternative A, an increase in equestrian use from current levels would result in an increased severity of effects. Alternatives B–F would result in beneficial effects on wildlife habitat by establishing designated roads and trails for equestrian use and reducing or eliminating cross-country use. However, equestrian use would continue to have long-term, adverse effects on wildlife and habitat (as described above) along designated trail corridors. With implementation of BMPs described in Section 4.0.1.2, adverse effects would be minor.

4.2.2.4.6 Boat Launches

Effects related to boat launches are addressed in Section 4.3.2.5.6.

4.2.2.4.7 Camping

Vernita

Effects related to camping at Vernita are addressed in Section 4.3.2.5.7.

Boat-In

Effects related to boat-in camping are addressed in Section 4.3.2.5.7.

Saddle Mountain

Under Alternative D, developed camping opportunities would attract increased visitor use in the Monument, resulting in adverse effects on wildlife through wildlife disturbance, vegetation trampling, soil compaction, introduction of noxious weeds, and increased risk of human-caused wildfire. Construction activities associated with campground development would result in short-term adverse effects on wildlife. Intensified visitor use within 1/4 mile of the campground would result in adverse effects on wildlife from the disturbance factors described above. With implementation of BMPs described in Section 4.0.1.2, and because the proposed campground would be developed in a previously disturbed area, adverse effects on wildlife are anticipated to be minor.

4.2.2.4.8 Modified Public Access

Columbia River Unit

Effects related to modified public access in the Columbia River Unit near the Vernita Bridge and the South and North shores are addressed in Section 4.3.2.5.8.

Sand Dunes. Under Alternatives C, D and E, access to the sand dunes on established trails would result in adverse effects through wildlife, habitat and vegetation disturbance; introduction of invasive non-native plant species; and increased risk of human-caused wildfire. With implementation of BMPs described in Section 4.0.1.2, adverse effects are anticipated to be minor.

Ringold Unit

Parking. Under Alternatives B–F, fewer parking lots would reduce the Monument’s maintenance workload, allowing additional resources for management actions (e.g., invasive species control, fire prevention) that would benefit habitat. Resultant beneficial effects on wildlife and habitat are anticipated to be minor.

Auto Tour. Under Alternative D, vehicle travel and incidental public use along the auto tour route would result in long-term adverse effects through introduction and dispersal of invasive non-native species, habitat fragmentation, wildlife disturbance, and wildlife injury or fatality from vehicle strikes (Spellerberg 1998). In addition, vehicle traffic and public use along the route would increase the risk of human-caused wildfire ignitions. Road construction activities would have both short- and long-term adverse effects on wildlife through disturbance, mortality and alteration of the physical environment (Trombulak and Frissel 2000). An auto tour route would attract increased visitor use in this area, with a concomitant increase in wildlife disturbance. However, with the implementation of BMPs described in Section 4.0.1.2, adverse effects are anticipated to be moderate. In addition, the auto tour route would provide some benefit to wildlife through reduced disturbance resulting from visitors traveling through areas in vehicles rather than engaging in out-of-vehicle activities (Holmes et al. 1993; Klein 1993).

Saddle Mountain Unit

Alternative B would have minor beneficial effects on uplands by reducing adverse effects associated with public use, such as disturbance and disruption of wildlife behavioral patterns; habitat effects associated with soil compaction, vegetation disturbance, and introduction of non-native invasive plants; and increased risk of human-caused wildfire. Under Alternatives A, C, D, E and F, public access in this area would result in adverse effects as described above. Under Alternatives A, D and E, increased visitation associated with motorized access would result in greater effects than under Alternatives C and F. With implementation of BMPs described in Section 4.0.1.2, adverse effects under Alternatives A, C, D, E and F are anticipated to be minor.

Wahluke Unit

West Access. Under Alternatives B–F, non-motorized access is anticipated to result in long-term wildlife disturbance, soil compaction, vegetation disturbance, introduction of non-native invasive plants, and increased risk of human-caused wildfire. With implementation of BMPs described in Section 4.0.1.2, adverse effects are anticipated to be minor.

Auto Tour: Effects under Alternative D would be similar to those described above for the auto tour route in the Ringold Unit under Alternative D.

4.2.2.4.9 Permit System

Under Alternative F, implementation of a permit system is anticipated to have negligible effects on wildlife and habitat.

4.2.3 Effects Analysis—Microbiotic Crust

4.2.3.1 Effects Common to All Alternatives

4.2.3.1.1 Surface-Disturbing Activities

Although microbiotic crust occurs in every unit of the Monument, its extent and frequency are in many cases related to past land use, fire history, soil types, and plant community structure. Farming, grazing, fire, irrigation and human disturbances have altered crust occurrences and connectivity. Direct effects on microbiotic crust would result primarily from surface-disturbing activities such as construction of facilities, vehicle traffic, and trampling. These activities lead to an increased risk of erosion and the introduction of invasive non-native species.

Trampling breaks up the sheaths and filaments holding the soil together and drastically reduces the capability of soil organisms to function, particularly in nitrogen fixation (Evans and Ehleringer 1993; Belnap et al 1994; Belnap 1995). Studies of trampling disturbance have noted that losses of moss cover, lichen cover, and cyanobacterial presence can be severe (10%, 33% and 50% in different studies (Anderson et al. 1982b)). As a result, runoff can increase by half, and the rate of soil loss can increase six times (Harper and St. Clair 1985).

Reasonably foreseeable activities, such as development of recreation facilities, rights-of-way, and interpretation/visitor services over the fifteen-year planning horizon, carry a potential for cumulative surface disturbance. Much of the surface disturbance associated with recreational facilities would occur in areas already disturbed by existing roads or other uses. In addition, visitor and equestrian use have the potential to cause surface disturbance and damage of microbiotic crust. Because microbiotic crust has not been extensively mapped in the Monument, the potential extent of damage resulting from public use and restoration efforts is difficult to estimate. However, it has been documented that damage to microbiotic crust structure occurs with only fifteen trampling passes, while visual evidence of bacteria and cryptogam cover was

reduced to near zero after fifty passes. Some soil crust redevelops in just one to three years, with little visual evidence of disturbance after five years. However, surface irregularity remained low after five years, suggesting that recovery was incomplete (Cole 1990). Crust regeneration and recovery would be dependent on elimination of a continuing disturbance and distance to a source of crust inoculant (distance from an intact microbiotic crust area). Based on use estimates and BMPs, it is anticipated that effects to microbiotic crusts from reasonable foreseeable activities will be minor to moderate over the planning time frame.

4.2.3.1.2 Control of Non-native Invasive Species

Non-native plants and noxious weeds displace native species and affect the structure and function of microbiotic crust in surrounding areas. The threat of weed expansion in the Monument under all alternatives may have moderate indirect adverse effects on microbiotic crust by altering plant community structure and function.

4.2.3.1.3 Restoration Activities

Vegetation restoration methods have the potential to cause some microbiotic crust disturbance over the fifteen-year planning horizon. However, revegetation methods would be used to restore native plant associations and would occur primarily in areas where soil crusts have been previously disturbed or have been disturbed by development or wildland fire. Other restoration activities in microbiotic crust areas would avoid disturbance through site planning and avoidance; however, some microbiotic crust may be disturbed through drill seeding or broadcast/harrowing activities associated with reestablishment of native species. Additionally, increased research on restoration ecology and microbiotic crust has the potential to develop new methods to restore disturbed areas to pre-disturbance conditions.

Restoration and maintenance of riparian areas to proper functioning condition would not adversely affect microbiotic crust because crusts are located primarily in upland shrub-steppe communities and not associated with riparian/riverine plant community associations.

4.2.3.1.4 Wildland Fire and Fire Suppression Activities

The degree to which microbiotic crusts are damaged by fires depends on the intensity of the fire. In areas where annual grass and weed species are prevalent, destruction and degradation of soil crusts would likely result from wildfires, as these fires burn hotter and faster than do wildfires under normal fire regimes in shrub-steppe ecosystems. Low-intensity fires, such as those in bunchgrass communities, do not remove all the structure of the crust, which allows for regrowth without significant loss (NRCS 1997). Perversely, although native vegetation in these low-

intensity fire areas would regrow, damage to microbiotic crust from fire within intact native plant communities may lead to an increased chance for invasion of weed species and associated effects.

Fire suppression activities could result in adverse effects associated with surface disturbance. See the discussion of surface-disturbing activities above.

4.2.3.1.5 Wildlife Population Control Activities

Control methods would be used to reduce populations to a level consistent with species management objectives and in a manner that controls target populations without impairing Monument resources (e.g., soil, vegetation, habitats of other wildlife species). Site-specific control actions, such as aircraft herding of animals into trap corrals, net gunning, and helicopter transport of ungulates, would have some minor disturbance effects on microbiotic crust. Direct effects on microbiotic crust could result at trails, corrals, transport sites, staging areas, and other areas with soil-disturbing activities. Site-specific research on microbiotic crust would be initiated in potential control areas; disturbance would be minimized through site placement and operational controls/stipulations prior to plan initiation.

4.2.3.1.6 Public Use

Effects of visitor use on microbiotic crust would occur primarily from trampling and disturbance related to activities such as hiking and equestrian use. As described above, crust disruption can result in decreased organism diversity, soil nutrients, stability, and organic matter. When the integrity of the crust is broken, soil is more susceptible to wind and water erosion, and non-native plant species invasion. In addition, intact crust areas adjacent to disturbed areas can be buried through wind and water erosion processes (USGS 2005).

4.2.3.2 Effects of Biological Resource Management Actions

Under Alternative A, the use of IPM techniques (chemical, biological, cultural, mechanical) would be expected to cause minor disturbance of microbiotic crust. Currently, 5,000–9,000 acres are treated annually, with most control efforts conducted along existing roads, firebreaks and travel-ways. Spot treatments of isolated weed infestations away from established road systems by backpack and ATV-mounted sprayers (approximately 2,000 acres/year) cause minor disturbance of microbiotic crust; the effects are mitigated by the timing of treatments—that is, conducting off-road work during spring and fall when soils and microbiotic crust are moist and resilient—and ensuring that disturbance does not occur repeatedly on the same area to the point

that it exceeds disturbance threshold levels. Mechanical treatments include hand pulling of small infestations; this technique disturbs soils in localized areas only.

Restoration management actions planned for each alternative are described in Section 4.0.3.1.2. Shrub-steppe restoration activities carried out under Alternative A would focus primarily on lands disturbed by wildfire events, maintenance-related project work, Hanford Site mitigation, and noxious weed control efforts. Native plant reestablishment provides protection of microbiotic crust from displacement and competition from aggressive non-native species. Moderate microbiotic crust effects may occur through soil disturbance resulting from revegetation efforts (drill seeding, native shrub plantings, harrowing of broadcast native seed).

Alternatives B–F, as described in Section 4.0.3.1.2, provide for restoration of degraded shrub-steppe habitats and other disturbed areas to a natural range of native plant associations. Under Alternatives B–F, weed populations would be prioritized and treated annually on the basis of threats analysis and their potential for spreading and infesting adjacent lands. Alternatives B, C, E and F would treat significantly more acres than Alternatives A and D. Treatments would be followed with seeding/planting of native species to reclaim the lands once occupied by non-native species.

Alternatives B–F would have minor direct effects on microbiotic crust through increased ground disturbance resulting from mechanical weed treatments and native species restoration actions. Likewise, some minor short-term effects on microbiotic crust may occur through soil disturbance resulting from drill seeding or harrowing of broadcast seed applications. Levels of disturbance would be commensurate with the extent of restoration treatments. In many cases, microbiotic crust disturbance would be negligible because restoration efforts would be focused on lands that have little or no remaining crusts, and microbiotic crust disturbance would be further minimized through the implementation of BMPs prior to restoration activities. Research on the restoration of microbiotic crust would be initiated in these restoration areas. By improving plant community health, shrub-steppe restoration activities would ultimately benefit microbiotic crust reestablishment. Accordingly, microbiotic crust protection and recovery would be greatest under Alternatives B and F, moderate under Alternatives C and E, and least under Alternatives A and D. Beneficial indirect effects of non-native invasive species control would include improving the health of native plant communities and reducing localized effects of weeds on microbiotic crust in shrub-steppe community interspaces.

Restoration activities on Rattlesnake Mountain would attempt to return portions of the site to pre-Manhattan Project conditions. Under all alternatives, the demolition and disposal actions associated with scheduled DOE remediation activities on top of Rattlesnake Mountain would have little to no effects on microbiotic crust. Buildings identified for cleanup are on concrete foundations surrounded by gravel. Because microbiotic crust has long been absent from the site, cleanup efforts would not affect microbiotic crust. Intact microbiotic crust on adjacent lithosol soils could recolonize these rehabilitated areas over time following completion of cleanup and

revegetation activities, resulting in a minor improvement in microbiotic crust conditions over the life of the CCP.

Effects on microbiotic crust of prescribed fires and emergency fire restoration projects would be evaluated prior to implementation, areas of intact microbiotic crust could be identified and avoided, and BMP's related to implementation of these projects would be used to protect microbiotic crust. The use of equipment to implement emergency fire rehabilitation actions has the potential for moderate effects on microbiotic crust by disturbing the soil surface. These actions also increase the short-term potential for wind and water erosion. In some cases, short-term minor-to-moderate detrimental effects to microbiotic crust would occur from these activities. However, long-term effects are anticipated to have minor to moderate benefits to microbiotic crusts, because reestablishment of native plant diversity and reduction of non-native plant species would increase the potential for microbiotic crust to re-colonize fire damaged areas.

4.2.3.3 Effects of Visitor Services Management Actions— Interpretation and Education

4.2.3.3.1 Interpretive Site Development

Alternative A would have negligible effects on microbiotic crust, mainly because any potential interpretive sites would be located along major travel routes and constructed to avoid adverse effects. Interpretive sites under Alternatives B–F would be designed and placed to reduce effects on microbiotic crust; however, moderate long-term effects within the footprint of specific development sites may be unavoidable. Secondary effects from increased visitor use in and around the interpretive sites may occur. Minor, long-term effects on microbiotic crust are expected within a 1/4-mile radius of each development site.

Construction of other visitor facilities (e.g., trailheads, parking areas, pullouts, restrooms) causes surface disturbance; construction of visitor facilities in previously undisturbed areas could have moderate effects on microbiotic crust. Additionally, visitors can be a primary transport vector for non-native invasive plant species. Construction of new sites has the potential to introduce weeds into areas where they have not previously been found. Prior to any construction, areas would be surveyed for microbiotic crust, and appropriate mitigation measures would be developed. Areas containing microbiotic crust would be avoided to the extent possible during placement of visitor facilities.

4.2.3.3.2 Interpretive Trail Systems

Because Alternative A does not provide for development of interpretive trails, negligible effects on microbiotic crust are anticipated.

Interpretive trails are anticipated to be an average of 1.5 miles and would be located to highlight examples of high-quality vegetation and other noteworthy resources. Care would be taken to site trails, trailheads and parking areas away from sensitive resources, while optimizing interpretation opportunities. Interpretive signs would convey the vulnerability of microbiotic crust and ask visitors to remain on the trail. Concentrating traffic on trails would avoid impacts to microbiotic crust, and consolidating existing traffic to trails could have minor, long-term beneficial effects on microbiotic crust.

4.2.3.4 Effects of Visitor Services Management Actions—Recreation

4.2.3.4.1 Hunting

Visitors pursuing big and upland game hunting activities in the Monument typically walk cross-country or follow game trails. These activities are dispersed across large areas that are open to hunting, the extent of which varies by alternative. Adverse effects of big and upland game hunting on microbiotic crust are anticipated to be negligible due to the seasonal use and the dispersed nature of travel used by hunters. Visitors hunting waterfowl in the Monument typically walk from a parking area to a desirable location, set up a blind, and remain stationary. In the past, hunters would dig waterfowl pass-shooting depressions along bluffs in the Wahluke Unit; however, this activity is no longer allowed. Most waterfowl hunters tend to use common footpaths between parking areas and hunting locations, resulting in surface disturbance along the Columbia River in the Ringold Unit and around the WB-10 Ponds and along bluffs above the Columbia River in the Wahluke Unit. Because waterfowl hunting takes place primarily on riparian or sandy soils where microbiotic crust is generally not present, negligible effects are anticipated.

4.2.3.4.2 Fishing

Because fishing activities occur on riparian soils where microbiotic crust is not present, negligible effects are anticipated.

4.2.3.4.3 Wildlife Observation and Photography

Under Alternatives B–F, minor beneficial effects would result from concentrating wildlife observation and photography activities in sites specifically designed to provide a quality experience while minimizing potential effects on microbiotic crust from trampling and disturbance. With implementation of BMPs described in Section 4.0.1.2, adverse effects are anticipated to be negligible.

4.2.3.4.4 Hiking

Under Alternative A, hiking activities are believed to have adverse effects on microbiotic crust as a result of trampling and disturbance at localized sites. Overall effects are believed to be minor due to the low level of use and relatively small area where hiking activity occurs. If cross-country hiking activities increase in the Monument under Alternative A, the severity of adverse effects could also increase.

Alternatives B–F could result in minor beneficial long-term effects on microbiotic crust by concentrating use on designated trail systems, reducing cross-country hiking and the likelihood of trampling in areas occupied by microbiotic crust. However, developed trail systems would likely result in increased hiking activity in the Monument. Intensified visitor use within 1/4 mile of trailheads and increased use along trail corridors would result in adverse effects as described above. Alternatives C, D and E would provide one or more hiking trails in the Rattlesnake Unit. However, with implementation of BMPs described in Section 4.0.1.2, and in view of the relatively small areas of microbiotic crust that would be affected by potential trail alignments, adverse effects under Alternatives B–F are anticipated to be minor.

4.2.3.4.5 Equestrian Use

Under Alternative A, cross-country equestrian travel is permitted in the Wahluke, Ringold and Columbia River Units. These activities are believed to have adverse effects on microbiotic crust as a result of trampling and disturbance. The extent of these effects is unknown, but they are estimated to be minor due to the low amount of use. Under Alternative A, an increase in equestrian use would result in increased severity of effects.

Under Alternatives B–F, the establishment of designated roads and trails for equestrian use and reducing or eliminating cross-country use could benefit microbiotic crust by reducing trampling effects. Again, developed trail systems would likely result in increased equestrian use in the Monument. Increased use within 1/4 mile of trailheads and increased use along trail corridors would result in adverse effects as described above. However, with implementation of BMPs

described in Section 4.0.1.2, Alternatives B–F are anticipated to result in minor adverse effects on microbiotic crust.

4.2.3.4.6 Boat Launches

Under all alternatives, actions proposed at Vernita, White Bluffs, Ringold and the South Shore of the Columbia River are anticipated to have negligible effects on microbiotic crust because vehicle travel, boat launching, and ancillary activities would take place on existing hardened surfaces or in riparian plant communities where microbiotic crust does not occur.

4.2.3.4.7 Camping

Vernita

Under Alternative A, illicit camping activities are believed to have negligible adverse effects on microbiotic crust because they are not found in the affected area, which consists of riparian vegetation and sandy cobblestone substrate along the river. Under Alternatives D and E, providing developed camping opportunities at Vernita would lead to year-round increases in visitor use in the Monument. Depending on the associated visitor activities, increased visitation could have minor, long-term, adverse effects on microbiotic crust.

Boat-In

Under Alternatives C, D and E, it is likely that campsites would be situated in the riverine corridor where microbiotic crust is not generally found; accordingly, negligible effects are anticipated. If campsites were located in areas near microbiotic crust, camping activities could result in long-term adverse effects on crusts within a 1/4-mile radius of the campsites. However, with implementation of BMPs described in Section 4.0.1.2, effects are anticipated to be minor.

Saddle Mountain

Under Alternative D, provision of developed camping opportunities in the Monument would result in increased visitor use in the Monument overall. Campground development itself would have negligible effects on microbiotic crust, because it would occur in previously disturbed locations. Intensified visitor use within 1/4 mile of the campground could result in long-term adverse effects on microbiotic crust from trampling and disturbance. However, with implementation of BMPs described in Section 4.0.2 and the relatively limited occurrence of microbiotic crust in the previously disturbed proposed campground vicinity, Alternative D is anticipated to result in minor, long-term, adverse effects on microbiotic crust.

4.2.3.4.8 Modified Public Access

Columbia River Unit

Riverlands. Under Alternative A, public access would continue to result in trampling and disturbance of microbiotic crust, although effects are anticipated to be minor due to the limited occurrence of crusts in the habitat types that occur in this area. Alternatives B, C, D, E, and F could result in minor beneficial effects by removing disturbance factors under Alternative A.

Sand Dunes. Under Alternatives C, D and E, trail access in the sand dunes is anticipated to have negligible effects due to the limited occurrence of crusts in the sand dune area.

South Shore. Under Alternatives C, D and E, access to the south shore is expected to result in negligible adverse effects on microbiotic crust because they do not occur in association with riparian or riverine plant communities in the Monument.

North Shore. Effects would be similar to those described for the South Shore.

Ringold Unit

Parking. Under Alternatives B–F, removal of excess parking lots is expected to result in negligible short-term effects on microbiotic crust, because parking lots are located in highly disturbed vegetation communities with no crust component. Over the long term, with restoration and protection from disturbance, these alternatives could result in beneficial effects on microbiotic crust by providing opportunities for their reestablishment.

Auto Tour. Under Alternative D, establishment of an auto tour route and incidental public use within the route corridor would result in long-term, adverse effects on microbiotic crust as described in Section 4.2.3.1.6. With implementation of BMPs described in Section 4.0.1.2 and the previously disturbed condition of this area, adverse effects on microbiotic crust are anticipated to be minor.

Saddle Mountain Unit

Alternative B would have minor beneficial effects on microbiotic crusts by reducing trampling and disturbance associated with public use. Public access in this area under Alternatives A, C, D, E and F would result in some effects through increased trampling and disturbance. Alternatives A, D and E would allow motorized access, leading to greater numbers of visitors and greater adverse effects than Alternatives C and F. However, with implementation of BMPs described in Section 4.0.1.2 and the relatively small expected occurrence of microbiotic crust within the habitats of the affected area, adverse effects under Alternatives A, C, D, E and F would be minor.

Wahluke Unit

West Access. Alternative A would result in no change on microbiotic crust by continuing to limit access and associated disturbance in the western portion of the Wahluke Unit. Alternatives B–F would provide for non-motorized access in this area, with resultant trampling and disturbance of microbiotic crust. Intensified visitor use within 1/4 mile of access points would result in additional effects as described above. However, with implementation of BMPs described in Section 4.0.1.2 and the relatively small expected occurrence of microbiotic crust in this area, adverse effects from Alternatives B–F are expected to be minor.

Auto Tour. Effects would be similar to those described above for the auto tour route in the Ringold Unit.

4.2.3.4.9 Permit System

Implementation of a permit system under Alternative F is anticipated to have negligible effects on microbiotic crust.

4.2.4 Effects Analysis—Sensitive Plant Communities

To date, approximately 80,057 acres of existing high-quality, functional shrub-steppe plant communities have been mapped and characterized in the Monument.¹²⁴ These communities are considered ‘sensitive.’¹²⁵ Currently there are 9,568 acres of sensitive plant communities mapped in the Columbia River Unit, 50,505 acres in the Rattlesnake Unit, 1,074 acres in the Ringold Unit; 3,490 acres in the Saddle Mountain Unit; and 16,420 acres in the Wahluke Unit. A more extensive vegetation inventory needed for the Rattlesnake Unit would increase this total. On the other hand, since the creation of the Monument in June 2000, three catastrophic fire events have altered the shrub component on more than 80,000 acres of Monument lands. With every major fire event, the importance of remaining native plant communities in the Monument increases.

¹²⁴ These plant communities are generally characterized by 10–25% native shrub cover (sagebrush species, spiny hopsage, antelope bitterbrush, winterfat, and black greasewood), at least 20% native grass cover as dominant species in the understory, and a low incidence (less than 20% cover) of non-native species.

¹²⁵ Sensitive plant communities, for the purpose of this analysis, are plant communities that represent foundation shrub-steppe plant associations of the Columbia Basin that have been diminished throughout their range by past and present land management activities; the designation includes those plant communities identified as “element” occurrences by the WNHP.

4.2.4.1 Effects Common to All Alternatives

4.2.4.1.1 Restoration Activities

Upland habitat restoration efforts would be implemented on identified at-risk rare and sensitive plant communities. Restoration activities would focus on disturbed sites within sensitive plant communities or on adjacent sites that threaten the ecological integrity of these communities.

4.2.4.1.2 Public Use

Visitor use would affect sensitive plant communities primarily through the introduction and spread of invasive species and through human-caused wildfire events. The spread of non-native invasive species in remote areas of the Monument is of particular concern, because populations may become established within sensitive plant communities before they are detected and treated. In addition, such species can increase the fuel loads and flammability of sensitive plant communities, thus increasing the severity of wildfire events.

4.2.4.2 Effects of Biological Resource Management Actions

Under Alternative A, the use of IPM techniques (chemical, biological cultural, mechanical) would be expected to cause minor disturbance of sensitive plant communities. Most control efforts are conducted along existing roads, firebreaks and travel-ways. Spot treatments of isolated weed infestations away from established road systems by backpack and ATV-mounted sprayers would have minor effects because treatments would be conducted in early spring and fall when plant communities are less susceptible to injury. Mechanical treatments include hand pulling of small infestations; this technique disturbs soils in the immediate treatment area only.

Under Alternatives B–F, weed populations would be prioritized and treated annually on the basis of threats analysis and potential for spreading and infesting adjacent lands. Alternatives B, C, E and F would treat significantly more acres than Alternatives A and D. Many treatments would need to be followed with seeding/planting of native species to reclaim the lands once occupied by non-native species.

Alternatives B–F would entail conducting annual shrub-steppe restoration activities on degraded shrub-steppe habitats or otherwise disturbed areas to return these sites to a natural range of native plant associations. Restoration activities would focus on disturbed sites within sensitive plant communities or on adjacent sites that threaten the ecological integrity of these communities. Treatments could include non-native invasive species treatment, native shrub plantings, and seeding of native species (broadcast, broadcast/harrow, drill seeding). Hand

planting of shrubs and native seedlings and integrated pest management techniques would have minor effects on sensitive plant communities. On undisturbed ground, Alternatives B–F would have minor direct effects on sensitive plant communities through increased ground disturbance resulting from mechanical weed treatments and native species restoration actions.

Minor effects on existing shrub cover may occur through revegetation efforts (drill seeding, native shrub plantings, harrowing of broadcast native seed). Shrub-steppe restoration activities would improve plant community health and longevity; direct effects are expected to be minor. Reestablishment of native plant communities would improve habitat and protect native species from displacement and competition by aggressive non-native species. Beneficial indirect effects of non-native invasive species control would include improving the health of native plant communities, improving habitat function, reducing the potential rates of spread of wildland fire, and protecting sensitive plant communities from disturbance and non-native species invasion or encroachment. For example, in the Wahluke Unit, shrub-steppe restoration activities could include treatment of approximately 25,000 acres over a fifteen-year period to protect and improve big sagebrush plant communities.

No reasonably foreseeable effects on sensitive plant communities would be expected through the implementation of wildlife population control efforts in the Monument.

4.2.4.3 Effects of Visitor Services Management Actions— Interpretation and Education

4.2.4.3.1 Interpretive Site Development

Under Alternative A, interpretive activities are limited and have negligible adverse effects on sensitive plant communities. If such activities increased in the future under Alternative A, the severity of adverse effects would also increase.

Under Alternatives B–F, reasonably foreseeable effects on sensitive plant communities would be minor. New interpretive sites would be sited, designed and constructed to avoid significant adverse impacts to sensitive plant communities. Interpretative messages would address ongoing management activities to study, protect and enhance sensitive plant communities and techniques to minimize impacts from recreational use. Indirect adverse effects would include the increased danger of wildfire from visitor use; however, the risk would not increase significantly.

4.2.4.3.2 Interpretive Trail Systems

Impacts under Alternative A would be similar to those described above for interpretive site development.

Under Alternatives B–F, interpretative trail systems would be designed to avoid adverse impacts to sensitive plant communities, although it would be desirable to route trails near such areas to provide visitor with first-hand views of these communities. Interpretive messages would address ongoing management activities to study, protect and enhance sensitive plant communities, and techniques to minimize impacts from recreational use. Beneficial effects could include the reduction of trampling in sensitive areas by concentrating existing visitor use on established trails.

4.2.4.4 Effects of Visitor Services Management Actions—Recreation

4.2.4.4.1 Hunting

Under all alternatives, hunting activities would occur on the Wahluke, Ringold and Saddle Mountain Units. Hunting activities, especially those that involve remote areas of the Monument, would result in some degree of invasive weed spread and an increased risk of human-caused wildfire. However, with implementation of BMPs described in Section 4.0.1.2, adverse effects on sensitive plant communities are anticipated to be minor.

4.2.4.4.2 Fishing

Effects of fishing activities on sensitive upland plant communities are anticipated to be negligible. Effects on sensitive plant communities associated with riverine habitats are addressed in Section 4.3.2.5.2.

4.2.4.4.3 Wildlife Observation and Photography

With implementation of BMPs described in Section 4.0.1.2, effects under all alternatives are anticipated to be negligible.

4.2.4.4.4 Hiking

Under Alternative A, hiking activities are believed to be minimal, with negligible adverse effects on sensitive plant communities. If hiking activities increase under Alternative A, the severity of adverse effects would also increase. Alternatives B–F would concentrate hiking on designated trail systems that would be routed to avoid sensitive plant communities to the extent possible. Because trail systems would not likely be able to entirely avoid these communities, and because it is anticipated that developed trail systems would result in increased hiking activity in the Monument, some degree of adverse effect is anticipated, as described in Section 4.2.4.1.2. However, with implementation of BMPs described in Section 4.0.1.2, the severity of adverse effect is anticipated to be minor.

4.2.4.4.5 Equestrian Use

Because of their low levels, equestrian activities under Alternative A are believed to have negligible adverse effects. However, an increase in equestrian use over current levels, especially cross-country use, would result in increased effect severity. Alternatives B–F would have beneficial effects on sensitive plant communities by establishing designated roads and trails for equestrian use. However, equestrian use is anticipated to increase with the advent of designated trails with a commensurate increase in adverse effects, especially the spread of non-native invasive plants, though with implementation of BMPs described in Section 4.0.1.2, adverse effects are anticipated to be minor.

4.2.4.4.6 Boat Launches

The effects related to boat launches are addressed in Section 4.3.2.5.6.

4.2.4.4.7 Camping

Vernita

The effects related to camping at Vernita are addressed in Section 4.3.2.5.7.

Boat-In

The effects related to boat-in camping are addressed in Section 4.3.2.5.7.

Saddle Mountain

Under Alternative D, campground development would have negligible effects as development would occur in a previously disturbed area away from sensitive plant communities. However, developed camping opportunities would promote increased visitor use in the Monument, with a probable increase in adverse effects from the activities discussed in Section 4.2.4.1.2. With implementation of BMPs described in Section 4.0.1.2, these adverse effects would be minor.

4.2.4.4.8 Modified Public Access

Columbia River Unit

Vernita Bridge, South Shore; North Shore; and South Shore. Effects related to modified public access are addressed in Section 4.3.2.5.8.

Sand Dunes. Access to the sand dunes on designated trails under Alternatives C, D and E would result in adverse effects as described in Section 4.2.5.1. With implementation of BMPs described in Section 4.0.1.2, those adverse effects are anticipated to be minor.

Ringold Unit

Parking. Under Alternatives B–F, removal of excess parking lots would reduce the number of areas needing operations maintenance and upkeep in the Monument, freeing additional resources for management actions that support sensitive plant communities such as invasive species control and fire prevention. Beneficial effects are anticipated to be minor.

Auto Tour. Under Alternative D, vehicle travel and incidental public use occurring along the auto tour route would contribute to an increased risk of the spread of non-native invasive species and human-caused wildfire events. With implementation of BMPs described in Section 4.0.1.2, adverse effects are anticipated to be minor.

Saddle Mountain Unit

Alternative B would have minor beneficial effects by reducing adverse effects associated with public use, including the spread of invasive non-native species and human-caused wildfire events. Public access in this area under Alternatives A, C, D, E and F would result in adverse effects as described above. Alternatives A, D and E would allow motorized access, causing increased visitation and a correspondingly higher risks of the spread of invasive non-native species and wildfire events from vehicle use than would Alternatives C and F. With implementation of BMPs described in Section 4.0.1.2, adverse effects under Alternatives A, C, D, E and F are anticipated to be minor.

Wahluke Unit

West Access. Under Alternatives B–F, non-motorized access would result in adverse effects on sensitive plant communities as described in Section 4.3.2.1.5. With implementation of BMPs described in Section 4.0.1.2, adverse effects are anticipated to be minor.

Auto Tour. Effects under Alternative D would be similar to those described for the auto tour route in the Ringold Unit.

4.2.4.4.9 Permit System

Under Alternative F, implementation of a permit system is anticipated to have negligible effects on sensitive plant communities.

4.2.5 Effects on Threatened, Endangered, and Sensitive Species

A number of plant and animal species that are considered to be rare and of management concern occur in the Monument. Species are listed by the federal government as endangered, threatened, or candidate species under the ESA (50 CFR 17), or as species of concern; species are also listed as endangered, threatened, or candidate species by the state of Washington (WNHP 2004; WDFW 2004). Section 3.9.5 (Endangered, Threatened, Rare or Sensitive Plants) presents complete descriptions of these species and their respective habitats.

Federally listed T&E and candidate species and species of concern on the Hanford Site comprise three fish species, two bird species, one mammal species, and two plant species. Spring-run Chinook salmon and steelhead are federally listed as endangered, although only upper Columbia River steelhead spawn in the Hanford Reach; the extent of natural spawning is not known. Bull trout and bald eagle are federally listed as threatened. Western sage grouse, Washington ground squirrel, White Bluffs bladderpod, and Umtanum desert buckwheat are federal candidates for listing under the ESA.

Persistent sepal yellowcress, Umtanum desert buckwheat, American white pelican, and sandhill crane are state-listed endangered species. Awned halfchaff sedge, desert dodder, Geyer's milkvetch, grand redstem, loeflingia, lowland toothcup, rosy pussypaws, White Bluffs bladderpod, white eatonella, bald eagle, ferruginous hawk, and western sage grouse are state-listed threatened species. Awned halfchaff sedge, grand redstem, lowland toothcup, and persistent sepal yellowcress are wetland species restricted to river riparian zones. Bull trout, spring-run Chinook salmon, and Upper Columbia steelhead are state candidate species.

Chapter 3 provides an exhaustive list of Washington State candidate and sensitive plant and wildlife species that occur in the Monument. Six shrub-steppe dependent species worth noting for this analysis are burrowing owl, loggerhead shrike, sage sparrow, sagebrush lizard, Townsend's ground squirrel, and black-tailed jack rabbit. These species depend on shrub-steppe habitat for most if not all of their life stages and have suffered substantial decline, due primarily to the conversion of shrub-steppe lands through agricultural and urban development, wildland fires, and invasion of non-native species.

Section 3.10.3.1 describes insect species that occur on the Monument. Approximately 1,500 species of insects have been identified; however, the number of insect species that actually occur in the Monument may be as high as 15,500. Recent surveys conducted by TNC identified 43 taxa new to science and 142 new findings in Washington State (Soll et al. 1999). Butterflies, grasshoppers and darkling beetles are among the most conspicuous of these findings, suggesting that the Monument still retains an assemblage of microhabitats large enough to support fauna that was once widespread throughout the arid interior West.

In addition to those species on the Hanford Site, four additional federally listed species may be present in Benton, Franklin and Grant Counties (FWS 2004). The Columbia Basin Pygmy rabbit is a state- and federally listed endangered species that was most recently restricted to a few small populations north of the Monument in Grant and Adams Counties; however, recent survey efforts have failed to locate this species in the wild. Ute ladies-tress is a federally listed threatened orchid that has never been observed near the Hanford Site, but it is documented in Chelan and Okanogan Counties (WNHP 2004) and could potentially be found along the Columbia River. Yellow-billed cuckoo is a federal candidate species that has rarely been observed in southeastern Washington. Northern wormwood is a federal candidate and state-listed endangered species that occurs along the Columbia River near Wanapum Dam, although extensive surveys along Hanford Reach shorelines have failed to locate this species in the Monument.

4.2.5.1 Effects Common to All Alternatives

Effects on TE&S species populations result primarily from loss or modification of habitat through disturbance; soil erosion and compaction; vegetation trampling; and the introduction and spread of invasive non-native species such as salt cedar, knapweed, purple loosestrife, and reed canarygrass. The implications or consequences of adverse effects on TE&S species are often exacerbated by such species' smaller and sometimes localized populations and specialized habitat requirements. Restrictions on surface-disturbing activities, mechanisms to control visitor use, fire prevention and control, habitat restoration, and an active weed control program all contribute to the protection and promote recovery of special-status plant species.

4.2.5.1.1 Control of Non-native Invasive Species

Actions to control non-native invasive species could have minor effects on TE&S species. For example, under Alternative A, integrated pest management control measures coupled with restoration activities on degraded shrub-steppe areas totaling approximately 5,500 acres per year would have minor effects on TE&S species. Projects would be designed and implemented to reduce adverse effects on listed species. Nevertheless, some effects could occur; these could include temporary wildlife disturbance brought about by human activity and the operation of machinery in treatment areas, as well as short-term effects on certain non-target plant species during integrated pest management treatments. Anticipated effects on TE&S species may include short-term adverse effects on individual plants, but this would not reduce or substantially affect the population of such species locally, regionally, or globally.

4.2.5.1.2 Restoration Activities

Most restoration actions would likely be beneficial to the recovery and conservation of these species. Complete inventories of the Monument are necessary to more accurately identify TE&S species and their associated habitats in order to implement comprehensive protection measures through land management actions. All restoration projects would require field inventories, project design and layout, NEPA analysis, and the avoidance of known and identified TE&S species prior to project implementation. The FWS would continue to work with private, county, state and federal partners, as well as adjacent land managers, to protect and restore TE&S populations and habitat.

4.2.5.1.3 Wildlife Population Control Efforts

No reasonably foreseeable effects on TE&S species are expected to result from the implementation of wildlife population control efforts in the Monument.

4.2.5.1.4 Public Use

Adverse effects of visitor-related activities on TE&S species would result primarily from loss or modification of habitat, including changes in vegetation community structure and composition, soil compaction, and establishment of invasive species; disturbance and modification of diurnal and seasonal wildlife behavioral patterns caused by the visible and audible presence of people, vehicles, watercraft, and domestic animals such as horses and dogs; habitat fragmentation associated with trails, roads, and recreation site development; and injury and mortality from vehicle strikes. In addition, effects would result from human-caused wildfire.

4.2.5.2 Effects of Biological Resource Management Actions

4.2.5.2.1 TE&S Plants

Alternative A

Non-native invasive plant species pose a serious threat to TE&S plant species. Under Alternative A, the use of IPM techniques (chemical, biological, cultural, and mechanical) would have minor effects on TE&S plant species. Spot applications that treat isolated weed infestations off established road systems may create minor disturbance of soils and vegetation, but would not affect plant community composition or non-target species. More general invasive species treatments, such as broad-spectrum weed control techniques (chemical and mechanical) along major transportation routes and within established firebreaks may affect non-target native plants. The use of chemicals in broadcast spraying operations to treat non-native invasive species has the potential to directly affect some non-target species. These effects can be minimized through the use of carefully planned applications guided by GPS technology. Employees or contractors with appropriate licence and certification would be responsible for using chemicals according to federal and state guidelines and would take precautions to prevent possible effects on non-target plant species.

An active noxious weed control program would focus on the removal of non-native invasive species in the most sensitive of habitats, such as special-status species populations. Priority weed treatments are conducted annually, and known rare plant populations are avoided. The early treatment of small weed populations protects associated plant communities from further degradation; this is an indirect beneficial effect.

Under Alternative A, rehabilitation activities described in Section 4.0.3.1.2 would ensure that existing TE&S inventories are reviewed and field verified, or that new surveys are conducted prior to initiation of rehabilitation treatments. Known TE&S populations are avoided and are consequently not disturbed by seeding and planting efforts.

Alternatives B–F

Under Alternatives B, C, D, E and F mechanical and cultural integrated pest management treatments would have minor effects on TE&S plant species. Both treatment types would potentially disturb soils through mechanical removal (hand pulling, discing, mowing) of weed species followed by the seeding of native species. Such treatments would be conducted only when it has been determined that these areas should be considered high priority for treatment because non-native invasive species threaten the ecological integrity of the area. Moreover, spot treatments would be used to avoid effects on non-target species. TE&S plants species known to exist in the project areas would be protected from disturbance through project-level

inventories followed by appropriate planning and implementation. Moderate to major indirect beneficial effects would be expected to result from the reduction or elimination of invasive species in sensitive plant communities, leading to reduced erosion and sedimentation, improved plant community stability, enhanced wildlife habitat, and increased habitat connectivity.

Rattlesnake Mountain

Restoration activities on the summit of Rattlesnake Mountain would attempt to return portions of the site to pre-Manhattan Project conditions through the demolition and disposal actions associated with scheduled DOE remediation activities. Under all alternatives these actions would provide improved upland habitat for TE&S species on top of Rattlesnake Mountain. Direct effects on TE&S species would be minor. Disturbance from demolition activities and soil disturbance in the removal of building materials, asphalt, gravel and concrete foundations would have limited and short-term effects on TE&S species. Minor, indirect, beneficial effects would include improvement of upland habitat by using native plantings for site stabilization, reduced noxious weed establishment, and reduced mortality of wildlife species from guy wires and entrapment in existing structures. Known TE&S populations would be avoided during cleanup activities. Under alternatives B, C and F, restoration activities would include the removal of the observatory, along with the other buildings and structures, and the effects would be similar to those described above. Under alternatives A, D and E, the observatory building and associated utilities would be retained, and therefore minor effects, including disturbance of TE&S wildlife species and plant communities and the potential for the introduction or spread of non-native invasive species, although reduced (due to the removal of other structures), would not be eliminated.

Fire

Direct effects of wildland fire on TE&S species and habitats can range from minor to major, depending on the size, location, and intensity of the fire. Effects include loss of individual specimens or local populations; modification of habitat structure (litter, soil temperature, hydrologic function, nutrients, soil microbial action, and plant community function); and loss of habitat. Indirect effects include a loss of shrub-steppe habitats, native seed banks, and species diversity; increased erosion; and establishment of non-native invasive species.

4.2.5.2.2 TE&S Fish

Wildland fire and upland habitat degradation pose the largest threat to habitat loss for listed species. For example, the sloughing of the White Bluffs is currently affecting spawning habitat for steelhead; erosion leads to silt deposition on spawning gravels and is causing the Columbia River channel to shift southward. Wildland fires and the spread of non-native invasive species

that adversely affect shrub-steppe habitats could degrade hydrologic functions of upland areas and cause additional sediment transport into the Columbia River.

Management actions proposed in this CCP would not significantly impact TE&S fish species. IPM and restoration actions would have negligible effects on fish species because wide buffers would be maintained to protect riverine and aquatic habitats. Restoration actions would have minor, indirect, beneficial effects on all fish populations by improving upland and riparian habitat conditions, thereby reducing erosion, improving hydrologic cycles, and improving water quality and quantity. Improved upland and riparian habitats could lead to increased viability of fish populations through habitat stabilization and improvement.

4.2.5.2.3 TE&S Birds

Under all alternatives, implementation of management actions would cause short-term disturbance of some listed species, such as bald eagle and ferruginous hawk. For example, IPM actions and restoration activities could temporarily displace wintering bald eagles from roosting areas, but these would be minor effects of short duration, because treatments would be timed to avoid potential disturbance of TE&S species (Stalmaster 1978; White 1985).

4.2.5.2.4 TE&S Mammals and Reptiles, Species of Concern, and Species New to Science

Proposed management actions would have negligible effects on mammals and reptiles, species of concern, and species new to science. As described above, IPM and restoration actions would cause short-term disturbance of insects and other species (e.g., burrowing owls, loggerhead shrikes, sage sparrows, sagebrush lizards, black-tailed jack rabbits). The planning and implementation of projects would take into account the critical life stages of each of these species and would time implementation of activities to avoid adverse effects. Restoration and IPM activities would cause short-term disturbance and displacement of these species but would have negligible direct effects. Restoration actions would have moderate indirect effects related to improving upland and riparian habitat conditions, thereby reducing erosion, improving hydrologic cycles, and improving habitat quality and connectivity. Improved upland and riparian habitats could lead to an increase in the viability of individual species through habitat stabilization and improvement.

Wildland fire and the spread of non-native invasive species would adversely affect shrub-steppe habitats through shrub and perennial vegetation loss, habitat degradation and fragmentation, direct mortality, and increased predation. Loss of late-successional habitat could be a serious threat to biological diversity because it would reduce the diversity of available habitats and microhabitats (Smith 1996).

4.2.5.3 Effects of Visitor Services Management Actions— Interpretation and Education

4.2.5.3.1 Interpretive Site Development

Interpretive site development is not planned under Alternative A; therefore, negligible adverse effects on TE&S species are anticipated.

Under Alternatives B–F, foreseeable direct effects on TE&S species would be minor. New interpretive sites would be sited, designed and constructed to avoid impacts. Interpretive site design could reduce existing effects by placing parking lots, trails and interpretative facilities away from sensitive habitats or, if appropriate, installing protective devices for sensitive plants where needed. Adverse effects would include the increased danger of wildfire from visitor use and the potential removal of sensitive plants by vandals; these effects would be minor. An increase in developed interpretive sites under Alternatives B–F would provide the visiting public the opportunity to learn about these species; ongoing management activities to study, protect and enhance their populations and habitat; and techniques to minimize impacts from recreational use.

4.2.5.3.2 Interpretive Trail Systems

Under Alternative A, interpretive trails would not be established in the Monument. There would be a negligible effect on TE&S species.

Under Alternative B–F, interpretive trails would provide increased opportunities to learn about TE&S species, their habitats, reasons for their decline, and techniques to minimize impacts from recreational use. The likely corresponding increase in visitation from providing interpretive trails could have a minor adverse effect on TE&S and their habitats. However, providing visitors with specific trails would likely have minor beneficial effects on TE&S species as visitors would be directed away from sensitive species or areas.

4.2.5.4 Effects of Visitor Services Management Actions—Recreation

4.2.5.4.1 Hunting

Hunting activities could result in the take of TE&S species through mistaken identity or illegal poaching. Species that may be susceptible include American white pelican, bald eagle,

ferruginous hawk, sandhill crane, and western sage grouse. Because such incidents are believed to be rare and isolated, effects at the population level are anticipated to be negligible.

4.2.5.4.2 Fishing

Fishing activities could result in the take of TE&S fish species—bull trout, spring-run Chinook salmon, and Upper Columbia steelhead—through mistaken identity, illegal harvest, or injury received from catch and release activities. In addition, litter, such as discarded hooks, lures, and fishing line, could injure or kill TE&S bird species such as American white pelican and bald eagle. Because such incidents are believed to be rare and isolated, effects at the population level are anticipated to be negligible.

4.2.5.4.3 Wildlife Observation and Photography

Under Alternative A, watercraft-based wildlife observation and photography activities would continue to disturb species that are seasonally conspicuous along the river corridor, such as American white pelicans and bald eagles, through noise, approaching or pursuing individuals, or lingering in important habitat areas. Wintering bald eagle foraging activities were found to be disrupted by boat and foot traffic on Washington's Skagit River (Stalmaster and Kaiser 1998). Current low levels of winter recreational use on the Hanford Reach are believed to have negligible adverse effects on TE&S species populations; however, if wildlife observation and photography activities increase over time, effects would increase in severity. Alternatives B–F could have a limited impact on TE&S species by concentrating wildlife observation activities in sites designed to provide a quality experience while minimizing potential effects; some degree of disturbance would likely occur as described in Section 4.2.5.1.4, especially from boating-based observation and photography activities in the river corridor. However, with implementation of BMPs described in Section 4.0.1.2, effects are anticipated to be minor.

4.2.5.4.4 Hiking

In general, the presence of trails and trail use can adversely affect TE&S species as described in Section 4.2.2.1.2. For example, curlews in the Monument nest in short grasslands, which are attractive to cross-country hikers because they are easier to traverse than denser vegetation communities dominated by trees or shrubs. Repeated disturbance of curlew nesting habitat can cause nest abandonment (Hamann et al. 1999). Hiking trails can create edge habitat for predators, potentially adversely affecting nesting habitats for species such as loggerhead shrikes, sage sparrows, and sage thrashers. Grassland birds have been found more likely to nest away from, rather than near, hiking trails in Colorado, and nests near trails experienced lower survival rates than nests away from trails (Miller et al. 1998). There is evidence that hiking activity in

breeding songbird territories causes curtailment of singing activity in some species, which may reduce breeding activity (Gutzwiller et al. 1998).

Trail construction and use can affect vegetation communities along the trail. Mechanisms of change include vegetation removal, drainage and grading. Resulting changes in moisture and sunlight intensity, coupled with new vectors for invasive weed dispersal, can affect plant communities along trails (Cole 1978).

Under Alternative A, hiking activities would result in some degree of adverse effects through factors described in Section 4.2.2.1.2. Because of low use levels, these effects are believed to be negligible; however, if hiking activities increase over time, effects would increase in severity. Alternatives B–F would have beneficial effects by concentrating existing use on designated trail systems and reducing cross-country hiking and its associated effects. However, developed trail systems are also anticipated to result in increased visitor use and hiking activity in the Monument, contributing to some additional disturbance along designated trail corridors as described in Section 4.2.2.4.2, although with implementation of BMPs described in Section 4.0.1.2, adverse effects are anticipated to be minor.

4.2.5.4.5 Equestrian Use

Effects of equestrian use and trails would be similar to those described above for hiking, with additional impacts from the increased severity of trampling and the spread of invasive species through horse excrement. Trampling effects of horses are more severe than those of humans due to hoof size and animal weight (Newsome et al. 2004). Trampling causes soil compaction and shearing as hooves cut through the soil surface. Erosion can increase after trampling because soil compaction reduces water infiltration and shearing dislodges soil particles (McClaran and Cole 1993). In addition, horse use on trails has been found to result in greater trailside vegetation disturbance, trail depth, and trail width than does hiking use; these effects are attributed to horses' size and weight as well as their tendency to wander from the trail (Weaver and Dale 1978).

Under Alternative A, continued equestrian use would adversely affect TE&S species through factors described in Section 4.2.2.5.5. The extent of these effects is unknown, but it is anticipated to be minor due to the infrequency of use. Under Alternative A, an increase in equestrian use over current levels would result in increased severity of effects. Alternatives B–F would result in beneficial effects on wildlife habitat by establishing designated roads and trails for existing and future equestrian use and reducing or eliminating cross-country use. However, equestrian use would continue to have long-term, adverse effects on wildlife and habitat along designated trail corridors as described above. With implementation of BMPs described in Section 4.0.1.2, adverse effects would be minor, though.

4.2.5.4.6 Boat Launches

Vernita

Due to the absence of habitat for TE&S species in the Vernita Bridge area, boat launching activities are anticipated to result in negligible effects. Boat launch development under Alternatives C, D and E is anticipated to result in increased boating use on the Columbia River; however, with implementation of BMPs described in Section 4.0.1.2, adverse effects are anticipated to be minor.

White Bluffs

The effects would be similar to those described for the Vernita Bridge area above.¹²⁶

Ringold

The effects would be similar to those described for the Vernita Bridge area above.

South Shore

Under Alternative D, providing developed boat launches could adversely affect bald eagle habitat by causing disturbance during the nesting season. However, with implementation of BMPs described in Section 4.0.1.2, adverse effects would be minor.

4.2.5.4.7 Camping

Vernita

Due to the absence of habitat for TE&S species in the Vernita Bridge area, camping activities under Alternatives A, D and E are anticipated to result in negligible effects.

Boat-In

Establishment of non-motorized, boat-in campsites under Alternatives C, D and E, could adversely affect bald eagles, American white pelicans, long-billed curlews, and ferruginous hawks through disturbance as described above (see “Wildlife Observation and Photography” at 4.2.5.5.3). Seasonal closures and implementation of BMPs described in Section 4.0.1.2 would result in adverse effects being minor.

¹²⁶ Although bald eagle roosting habitat is present in the vicinity, it is located outside the zone of effects of the White Bluffs launch area.

Saddle Mountain

The effects of a developed campground under Alternative D would be similar to those described for the Vernita Bridge campground above.

4.2.5.4.8 Modified Public Access

Columbia River Unit

Vernita Bridge, South Shore. Because this area does not overlap with sensitive habitat for TE&S species, effects are anticipated to be negligible under all alternatives.

South Shore. Providing access to the south shore could result in adverse effects on species such as bald eagles, American white pelicans, long-billed curlews, and ferruginous hawks through disturbance as described above (see “Wildlife Observation and Photography” at 4.2.5.5.3). However, with implementation of BMPs described in Section 4.0.1.2, adverse effects are anticipated to be minor.

North Shore. The effects would be similar to those described for south shore access.

Sand Dunes. Providing access to the sand dunes could result in adverse effects on species such as sagebrush lizards, Columbia River tiger beetles, loggerhead shrikes, burrowing owls, long-billed curlews, and Townsend’s ground squirrels through disturbance as described in Section 4.2.2.1.2. However, with implementation of BMPs described in Section 4.0.1.2, adverse effects are anticipated to be minor.

Ringold Unit

Parking Lots. Because the affected areas do not provide sensitive habitat for TE&S species, effects are anticipated to be negligible under all alternatives.

Auto Tour. The presence of a road and vehicle use can adversely affect many TE&S species. For example, songbirds are sensitive to low noise levels and generally exhibit lower breeding densities and reduced species richness along roads than in control areas. Roads can serve as barriers to movement of wildlife taxa such as beetles and small mammals. Amphibians and reptiles are particularly susceptible to vehicle mortality on roads with low to moderate traffic (Formann and Alexander 1998). Roads also serve as conduits for invasive weed seed transport on vehicle undercarriages, which can rapidly collect and distribute weed seeds (Montana State University Extension Service 2002). An auto tour route under Alternative D is anticipated to result in adverse effects on species such as sage sparrows, loggerhead shrikes, sage thrashers, black-tailed jackrabbits, sagebrush lizards, striped whipsnakes, and a variety of insects through

disturbance as described in Section 4.2.2.1.2. However, with implementation of BMPs described in Section 4.0.1.2, effects are anticipated to be minor.

Saddle Mountain Unit

Under Alternatives A and D, public access to the Saddle Mountain summit area would result in adverse effects on TE&S species such as sagebrush lizards, loggerhead shrikes, sage thrashers, sage sparrows, and black-tailed jackrabbits through disturbance as described in Section 4.2.2.1.2. With implementation of BMPs described in Section 4.0.1.2, effects are anticipated to be minor, though.

Alternative B would result in minor beneficial effects by removing the disturbance factors on the summit described above. Alternatives C and F would result in minor beneficial effects by removing the disturbance factor of vehicle use and reducing the number of visitors to the Saddle Mountain summit area.

Wahluke Unit

West Access. Non-motorized public access under Alternatives B–F would result in adverse effects on several TE&S species (long-billed curlews, sagebrush lizards, black-tailed jackrabbits, burrowing owls) through disturbance factors described in Section 4.2.2.1.2. However, with implementation of BMPs described in Section 4.0.1.2, effects are anticipated to be minor.

Auto Tour. The effects would be similar to those described for the Ringold auto tour route.

4.2.5.4.9 Permit System

The effects of a permit system under Alternative F are anticipated to be negligible.

4.3 Effects on Riverine and Other Aquatic/Wetland Resources

4.3.1 Assumptions

Effects on riparian resources are broadly similar to effects on wildlife and vegetation; these effects have been discussed in earlier sections where applicable. Comprehensive data collection

on riparian resources has not been completed at this time, but preliminary inventory information is available and has been used in the analysis where possible.

Effects on riparian resources result directly and indirectly from the removal of vegetation; the degradation of water quality; the construction and maintenance of facilities (e.g., recreation, communication, power transmission, irrigation); and vegetation trampling. Daily fluctuations in water levels caused by water releases for hydroelectric generation also affect riverine plant communities, shoreline integrity, individual species, and aquatic habitats. These activities change the composition of vegetative associations by causing surface disturbance and spread of non-native invasive species; increase erosion along shorelines; increase sediment deposition into riparian plant communities, leading to habitat degradation; and may directly affect roost and nest sites (Davis 1986).

Visitor use has the potential to cause surface disturbance; however, the extent and effects of such disturbance are difficult to quantify. Numerous factors could cause disturbance of these habitats, including bank fishing, recreational boating and associated shoreline use activities, beaching of watercraft, and boat wake effects.

Vegetation restoration methods have the potential to cause surface disturbance on approximately 800 acres within the Columbia River Unit over the fifteen-year planning horizon.

Protecting riparian resources in the Monument could include area and use restrictions; site-specific design plans and inventories for construction/improvements of facilities in riparian areas; limitations and restrictions on surface-disturbing activities; mechanisms to control visitor use; closure to vehicular travel of designated routes; monitoring of riparian areas; monitoring of vegetative conditions; restoration and revegetation provisions for all associated activities affecting riparian and wetland areas; and an active noxious weed removal program. Additionally, research would facilitate increased knowledge of these areas of the Monument, and the application of adaptive management principles would provide mechanisms for changing management based on the best available science.

River users constitute a large portion of the visiting public. Accordingly, many interpretive efforts will focus on providing Monument information and resource interpretation specifically targeting the boating public. The importance of protecting nesting and feeding wildlife from disturbance will be highlighted, as will be the fragility of riparian and riverine habitats.

4.3.2 Effects Analysis—Wildlife and Habitat

4.3.2.1 Effects Common to All Alternatives

4.3.2.1.1 Control of Non-native Invasive Species

Species such as salt cedar, rush skeletonweed, purple loosestrife, Russian knapweed, and Russian olive are prevalent in riparian areas, irrigation wasteways and settling ponds, seeps and spring areas. Non-native species would be treated as needed to complement riparian area restoration objectives. Adaptive management strategies and IPM techniques would be used to initiate treatment in sensitive and biologically diverse riparian plant communities. Project work would focus primarily on spot treatments of non-native invasive species populations that threaten the ecological integrity of adjacent lands and habitats. Spot treatments could use chemical, biological, mechanical or cultural (native species plantings) techniques to eradicate or reduce non-native invasive species in riparian habitats.

4.3.2.1.2 Restoration Activities

Shrub-steppe restoration in upland areas as described in Section 4.0.3.1.2 would complement restoration activities in riverine and aquatic areas and would have negligible effects on riparian habitats. Beneficial indirect effects would be moderate; these would include the reduction or elimination of invasive species in native plant communities, leading to improved wildlife habitat conditions and wildlife biodiversity; improved hydrologic functions; stabilization of soils; and improvement of plant community structure, function and connectivity.

4.3.2.1.3 Wildland Fire and Fire Suppression Activities

Catastrophic wildfire is a major disturbance component that can destroy and degrade riverine/aquatic/wetland habitats. High-intensity fire events lead to an increased chance for invasion of weed species and associated effects on wetland habitats. Direct effects can be minor to major and include the loss of vegetation and riparian/aquatic habitat structure and function. The loss of trees in riverine systems directly affects nesting, roosting and foraging activities for avian species. Wetland areas are resilient in nature and recover more quickly than shrub-steppe habitats; however, wetland areas are also prone to encroachment of non-native invasive species. Some effects can be mitigated through BAER actions, but such efforts take some time to reverse the adverse effects of catastrophic wildlife. Indirect effects would be minor to major depending on fire intensity and burn severity and would include loss of wildlife habitat and connectivity,

vegetation biodiversity, wildlife diversity, increased erosion, and establishment of non-native invasive species.

4.3.2.1.4 Public Use

The effects of visitor use and facility development on riverine wildlife are associated with loss or modification of habitat, including soil compaction; increased soil erosion; changes in vegetation community structure and composition; spread of invasive species such as salt cedar, perennial pepperweed, purple loosestrife, reed canarygrass, Eurasian water milfoil, hydrilla and others; and an increased potential of human-caused wildfire.

Wildlife disturbance would result from the visible and audible presence of people, vehicles, watercraft and domestic animals such as horses and dogs. Disturbance effects on wildlife are well documented and include altered behavior such as flight and selection of suboptimal habitat (Klein 1993); physiological changes such as altered temperature and heart rate (Buckley 2004); and reduction of time and energy spent in primary activities such as feeding, resting, mating displays, and parental care (Frid and Dill 2002). Waterbirds can be especially vulnerable to disturbance because their size and physical beauty tend to attract humans (Carney and Sydeman 1999). Human disturbance of colonial nesting waterbirds, such as great blue herons and great egrets, has been found to cause reproductive failure, population decline, and displacement (Erwin 1989; Rodgers and Smith 1995; Skagen et al. 2001). In addition, wildlife injury and mortality would result from the harvest of game fish and wildlife species and from collisions between vehicles and wildlife (Ashley and Robinson 1996; Jones 2000).

The effects of boating on wildlife vary depending on the wildlife species; the season; and boat size, speed, noise level, and proximity (DeLong 2002). The number of boats present is not necessarily an accurate indicator of disturbance level because the presence of a single boat can be just as disturbing as the presence of many (Knight and Knight 1984). Motorboats have been found to have the greatest disturbance potential because they involve both movement and noise, whereas non-motorized boats involve only movement (Knight and Cole 1995). However, non-motorized boats can navigate along shallow shorelines and get very close to nesting waterbirds, also causing considerable disturbance (Speight 1973 as cited in DeLong 2002). During the breeding season, disturbance can cause nest abandonment, increased predation of young, and subject young birds to stress (DeLong 2002). Breeding colonial waterbirds can be particularly susceptible because of their high-density nesting habits (Rodgers and Smith 1995). In the Hanford Reach, where there are relatively few stands of trees, colonial waterbird nesting areas are easily identified by the casual observer, further contributing to the vulnerability of such colonies to disturbance.

4.3.2.2 Effects of Biological Resource Management Actions

Under Alternative A, no riparian restoration is proposed; consequently, no direct or indirect effects on wildlife or habitat are anticipated.

Under Alternatives B–F, threats or actions adversely affecting the aquatic environment would be mapped and treated. A full range of treatments would be used to accomplish rehabilitation efforts; these include IPM techniques, removal of non-native vegetation, soil stabilization, and native plantings and seeding. Rehabilitation treatments would be prioritized and implemented annually on the basis of threat analysis, with the objective of restoring at-risk riparian areas to proper functioning condition. Moderate direct effects of project implementation would include soil disturbance in riparian plant communities associated with removal of non-native vegetation (e.g., Russian olive) and soil contouring; effects on soil stability, refuge and thermal cover, ecotones, edge effect, and nesting habitat; and short-term wildlife disturbance or displacement. In sensitive riparian plant communities where non-native species dominate and soil disturbance would adversely affect riverine habitats, the integrated application of many tools may be required (Katz 2003). Adaptive management strategies in concert with IPM techniques would be used to initiate treatment on sensitive and biologically diverse riparian plant communities. Restoration of wildlife habitat would be subject to project-level NEPA analysis.

Reduction or elimination of invasive species in native plant communities would have moderate, indirect, beneficial effects on resource conditions; wildlife habitat; and plant community structure, function and connectivity. Large populations of noxious weeds present in riverine areas of the Monument would require extensive treatments carried out in an integrated fashion to control species such as Russian olive, purple loosestrife, salt cedar, rush skeletonweed, and Russian knapweed. Indirect benefits of riparian restoration efforts include long-term soil and streambank stabilization, improvement of hydrologic function, reduced sedimentation, improved fish and wildlife habitat, and improved wildlife diversity.

Under Alternatives C, D and E, water control structures, dikes and ponds would be installed or repaired in appropriate areas surrounding irrigation waterways and artificial seeps on approximately 800 acres in the Wahluke Unit and 320 acres of seasonal wetlands in the Ringold Unit. These management activities would allow for enhancement of riparian habitat characterized by a mosaic of native shrubby thickets with patches of deciduous trees and grass/forb dominated understory and would benefit wetland-dependent species over the life of the CCP. Water management in these areas would allow for improved waterfowl and aquatic habitat characteristic of native faunal communities of the Columbia River; reduce non-native invasive species that now occupy the sites; provide opportunities for the reestablishment of native species; and create long-term wildlife habitat benefits for migratory species. However, the restoration of functional wetland systems overall would have minor indirect, beneficial effects, due to the small number of acres involved in these projects relative to the number of acres contained in the Monument. Minor direct effects would include short-term soil

disturbance and erosion associated with removal of non-native invasive species (e.g., Russian olive), dike construction, and soil recontouring activities. There would be minor long-term disturbance associated with annual ditch cleaning and system maintenance activities to maintain wetland vegetation and water control structures.

Under Alternatives B, C and F, all restoration activities would be prioritized on the approximately 1,200 acres of riparian areas within the Columbia River and Rattlesnake Units where natural succession has been altered by disturbance. Disturbance factors have included river fluctuations associated with hydroelectric production; wildland fire; infrastructure development (power lines, monitoring stations, pumping stations, nuclear development and cleanup activities); public use effects; and accelerated erosion of the White Bluffs. Restoration activities would have minor direct effects on riparian areas; these effects would include soil disturbance and short-term sedimentation related to control of non-native invasive species, native plantings, and streambank stabilization projects. Indirect benefits from riparian restoration efforts include long-term soil and streambank stabilization, improved hydrologic function, reduced sedimentation, improved fish and wildlife habitat, and improved wildlife diversity.

Restoration activities on the summit of Rattlesnake Mountain would attempt to return portions of the site to pre-Manhattan Project conditions through the demolition and disposal actions associated with scheduled DOE remediation activities. Under Alternatives B–F, DOE management activities on the summit of Rattlesnake Mountain would improve the aquatic habitat of one spring near the summit.¹²⁷ Buildings identified for cleanup would be removed and upland habitats would be restored. Minor direct effects would be anticipated to result from ground-disturbing activities to remove building materials, gravel and concrete foundations. Minor beneficial indirect effects would include site stabilization through seeding with native species, reduced noxious weed populations, and improved wetland habitat conditions.

Under Alternatives B–F, Monument-wide population control/herd management actions would be undertaken as needed on the basis of scientific resource management data. No direct effects on riverine/aquatic habitats are foreseeable or expected to result from these actions. Site-specific control actions, such as aircraft herding of animals into trap corrals, net gunning, and helicopter transport of ungulates, would not be conducted in areas where these activities would adversely affect riverine/aquatic habitats.

¹²⁷ A well and pumphouse at the spring on the north face of Rattlesnake Mountain was developed to provide water to the NIKE missile control center during the Cold War era. Removal of these facilities would improve this wetland habitat through scheduled DOE remediation activities on top of Rattlesnake Mountain.

4.3.2.3 Effects of Visitor Services Management Actions— Interpretation and Education

4.3.2.3.1 Interpretive Site Development

Alternative A would have negligible effects on riverine and aquatic habitats. To minimize effects, existing informational signs are located at previously disturbed areas along major entry points and travel routes in the Monument.

Under Alternatives B, C and F, interpretive sites would be located near visitor facilities (e.g., boat launches, river access points, trails, roads); under Alternatives D and E, they would be more widely dispersed. Developing visitor facilities and interpretive sites directly affects riparian resources by removing vegetation and causing ground disturbance, leading to erosion and increased sedimentation, and by visitor use around sites, resulting in further surface disturbance and soil erosion. Moreover, human activity is a primary mechanism for the transport of noxious weed species. Construction of new sites has the potential of introducing invasive non-native species into areas where they have not previously been found. The effects of such introductions are described in Section 4.4.2.4.1. Projected increases in use of all facilities would result in an increase in all these effects. Ease of access generally limits minor effects from use of interpretive sites to within 1/4 mile of the sites. Proper planning and placement of interpretive sites would be coupled with the use of informational signs, educational materials, trails, physical improvements, and law enforcement patrols to reduce and mitigate these effects.

4.3.2.3.2 Interpretive Trail Systems

Under Alternative A, no interpretive trails are planned. This would continue long-term adverse effects on aquatic and riverine ecosystems as these areas are currently subjected to the highest levels of visitor use and off-trail travel, and resource disturbance is uncontrolled in areas open to public use. With the increased visitation that is anticipated, these adverse effects would also increase.

Under Alternatives B–F, interpretative trail systems would directly affect riverine and aquatic habitats through the creation of some trail systems in and around riparian habitats. Trail construction would have moderate short-term effects and minor long-term effects. Effects include soil disturbance, vegetation loss, soil erosion, the spread and establishment of non-native invasive species, and an increased risk of wildland fire. Beneficial long-term effects include the reduction of impacts on surrounding sensitive riverine and aquatic resources by concentrating uses on established trail systems and enhancing interpretation and education opportunities.

4.3.2.4 Effects of Visitor Services Management Actions—Recreation

4.3.2.4.1 Hunting

The effects would be similar to those described in Section 4.2.2.5.2.

4.3.2.4.2 Fishing

Fishing activities on the Monument result in the mortality of salmon, steelhead, bass, northern pikeminnow, whitefish and other species; however, annual population and harvest surveys conducted by the NOAA-Fisheries indicate that population-level effects from fishing are negligible. Angler wading activity in incubation (redd) areas has been found to cause mortality of salmon eggs during certain stages of embryonic development (Roberts and White 1992). Adverse effects of wading in the Hanford Reach are believed to be minor due to the lack of overlap between wading areas and redds. Under all alternatives, fishing and related activities (e.g., walking along shorelines, wading, float tubing, and boating) would continue to cause wildlife disturbance as described in Section 4.3.2.1.4. Discarded fishing line would continue to cause injury and mortality of birds through entanglement. With implementation of BMPs described in Section 4.0.1.2, adverse effects are anticipated to be minor. On the other hand, fishing activities may provide indirect beneficial effects by fostering increased appreciation and support for conservation of natural resources.

4.3.2.4.3 Wildlife Observation and Photography

The effects would be the same as those described in Section 4.2.2.5.3.

4.3.2.4.4 Hiking

The effects would be the same as those described in Section 4.2.2.5.4.

4.3.2.4.5 Equestrian Use

The effects would be the same as those described in Section 4.2.2.5.5.

4.3.2.4.6 Boat Launches

Vernita

Under all Alternatives, vehicle access and recreation activities in the launch vicinity would result in minor adverse effects through disturbance and disruption of wildlife behavioral patterns, such as nesting, roosting, foraging and migration, as well as through increased rates of introduction of non-native invasive plant species. Under all alternatives, restricting vehicles to designated routes and a designated boat launch would have beneficial effects on wildlife by concentrating vehicle use in designated areas and eliminating cross-country vehicle use. However, unless rehabilitation efforts are implemented to restore areas affected by years of cross-country vehicle use, these beneficial effects would be negligible. Under Alternatives C, D and E, a developed boat launch would likely draw increased visitor use to this site and along the Columbia River Unit. Increased visitor use in the Columbia River Corridor Unit would result in adverse effects through disturbance as described in Section 4.3.2.1.4. In addition, minor, short-term adverse effects on wildlife would result from boat launch development. However, with implementation of BMPs described in Section 4.0.1.2, these effects are anticipated to be minor.

White Bluffs

Under Alternatives A, B, D, E and F, vehicle access and recreation activities in the White Bluffs launch vicinity would continue to have long-term, minor adverse effects through wildlife and habitat disturbance as described in Section 4.3.2.1.4. However, Alternatives E and F may result in reduction of these effects because the launch would be closed to motorized use, presumably decreasing usage levels. Alternative C would result in minor, beneficial, long-term effects on wildlife by increasing the difficulty of access and reducing overall visitor use and disturbance of wildlife and habitat in the area.

Ringold

Under Alternatives B–F, effects on wildlife and habitat from boat launch development are anticipated to be negligible due to the previously disturbed nature of this area associated with hatchery and irrigation return canal operations. Development of this launch site would result in increased use at the Ringold Fish Hatchery site, resulting in long-term, minor adverse effects on wildlife in the immediate area through wildlife and habitat disturbance as described in Section 4.3.2.1.4. Providing a developed boat launch in this area would likely result in increased visitor use in the river corridor, resulting in disturbance factors constituting long-term, minor adverse effects as described in Section 4.3.2.1.1.

South Shore

Under Alternative D, vehicle travel, boat launching, and other activities would adversely affect wildlife through wildlife and habitat disturbance as described in Section 4.3.2.1.4. Development of a boat launch and associated site improvements (e.g., parking areas, toilets) would have minor, short-term, adverse effects by causing wildlife disturbance during construction activities. Providing a developed boat launch on the south shore would likely result in increased visitor use in the river corridor, resulting in long-term adverse effects through disturbance factors described above. However, with implementation of BMPs described in Section 4.0.1.2, these effects are anticipated to be minor.

4.3.2.4.7 Camping

Vernita

Under Alternative A, camping activities are believed to cause minor adverse effects on riverine wildlife and habitat as described in Section 4.3.2.1.4. Alternatives B, C and F would result in minor beneficial effects by eliminating camping activities. This discontinuation of camping activities would likely displace overnight users to nearby camping areas outside the Monument, such as the Benton County Horn Rapids Park or developed campgrounds in the communities of Mattawa and Desert Aire. Under Alternatives D and E, developed camping opportunities would lead to year-round increases in visitor use. Depending on the number of visitors, minor to moderate adverse effects would result from increased visitor use in the Monument.

Boat-In

Under Alternatives C, D and E, non-motorized boat-in campsites would attract increased use by non-motorized boaters on the Hanford Reach from spring through fall. Increased non-motorized boating activity would result in wildlife disturbance along the river corridor. Camping activities would result in adverse effects on wildlife through disturbance as described above. Camping activities would affect vegetation through disturbance and trampling, although these vegetation effects would be minimized by locating campsites on terrain that is resistant to these effects and by strictly requiring visitors to camp within designated sites (Cole and Monz 2004). Implementation of other BMPs as described in Section 4.0.1.2 will result in effects being minor.

Saddle Mountain

The effects related to camping in the Saddle Mountain Unit are addressed in Section 4.2.2.5.7.

4.3.2.4.8 Modified Public Access

Columbia River Unit

Vernita Bridge, South Shore. Under Alternative A, factors associated with the presence of humans and vehicles (i.e., wildlife disturbance, soil compaction, vegetation disturbance, introduction and establishment of invasive non-native plant species, and increased risk of human-caused wildfire) would continue have minor adverse effects on wildlife. Alternatives B, C, D and F would result in minor beneficial effects on wildlife by removing these disturbance factors. However, this action would likely displace users to the north side of the river, resulting in minor increases in adverse effects on wildlife there. Alternative E would result in minor beneficial effects on wildlife by limiting use to designated roads and trails.

South Shore. Under Alternatives C, D and E, providing access to the south shore would result in adverse effects on riverine wildlife and habitat through wildlife disturbance, soil compaction, vegetation disturbance, introduction and establishment of invasive non-native plant species, and increased risk of human-caused wildfire. With implementation of BMPs described in Section 4.0.1.2, the effects of providing access to the south shore are anticipated to be minor.

North Shore. The effects would be similar to those described for the South Shore.

Ringold, Saddle Mountain, and Wahluke Units

The effects related to modified public access in the Ringold, Saddle Mountain, and Wahluke Units are addressed in Section 4.2.2.5.8.

4.3.2.4.9 Permit System

Under Alternative F, implementation of a permit system is anticipated to have negligible effects on wildlife and habitat.

4.3.3 Effects Analysis—Sensitive Plant Communities

Several sensitive plant species occur in riparian areas—persistent sepal yellowcress (persistent sepal yellowcress has been identified at eighteen locations north of the 300 Area), false pimpernel, and shining flatsedge.

The restoration of riparian areas to proper functioning condition would enhance sensitive aquatic habitats throughout the Monument. Approximately 100 linear miles of riparian habitat have been inventoried in the Monument, constituting 80% of the total riparian habitat assumed to

occur within the Monument boundaries. Due to the significance of riparian plant communities in this desert environment, the majority of riparian communities have been classified as sensitive. Additional surveys are needed to determine riparian health and function in order to prioritize treatments. Non-functioning and at-risk riparian areas have the potential for continued degradation until remediation actions are taken to stop or reverse effects.

4.3.3.1 Effects Common to All Alternatives

In general, effects would be similar to those described for sensitive plant communities in Section 4.2.4.1.

4.3.3.2 Effects of Biological Resource Management Actions

Under Alternative A, no active riparian restoration is proposed; consequently, no effects on sensitive plant communities are anticipated.

Under Alternatives B–F, threats or actions adversely affecting the aquatic environment and sensitive riparian plant communities would be mapped and treated. A full range of treatments would be utilized to accomplish rehabilitation efforts; these include IPM techniques, non-native vegetation removal, soil stabilization, and native plantings and seeding. Rehabilitation treatments would be prioritized and implemented annually on the basis of threat analysis. Soil disturbance, removal of non-native vegetation, and soil contouring would have moderate direct effects on sensitive riparian plant communities. Although moderate effects are anticipated because of the limited size, access and sensitivity of these aquatic plant associations, the effects would be of short duration due to the resiliency of these mesic communities. The reduction or elimination of invasive species in native plant communities would have moderate beneficial effects, including improvement of resource conditions, wildlife habitat, and plant community structure, function and connectivity.

4.3.3.3 Effects of Visitor Services Management Actions— Interpretation and Education

4.3.3.3.1 Interpretive Site Development

Alternative A would have negligible effects on sensitive plant communities. Interpretive signs and kiosks at major entry points and travel routes in the Monument are in locations that have already been affected; this condition ensures protection of sensitive plant communities.

Under Alternatives B–F, a variety of interpretive sites are planned. Interpretive sites would be located in and adjacent to areas that may contain sensitive plant communities. Such choice of location is necessary to properly interpret the significance and fragility of these resources in aquatic and riverine habitats. Minimal short-term adverse effects are anticipated to result from site development. Design features would be incorporated to minimize effects following the initial construction phase. All interpretive sites would expressly avoid any locations supporting aquatic and riverine plants that are considered rare, threatened, or endangered by state or federal standards. Proposed interpretive sites would highlight the Monument’s sensitive plant communities in aquatic and riverine habitats while encouraging visitors to protect them.

4.3.3.3.2 Interpretive Trail Systems

Under Alternative A, no interpretive trails are planned, so there would be no impacts. Under Alternatives B–F, interpretive trails would be sited traversing or adjacent to areas that contain sensitive plant communities (e.g., Saddle Mountain Lakes, Columbia River shoreline). Because the visiting public has already expressed interest in these resources, and would seek them out with or without the advantage of interpretive trails, these particular resources would be included in the proposed interpretive trail system. It is anticipated that an interpretive trail system would have long-term beneficial effects on the protection and appreciation of sensitive plant communities by promoting education and increased visitor awareness.

4.3.3.4 Effects of Visitor Services Management Actions—Recreation

4.3.3.4.1 Hunting

Under all alternatives, waterfowl hunting activities would occur along the north shoreline within the Columbia River Corridor Unit downstream of the old Hanford Townsite. While these activities have the potential to adversely affect sensitive plant communities by increasing the risk of invasive weed spread and human-caused wildfire, the effects are anticipated to be negligible due to the lack of overlap of sensitive riverine plant communities and waterfowl hunting areas.

4.3.3.4.2 Fishing

Under all alternatives, fishing and related activities would include walking along shorelines, potentially affecting sensitive plant communities through trampling and by spreading invasive non-native plant species. However, with implementation of BMPs described in Section 4.0.1.2, adverse effects are anticipated to be minor.

4.3.3.4.3 Wildlife Observation and Photography

The effects would be the same as those described in Section 4.2.4.5.3.

4.3.3.4.4 Hiking

The effects would be the same as those described in Section 4.2.4.5.4.

4.3.3.4.5 Equestrian Use

The effects would be the same as those described in Section 4.2.4.5.5.

4.3.3.4.6 Boat Launches

Because proposed boat launch areas would be located in previously disturbed areas with no sensitive plant communities, effects are anticipated to be negligible.

4.3.3.4.7 Camping

Because camping activities would not occur in sensitive plant communities in the Vernita area and boat-in sites, negligible effects are anticipated. However, developed camping opportunities would attract increased visitor use in the Monument, with a probable increase in adverse effects associated with various recreational activities as discussed throughout this section. However, with implementation of BMPs, adverse effects are anticipated to be minor.

Saddle Mountain

The effects are addressed in Section 4.2.4.5.7.

4.3.3.4.8 Modified Public Access

Columbia River Unit

Vernita Bridge, South Shore. Under Alternative A, adverse effects on sensitive plant communities as described in Section 4.2.4.1.2 would continue. Alternatives B, C, D and F would result in minor beneficial effects by removing disturbance factors associated with public use in this area. Under Alternative E, limiting use to designated roads and trails would reduce

effects; however, the spread of invasive non-native species and the risk of human-caused wildfire events would continue to be minor adverse effects.

Sand Dunes. Effects are addressed in Section 4.2.4.5.8.

South Shore. Under Alternatives C, D and E, public access is anticipated to result in adverse effects on sensitive plant communities as described in Section 4.2.4.1.2. With implementation of BMPs described in Section 4.0.1.2, these adverse effects are anticipated to be minor.

North Shore. Under Alternatives D and E, effects would be similar to those described above for South Shore access.

Ringold Unit

The effects are addressed in Section 4.2.4.5.8.

Saddle Mountain Unit

The effects are addressed in Section 4.2.4.5.8.

Wahluke Unit

The effects are addressed in Section 4.2.4.5.8.

4.3.3.4.9 Permit System

Under Alternative F, implementation of a permit system is anticipated to have negligible effects on sensitive plant communities.

4.3.4 Effects Analysis—Threatened, Endangered and Sensitive Species

4.3.4.1 Effects Common to All Alternatives

Effects on TE&S species populations occur primarily from loss or modification of riparian habitat, disturbance, soil compaction, trampling and introduction of invasive non-native plant species. As described in Section 4.2.5, the primary TE&S species occurring within riparian areas are bald eagles, Upper Columbia River steelhead (rearing habitat), persistent sepal

yellowcress, and American white pelicans. Water fluctuations in the Hanford Reach continue to adversely affect some TE&S species such as persistent sepal yellowcress. Restrictions on surface-disturbing activities, mechanisms to control visitor use, fire control, restoration activities, and an active weed control program would all contribute to the protection and recovery of TE&S species. Most actions described in this CCP would likely be beneficial to the recovery and conservation of these species. Complete inventories of the Monument are necessary to more accurately identify at-risk riparian plant communities and their importance to TE&S populations and associated habitats in order to implement comprehensive protection measures through land management actions. The FWS would continue to work with private, county, state and other federal partners, as well as adjacent land managers, to protect and restore TES populations and habitat. For a more complete discussion of effects on species in this community, refer to Sections 4.3.2 and 4.3.3.

4.3.4.2 Effects of Biological Resource Management Actions

Under Alternatives B, C and D, riparian restoration activities would have negligible effects on TE&S species. Restoration of riparian areas to proper functioning condition and maintenance of those conditions would enhance habitat for riparian-dependent species (e.g., persistent sepal yellowcress) and would contribute to the overall protection of TE&S species dependent on these areas for food and shelter. Projects will avoid known TE&S populations and will be timed to reduce disturbance to migratory species. If restoration actions along the Columbia River are implemented during the fall and winter months, there could be minor short-term disturbance of bald eagles. Such disturbance would be confined to the immediate project vicinity and would have negligible effects on eagles and their roosting and foraging activities along the Hanford Reach. Indirect effects include plant community stabilization, reestablishment of native vegetation, and control of invasive non-native species.

No reasonably foreseeable effects on TE&S species would be expected to result from efforts to control wildlife populations in the Monument.

4.3.4.3 Effects of Visitor Services Management Actions— Interpretation and Education

4.3.4.3.1 Interpretive Site Development

Alternative A would have negligible effects on TE&S species. Interpretive signs and kiosks are located along major entry points and travel routes within the Monument and pose no threat to TE&S species.

An increase in developed interpretive sites under Alternatives B–F would result in an increase of interpretation and education offerings highlighting TE&S species. These materials would provide the visiting public with an increased opportunity to learn about these species; ongoing management activities to study, protect and enhance their populations and habitat; and the FWS’ mission to protect and conserve wildlife and habitat. The likely corresponding increase in visitation could have a minor adverse effect on TE&S species, which may be more than offset by visitors learning how to protect these species. All interpretive sites would be designed to mitigate any potential direct adverse effects on TE&S species.

4.3.4.3.2 Interpretive Trail Systems

Under Alternative A, interpretive trails would not be established in the Monument. There would be a negligible effect on TE&S species.

An expanded interpretive trail system would provide the visiting public with increased opportunities for experiencing the Monument and viewing and learning about TE&S species, their habitats, and reasons for their decline. The likely corresponding increase in visitation could have a minor adverse effect on TE&S and their habitats. Establishing interpretive trails would have beneficial impacts on TE&S by concentrating visitors on trails designed to minimize impacts, as well as educating visitors about species conservation.

4.3.4.4 Effects of Visitor Services Management Actions—Recreation

These effects are addressed in Section 4.2.5.1.4.

4.4 Effects on Invasive Species

Settlement of the Columbia River Basin brought the conversion of shrub-steppe habitats for agriculture, urban development, and national defense. Non-native invasive species, such as cheatgrass, yellow star-thistle, Russian thistle, rush skeletonweed, and knapweed, have become established and now constitute the second largest threat to the biological integrity of the shrub-steppe ecosystem (following wildland fire).

4.4.1 Assumptions

Invasive species are extremely adaptable to disturbance influences and often outcompete native species following ground disturbance, fire and drought conditions (D’Antonio et al. 1992). Many species can produce seed that remains dormant in the soil for decades and will germinate when growing conditions are favorable. Invasive species are easily spread by wind, water, animals, vehicles and clothing, expanding their foothold into shrub-steppe habitats as conditions allow.

4.4.2 Effects Analysis—Invasive Species

4.4.2.1 Effects Common to All Alternatives

4.4.2.1.1 Effects of Invasive Species on Native Vegetation Communities

Some weed populations are the result of past human activities—farming, grazing, emigrant travel, and homesteading. Currently, visitors, vehicles and wind are the primary vectors for the dispersal of noxious weed species. Most noxious weed populations mapped to date are adjacent to major travel corridors (roads, trails, irrigation canals, railroad lines). Human activity, vehicles and wind have distributed these weeds farther into the shrub-steppe plant communities as activity levels have increased in the Monument. The construction of new facilities and increased visitor use of these areas have the potential to introduce weeds into areas where they have not previously been found.

4.4.2.1.2 Wildland Fire and Fire Suppression Activities

Fire suppression activities can have moderate to major direct effects on the spread of non-native invasive species by surface-disturbing factors such as fireline creation and erosion. Some of these effects can be mitigated through BAER actions. Emergency use of equipment (e.g., discing) for fire suppression has the potential to affect invasive species abundance by clearing vegetation and microbial crust and by dispersing seed from other weed populations. However, fireline construction is also an effective method to contain fires when they are small, thereby limiting the expansion of invasive species expansion onto thousands of acres that could otherwise burn without the use of aggressive suppression tactics. The effects of fire suppression activities can be mitigated through pre-suppression planning, initial attack stipulations, use of existing firebreaks and roads to confine and contain wildland fire, and properly implemented rehabilitation treatments.

4.4.2.1.3 Wildlife Population Control Activities

All alternatives provide for wildlife population control in the Monument, as needed, on the basis of scientific resource management data. Site-specific control actions, such as aircraft herding of animals into trap corrals, net gunning, and helicopter transport of ungulates, would create some disturbance of upland habitats and increase the potential for expansion of non-native invasive species. However, direct effects would be minor; these would include crushed vegetation, vehicle tracks, trails, corrals, disturbed soils, and effects on vegetation around transport sites and staging areas. Direct effects on upland habitats and the associated potential for expansion of non-native species would occur with each trapping effort; however, these effects would be minimized through the use of integrated application of all population control management options. Minor indirect effects of population control management efforts would include erosion and the potential for non-native species encroachment into disturbed areas of upland plant communities. These effects would be lessened through the rehabilitation of affected sites with native species following operations.

4.4.2.1.4 Public Use

Under all alternatives, visitor use activities would play a role in invasive species transport, both to and within the Monument. Section 3.13 provides a complete discussion of invasive species issues specific to the Monument. Invasive species may be spread by horse excrement; human clothing and footwear; and vehicles, watercraft, and equipment that travel through infested areas and carry seeds or plant fragments to non-infested areas (DiTomaso 2000). Introduced plant species threaten ecosystem integrity through native species displacement, plant community simplification, habitat fragmentation, increasing fuel loads, strengthening wildfire intensity, and increasing wildfire frequency (Brooks et al 2004). Ground disturbance from visitor facility development and visitor use would provide favorable opportunities for invasive weeds to spread and/or become established in new areas.

4.4.2.2 Effects of Biological Resource Management Actions

Under Alternative A, the use of IPM techniques (chemical, biological, cultural, mechanical) would have moderate effects on non-native invasive species. Weeds are treated along major transportation corridors annually to prevent the spread of non-native invasive species into adjacent upland plant communities. Road corridor treatments have moderate effects on soils and vegetation within ten feet of the edge of road systems, but they have negligible effects on upland habitats. Spot spraying, hand pulling, and seeding with native species (cultural control) are conducted annually on high-priority weed populations in off-road situations. With current staffing and funding, only a small portion of known weed infestations (the highest priorities) are mapped, treated and monitored each year. The treatment of isolated weed infestations away

from established road systems can cause minor disturbance of soils and vegetation but does not adversely affect plant community composition and function or increase the potential for further weed establishment or expansion. The early treatment of small weed populations, protecting associated plant communities from further degradation, is an indirect beneficial effect.

Alternatives B–F would use IPM techniques for control efforts on larger acreages each year as funding allows. Under these alternatives, weed populations would be prioritized and treated annually on the basis of threat analysis and each population’s potential for off-site movement and infestation of adjacent lands. Direct effects on soils, vegetation, watershed function, and biodiversity would be considered in all treatment recommendations. In those sensitive plant communities where disturbance of soil and plant community structure and function would adversely affect upland habitats, the use of multiple tools (chemical, biological, mechanical, cultural) may be required. Moderate short-term adverse effects would be expected from mechanical and cultural treatments. Both treatment types would potentially disturb soils through mechanical removal (hand pulling, discing, mowing) of weed species and the seeding of native species using cultural treatments. The reduction or elimination of invasive non-native species in native plant communities would be considered moderate to major indirect beneficial effects; these effects would lead to improved resource conditions, plant community stability, wildlife habitat, and habitat connectivity. Extensive integrated treatments throughout the Monument will be necessary to control species such as yellow star-thistle, rush skeletonweed, and knapweed. Each weed treatment would be conducted in accordance with the Monument’s IPM Plan and in accordance with stipulations set forth in annual PUPs.

Alternatives B–F would entail annual restoration activities on approximately 6,000, 4,000, and 2,000 acres, respectively. Restoration methods would be used to restore degraded shrub-steppe habitats or disturbed areas to proper functioning condition. Treatments would include wildland fire BAER; additionally, prescribed fires would be followed by seeding, hand planting of nursery stock, drill or broadcast seeding, or broadcast/harrowing activities. Moderate adverse effects would occur through soil disturbance and effects on plant community structure resulting from revegetation efforts. Beneficial indirect effects would be expected to include native plant reestablishment and improved biological diversity, hydrologic processes, site health, and plant community structure and function. Shrub-steppe restoration activities would also include the treatment of non-native invasive species. The level of treatment would be based on the species present in the restoration site and the threats that each poses to the health of shrub-steppe plant communities.

Some species, such as cheatgrass, may never be eradicated from a community. However, the level and type of treatment implemented could reduce direct competition with native species, and natural succession could, once natives are reestablished on site, reduce cheatgrass percentages. Reducing the percentage of cheatgrass within a plant community could reduce future fire effects by reducing fire intensity and burn severity (Link et al. 2003).

Restoration activities on the summit of Rattlesnake Mountain would attempt to return portions of the site to pre-Manhattan Project conditions. Under all alternatives upland habitat would be improved through the demolition and disposal actions associated with scheduled DOE remediation activities on top of Rattlesnake Mountain. Buildings identified for cleanup would be removed and upland habitats would be restored; such disturbance without subsequent native seeding/planting of native species would be conducive to invasive species spread. In those instances where the removal of buildings also reduces the amount of access, especially vehicular access, the associated reduction in the spread of invasive species would be an indirect effect of cleanup, resulting in improvements of upland habitat. Under alternatives B, C and F, restoration activities would include the removal of the observatory, along with the other buildings and structures, and the effects would be similar to those described above. Under alternatives A, D and E, the observatory building and associated utilities would be retained, and therefore the potential for the introduction or spread of non-native invasive species, although reduced (due to the removal of other structures), would not be eliminated.

4.4.2.3 Effects of Visitor Services Management Actions— Interpretation and Education

4.4.2.3.1 Interpretive Site Development

Alternative A would have negligible effects on invasive species. Interpretive signs and kiosks at major entry points and travel routes in the Monument are in locations that have already been disturbed; they are also within active invasive species treatment areas to ensure protection of natural resources.

Under Alternative D, the Monument-wide establishment of twenty interpretive sites would entail the greatest extent of interpretive development of any alternative. This development could disturb up to approximately thirty acres of the area opened to the public. Developing visitor facilities and interpretive sites can directly affect vegetation associations in upland and riparian habitats by removing plants and microbiotic crust. The risk of spreading non-native invasive species would increase proportionately to the amount of ground disturbed, the number and placement of interpretive sites, and visitor numbers. All improvements would be evaluated, planned, and constructed after the completion of project-level NEPA analysis, site inventories, and evaluations to avoid habitat degradation and to reduce the spread of non-native invasive species.

Indirect effects that would contribute to the spread of non-native invasive species include vegetation trampling, microbiotic crust disturbance, soil disturbance, and erosion. To avoid this, proper planning and placement of interpretive sites would be coupled with use of informational signs, educational materials, trails, physical improvements, and law enforcement patrols to

reduce these effects. Disturbed ground surfaces prone to infestations of invasive species would be treated and landscaped with native species.

Long-term beneficial effects from interpretative site development would include heightened visitor awareness and appreciation of the fragility of shrub-steppe ecosystems, the dangers associated with the spread of invasive species, methods visitors can employ to stop the spread of invasive species, and the development of partnerships for habitat protection and preservation.

4.4.2.3.2 Interpretive Trail Systems

Under Alternative A, no interpretive trails are planned; accordingly, there would be negligible effects on invasive non-native species.

Under Alternatives B–F, interpretive trail development would directly affect the spread of non-native invasive species spread by the creation of trail systems through shrub-steppe and riparian habitats. Minor effects include microbiotic crust disturbance, soil disturbance, and vegetation loss. Indirect effects could include soil erosion, spread and establishment of non-native invasive species, and increased risk of wildland fire. Beneficial effects would include the reduction of trampling in sensitive upland habitats by concentrating existing use onto established trail systems, the creation of a corridor of activity that could be monitored and treated for new infestations, and improved interpretation and education opportunities. None of the proposed interpretive trails have been sited; trail design and alignment would not be undertaken until a thorough site plan and inventory of each area has been completed. Any construction of interpretive trails in the Monument would require surveys prior to construction to identify the presence of sensitive resources.

4.4.2.4 Effects of Visitor Services Management Actions—Recreation

4.4.2.4.1 Hunting

Visitors pursuing hunting activities in the Monument would transport invasive weed seeds as described at 4.0.1.1.8. With implementation of BMPs described in Section 4.0.1.2, effects would be minor.

4.4.2.4.2 Fishing

The effects would be similar to those described for hunting.

4.4.2.4.3 Wildlife Observation and Photography

Under Alternatives B–F, intensified visitor use patterns within 1/4 mile of developed sites would result in long-term adverse effects from the spread of invasive non-native species. With implementation of BMPs described in Section 4.0.1.2, these effects would be minor. Under these alternatives, minor beneficial effects would result from concentrating wildlife observation and photography activities in sites that can be readily targeted for invasive species control.

4.4.2.4.4 Hiking

Under Alternative A, hiking activities would continue to contribute to the spread of non-native invasive species by transporting weed seeds from outside the Monument and spreading existing populations within the Monument. Due to relatively low use levels, though, adverse effects are believed to be minor; however, if cross-country hiking activities increase in the Monument, the severity of adverse effects would also increase.

Alternatives B–F would result in minor beneficial effects by concentrating use on designated trail systems that can be readily targeted for invasive species control. However, developed trail systems would likely result in increased hiking activity in the Monument, with concomitant increased transport of invasive weeds. Furthermore, ground disturbance associated with trail development would contribute to favorable conditions for weed establishment. However, with implementation of BMPs described in Section 4.0.1.2, adverse effects are anticipated to be minor.

4.4.2.4.5 Equestrian Use

Under Alternative A, equestrian activities would continue to contribute to the spread of invasive non-native species through the transport and spread of weed seeds. If cross-country equestrian activities increase under Alternative A, the severity of adverse effects would also increase. In addition, ground disturbance from hoof effects would contribute to favorable conditions for weed establishment.

Alternatives B–F would result in minor beneficial effects by concentrating use on designated trail systems that can be readily targeted for invasive species control. However, developed trail systems would likely result in increased equestrian activity in the Monument, with a concomitant increased transport of invasive non-native species. Ground disturbance associated with trail development activities would contribute to favorable conditions for weed establishment. However, with implementation of BMPs described in Section 4.0.1.2, adverse effects are anticipated to be minor.

4.4.2.4.6 Boat Launches

Vernita

Under all alternatives, vehicle access and recreational activities in the launch vicinity would continue to have minor adverse effects through the transport and spread of invasive non-native species. Under Alternatives C, D and E, ground disturbance related to boat launch development would further contribute to favorable conditions for weed establishment. Boat launch improvements would also likely result in increased watercraft using the Hanford Reach, with a concomitant increase in the transport of invasive species. However, with implementation of BMPs described in Section 4.0.1.2, the overall effects are anticipated to be long term and minor.

White Bluffs

Under Alternatives A, B, D, E and F, vehicle access and recreation activities in the White Bluffs launch vicinity would continue to result in long-term, minor adverse effects through the transport and spread of invasive non-native species. Alternative C would result in long-term, minor beneficial effects by increasing the difficulty of access and reducing overall visitor use and associated invasive species transport. However, this benefit would be relatively minor in the context of the potential for invasive species transport associated with powering and irrigation canal operations and maintenance.

Ringold

Under alternatives B–F, the effects of boat launch development on non-native invasive species introduction and spread are anticipated to be negligible with implementation of BMPs described in Section 4.0.1.2. This action would result in increased use at the Ringold Fish Hatchery site, resulting in long-term, minor adverse effects on transport of invasive species in the river corridor. Boat launch improvement would also likely result in increased watercraft use of the Hanford Reach, with a concomitant increase in transport of invasive species. However, with implementation of BMPs described in Section 4.0.1.2, the overall effects are anticipated to be long term and minor.

South Shore

The effects under Alternative D would be similar to those described for the Ringold launch development above.

4.4.2.4.7 Camping

Vernita

Under Alternative A, dispersed camping activities are believed to cause minor effects through the transport and spread of invasive species. Alternatives B, C and F would result in minor beneficial effects by eliminating effects associated with camping. Under Alternatives D and E, developed camping opportunities would lead to year-round increases in visitor use at this location and on the Monument, with a concomitant increase in the transport and spread of invasive species. However, with implementation of BMPs described in Section 4.0.1.2, these effects are anticipated to be minor.

Boat-In

Under Alternatives C, D and E, camping activities would result in the increased transport and spread of invasive species in the campsites. In addition, non-motorized boat-in camping opportunities would attract increased use by non-motorized boaters on the Hanford Reach, with a concomitant increase in the transport and spread of invasive species. However, with implementation of BMPs described in Section 4.0.1.2, these effects are anticipated to be minor.

Saddle Mountain

Under Alternative D, developed camping opportunities would attract increased visitor use, resulting in increased transport and spread of invasive species. In addition, ground disturbance during campground development would provide opportunities for invasive weed establishment. However, with implementation of BMPs described in Section 4.0.1.2 and siting of the proposed campground in a previously disturbed area, adverse effects are anticipated to be minor.

4.4.2.4.8 Modified Public Access

Columbia River Unit

Vernita Bridge, South Shore. Under Alternative A, visitor use would continue to result in the transport and spread of invasive species, with anticipated minor, long-term, adverse effects. Alternatives B, C, D and F would result in minor, long-term, beneficial effects by removing visitor use from this area, which would likely increase the effectiveness of invasive species control efforts by reducing transport and establishment mechanisms. Alternative E would result in minor, long-term, beneficial effects by limiting visitor use to designated roads and trails.

South Shore. Under Alternatives C, D and E, providing access to the south shore would contribute to the transport and spread of invasive species by expanding the number of sites

accessible to people, outdoor equipment, and vehicles. However, with implementation of BMPs described in Section 4.0.1.2, adverse effects are anticipated to be long term and minor.

North Shore. The effects would be similar to those described above for the South Shore.

Sand Dunes. The effects would be similar to those described above for the South Shore.

Ringold Unit

Parking Lots. Under Alternatives B–F, removal of excess parking lots would reduce the number of areas potentially serving as dispersal sites for invasive species. The number of sites requiring operations maintenance and upkeep would also be reduced, potentially allowing additional resources to be directed to invasive species control efforts. Beneficial effects are anticipated to be long-term and minor.

Auto Tour. Under Alternative D, an auto tour route would result in adverse effects by opening up a new corridor for invasive weed introduction. In addition, ground disturbance resulting from road construction activities would have adverse effects by providing opportunities for invasive species to become established. However, with careful implementation of BMPs described in Section 4.0.1.2, adverse effects are anticipated to be long-term and minor.

Saddle Mountain Unit

Alternative B would result in minor beneficial effects on the Saddle Mountain summit by eliminating public use and associated modes of invasive species dispersal. Under Alternatives A, C, D, E and F, continued public access in this area would contribute to the transport and spread of non-native invasive species; greater adverse effects would result from Alternatives A, D and E, which would allow motorized access. Under all alternatives, the implementation of BMPs described in Section 4.0.1.2 would result in minor adverse effects.

Wahluke Unit

West Access. Under Alternatives B–F, public access in this area would result in the transport of invasive plant species seeds and disturbance of soil and vegetation. These effects could provide favorable conditions for invasive weed establishment. Much of this area presently contains invasive weed populations such as cheatgrass, knapweed, yellow star-thistle, rush skeletonweed, and kochia. However, with implementation of BMPs described in Section 4.0.1.2, additional adverse effects are anticipated to be minor.

Auto Tour. The effects under Alternative D would be similar to those described for the auto tour route in the Ringold Unit.

4.4.2.4.9 Permit System

Under Alternative F, implementation of a permit system is anticipated to have negligible effects on the introduction and spread of invasive species.

4.5 Effects on Habitat Connectivity

Connectivity of habitats is one of the features that promotes and sustains the biological diversity of species (Beir 1998) and habitats in the Monument. Resource management plans for the Hanford Site call for preserving and enhancing ecosystem integrity by managing biological resources at a scale commensurate with the scale of the natural processes that sustain them; protecting communities, ecosystems and landscapes to ensure protection for a large number of species and their interrelationships; managing to maintain evolutionary and ecological processes; minimizing fragmentation by promoting the natural pattern and connectivity of habitats; restoring degraded resources to enhance ecosystem integrity; avoiding the introduction of non-native species and expansion of existing non-native species into native communities; protecting rare and ecologically important species and unique or sensitive environments; maintaining or mimicking natural structural diversity; and monitoring ecosystem integrity. Although adversely affected by wildland fire and past land management practices, sensitive habitats on the Hanford Site have recovered and endured, aided by sixty years of minimal disturbance.

4.5.1 Assumptions

Monitoring of restoration activities will be conducted to document treatment success and to evaluate the direct and indirect effects on site connectivity and habitat fragmentation.

4.5.2 Effects Analysis—Habitat Connectivity

4.5.2.1 Effects Common to All Alternatives

4.5.2.1.1 Ground-Disturbing Activities

Direct effects on habitat connectivity result primarily from surface-disturbing activities, such as the construction of facilities (e.g., power lines, irrigation delivery and return systems, roads);

agricultural development; wildland fire effects; and the encroachment of non-native invasive species, leading to the modification of habitat structure and function. There is a potential for cumulative surface disturbance of approximately 1,000 acres from reasonably foreseeable activities, such as the development of recreation facilities, rights-of-way, and interpretation/visitor services over the fifteen-year planning horizon. Much of the surface disturbance associated with recreational facilities would occur in areas already disturbed by existing roads or other uses.

4.5.2.1.2 Restoration Activities

Vegetation restoration methods have the potential to cause surface disturbance on 90,000 treatment acres over the fifteen-year planning horizon. Revegetation methods would be used to restore native plant associations; these would be implemented—primarily in areas already disturbed, or areas disturbed by development or wildland fire—to improve habitat function and connectivity. Restoration efforts would be based on detailed inventories and prioritized to improve connectivity and habitat effectiveness. Partnerships with adjacent landowners and cooperating agencies would be developed to preserve and promote connectivity between land ownerships, to actively control infestations of non-native invasive species, and to ensure adequate controls on visitor and vehicle use in the Monument. These efforts would contribute to the increased protection afforded by the actions in this CCP. Additionally, increased research on restoration ecology has the potential to develop new methods to restore disturbed areas to pre-disturbance conditions.

4.5.2.1.3 Wildlife Population Control Activities

Population control and herd management activities would be implemented as needed and based upon scientific resource management data. No effects on connectivity or habitat fragmentation are anticipated to result from these efforts.

4.5.2.1.4 Public Use

Adverse effects of visitor facilities on habitat connectivity would result from loss or modification of habitat. Trails and roads can act as significant barriers to the movement of many wildlife species, both large and small (Buckley 2004). Trails and roads can interfere with or preclude seasonal migration and/or dispersal of smaller species (Joslin and Youmans 1999), leading to isolated populations and inbreeding. Inbreeding can result in lower birth weight, survival and resistance to disease and predation; reduced genetic diversity; and increased extinction rates (Keller and Waller 2002). Facilities and roads can provide avenues for generalist predators—such as coyotes, raccoons, foxes, magpies and crows—as well as non-native species—such as

starlings and mice—to expand their range, which can reduce the success of specialized species with narrower habitat requirements.

4.5.2.2 Effects of Biological Resource Management Actions

Section 4.0.3.1 presents a description of restoration and IPM activities. Non-native invasive plant species pose a serious threat to native biodiversity, wildlife habitat, and connectivity. Weeds alter ecosystem structure and function; disrupt food chains and other ecosystem characteristics vital to wildlife (including TE&S species); and can dramatically alter key ecosystem processes such as hydrology, productivity, nutrient cycling, and fire regimes (Mack et al. 2000; Brooks and Pyke 2001; Randall 2001).

Under Alternative A, the use of IPM techniques (chemical, biological, cultural, mechanical) would not affect connectivity. The treatment of isolated weed infestations away from established road systems would have negligible effects on soils and vegetation and would not cause fragmentation of existing plant communities.

Weed populations would be prioritized and treated annually on the basis of threat analysis and the target population's potential for off-site movement and infestation of adjacent lands. Under Alternatives B, C and F, a greater number of acres would be mapped and treated using an integrated approach of methods (chemical, biological, mechanical, and cultural; see Section 4.0.3.1.1). Under Alternatives D and E, the number of acres treated would be limited due to staffing and financial limitations. Under all alternatives, minor effects on connectivity would be expected to result from mechanical and cultural treatments of non-native invasive species. Both treatment types would potentially disturb soils through mechanical removal (hand pulling, discing, mowing) of weed species and reseedling of native species using cultural treatments. These effects could have short-term effects on ecotones, edge effects, and connectivity between habitats. The reduction or elimination of non-native invasive species in native plant communities would have moderate to major indirect effects, leading to improved resource conditions, wildlife habitat, and connectivity.

Under Alternative A, restoration activities would focus primarily on lands disturbed by wildfire events, maintenance-related project work, Hanford Site mitigation, and noxious weed control efforts. Minor effects on connectivity may result from revegetation efforts that cause soil and ecotone disturbance. Indirect effects include benefits to connectivity through native plant reestablishment and the improvement of biological diversity, site health, and plant community structure and function.

Under Alternatives B–F, restoration activities would be implemented to restore degraded shrub-steppe habitats or otherwise disturbed areas to a natural range of native plant associations and to improve habitat connectivity. These treatments would consist of BAER activities, prescribed

fires followed by drill seeding, hand planting of nursery stock, broadcast seeding, or broadcast/harrowing activities. Some restoration activities would be limited to planting activities. These activities would be used to restore a natural range of native plant associations that will directly and indirectly improve the condition of native vegetation throughout the Monument.

Restoration activities on the summit of Rattlesnake Mountain would attempt to return portions of the site to pre-Manhattan Project conditions. Under all alternatives, habitat connectivity would be improved through the demolition and disposal actions associated with scheduled DOE remediation activities. Buildings identified for cleanup would be removed, and upland habitats would be restored. Minor direct effects on connectivity would result from ground-disturbing activities to remove building materials, asphalt, gravel, roadways and concrete foundations. Moderate indirect beneficial effects to connectivity would include site stabilization through seeding with native species, reduced establishment of noxious weeds, and improved upland habitat and connectivity. Proper restoration of these cleanup sites along with native vegetation reestablishment would improve connectivity between the lithosol plant communities on top of Rattlesnake Mountain and the bunchgrass communities on the mountain's northern and southern aspects. Under alternatives B, C and F, restoration activities would include the removal of the observatory, along with the other buildings and structures, and the effects would be similar to those described above. Under alternatives A, D and E, the observatory building and associated utilities would be retained; however, the effect of the observatory on connectivity is considered negligible.

Under Alternatives B–F, restoration of riparian areas to proper functioning condition and maintenance of these areas would enhance native vegetation and contribute to overall habitat connectivity in the Monument. Direct effects on connectivity in riparian areas would be negligible. As part of site-specific riparian restoration activities, removal of non-native species (e.g., Russian olive, salt cedar) could have minor effects on habitat connectivity by disturbing soils, hiding and thermal cover, ecotones, and nesting habitat. These effects would be mitigated through native plantings and area rehabilitation. Indirect beneficial effects of riparian restoration efforts include soil stabilization and improved habitat function, connectivity and wildlife diversity.

Fire suppression activities can have moderate to major effects on connectivity through the creation of firelines and erosion. These effects can be mitigated by BAER actions, but they take time to remedy, especially in dry climates such as the Monument's. Emergency use of equipment (e.g., discing) for fire suppression has the potential to affect connectivity by clearing vegetation and microbiotic crust, in turn allowing for erosion and the invasion of non-native species. Effects caused by fire suppression activities can be mitigated through pre-suppression planning, adherence to initial attack stipulations, use of existing fire breaks and roads to confine and contain wildland fire, and properly implemented rehabilitation treatments.

4.5.2.3 Effects of Visitor Services Management Actions— Interpretation and Education

4.5.2.3.1 Interpretive Site Development

No interpretive site development would occur under Alternative A; therefore, negligible adverse effects on habitat connectivity are anticipated.

The maximum of twenty sites proposed under Alternative D would disturb approximately thirty acres in the areas accessible to the public. All improvements would use BMPs to avoid habitat fragmentation and protect habitat connectivity. Proper planning and placement of visitor facilities and visitor use patterns on the landscape would have indirect effects on connectivity. Beneficial long-term effects would include visitor awareness and appreciation for the fragility of shrub-steppe ecosystems, preservation of connectivity, and development of partnerships between the Monument and adjacent landowners for habitat protection and conservation of connectivity.

4.5.2.3.2 Interpretive Trail Systems

Under Alternative A, interpretive trails would not be established on the Monument. There would be no effect on habitat connectivity.

Under Alternatives B–F, interpretive trails would be located in a variety of shrub-steppe and riparian habitats. This trail system would introduce visitor foot traffic into areas that previously received only light and intermittent use. However, trails would be designed and sited to minimize habitat fragmentation; accordingly, they would have minor effects on connectivity.

4.5.2.4 Effects of Visitor Services Management Actions—Recreation

4.5.2.4.1 Hunting

Most visitor amenities for hunting would be temporary and minimal, potentially comprising hunting blinds and hunter check stations. In addition, depending on the outcome of step-down planning, permanent access development, such as access points and parking areas, would serve multiple user groups where possible (e.g. hunters, anglers, hikers, and other visitors). With implementation of BMPs described in Section 4.0.1.2, effects on connectivity are anticipated to be negligible.

4.5.2.4.2 Fishing

Visitor facility developments for fishing would be co-located with those already existing or would be planned for multiple use (e.g., parking areas would be sited to provide for hunting, fishing, hiking and other recreational activities). With implementation of BMPs described in Section 4.0.1.2, effects on connectivity are anticipated to be negligible.

4.5.2.4.3 Wildlife Observation and Photography

Under Alternative A, effects on connectivity would be negligible. Under alternatives B–F, development of wildlife observation and photography sites could include permanent developments such as observation blinds, footpaths, signs and parking areas. With implementation of BMPs described in Section 4.0.1.2, adverse effects on connectivity are anticipated to be minor.

4.5.2.4.4 Hiking

Hiking activities under Alternative A are believed to have minor adverse effects on habitat connectivity through the establishment of user-created hiking routes and associated habitat disturbance and fragmentation. If hiking activities increase under Alternative A, the severity of adverse effects would also increase. Alternatives B–F would result in minor beneficial effects on habitat connectivity by concentrating hiking activity onto trail systems that are designed to minimize connectivity effects. However, some effects on connectivity would result from development of trails, trailheads, parking areas, and signs. However, with implementation of BMPs described in Section 4.0.1.2, adverse effects are anticipated to be minor.

4.5.2.4.5 Equestrian Use

Connectivity effects would be similar to those described for hiking.

4.5.2.4.6 Boat Launches

Vernita

Boat-launching activities under Alternative A are believed to have adverse effects on connectivity as a result of habitat loss associated with vehicle traffic on user-created routes in the area. Under all alternatives, restricting vehicles to designated routes and a designated boat launch could result in beneficial effects on habitat connectivity by concentrating vehicle use in

designated sites. However, unless rehabilitation efforts were implemented to restore areas affected by years of cross-county vehicle use, beneficial effects would be negligible. Under Alternatives C, D and E, a developed boat launch would result in minor adverse effects by hindering movement of species from the river to adjacent uplands. However, because nearby areas are available with unimpeded connections between river and uplands, adverse effects are anticipated to be minor.

White Bluffs

Under Alternatives A, B, D, E and F, the access road, parking areas, and boat launch would have minor adverse effects on habitat connectivity by hindering wildlife movement from the river to adjacent uplands and by causing habitat loss as a result of site hardening. Alternative C would result in minor beneficial effects on habitat connectivity by removing the boat launch and parking areas.

Ringold

Under alternatives B–F, the effects of boat launch development on habitat connectivity and habitat are anticipated to be negligible as the area is already disturbed by the fish hatchery and irrigation canal operations.

South Shore

Under Alternative D, development of an access road, parking area, and boat launch would adversely affect connectivity through habitat loss and fragmentation. Because of the previously disturbed nature of this area and the availability of nearby areas with unimpeded connections between river and uplands, with implementation of BMPs described in Section 4.0.1.2 the adverse effects are anticipated to be minor.

4.5.2.4.7 Camping

Vernita

Under Alternative A, camping activities are believed to cause minor adverse effects on connectivity through habitat loss associated with user-created vehicle routes and dispersed camping areas. Alternatives B, C and F would result in minor beneficial effects on habitat connectivity and habitat by eliminating these effects. Under Alternatives D and E, development of a campground would adversely affect connectivity through habitat loss and fragmentation. However, because of the previously disturbed nature of this area and the availability of nearby areas with unimpeded connections between river and uplands, with implementation of BMPs described in Section 4.0.1.2 the adverse effects are anticipated to be minor.

Boat-In

Under Alternatives C, D and E, it is anticipated that establishment of boat-in campsites would require minimal development and/or site hardening. However, visitor use at the designated campsites would cause habitat loss through soil compaction and vegetation disturbance. Campsite development and the possible creation of ‘social’ trails would cause further fragmentation of habitat for species moving along the river corridor or between the river and upland areas. However, with implementation of BMPs described in Section 4.0.1.2, adverse effects are anticipated to be minor.

Saddle Mountain

Under Alternative D, a developed campground would result in adverse effects on habitat connectivity through habitat loss and fragmentation. With implementation of BMPs described in Section 4.0.1.2, and the location of the proposed campground in a previously disturbed area near an existing highway, these adverse effects are anticipated to be minor.

4.5.2.4.8 Modified Public Access

Columbia River Unit

Vernita Bridge, South Shore. Alternative A would continue minor adverse effects on connectivity through habitat loss and fragmentation resulting from user-created vehicle routes throughout the area. Under Alternatives B, C, D and F, minor beneficial effects would result from removing these disturbance factors, although these beneficial effects would be minimized if habitat restoration efforts are not implemented. Alternative E would result in minor beneficial effects by concentrating use on designated roads and trails.

Sand Dunes. Alternatives C, D and E would result in adverse effects on habitat connectivity by causing habitat and vegetation disturbance and increasing the risk of introduction of non-native invasive species and human-caused wildfire. However, with implementation of BMPs described in Section 4.0.1.2, these effects would be minor.

South Shore. Alternatives C, D and E would result in adverse effects on connectivity through habitat loss and fragmentation associated with access and trail development. However, with implementation of BMPs described in Section 4.0.1.2, these effects would be minor.

North Shore. Under Alternatives D and E, the effects would be similar to those described for the South Shore.

Ringold Unit

Parking Lots. By reducing the number of developed parking lots, Alternatives B–F would have minor beneficial effects on connectivity for some wildlife species.

Auto Tour Route. Under Alternative D, development of an auto tour route would cause fragmentation between habitat areas on either side of the tour route. With implementation of BMPs described in Section 4.0.1.2, and because of the existing road corridor in this area, adverse effects are anticipated to be minor.

Saddle Mountain Unit

Under Alternatives A, D and E, minor adverse effects on connectivity would continue from the Saddle Mountain Road. Under Alternatives B, C and F, although the road would be closed totally or in part to public vehicle use, it would remain in place as an administrative road used to access communication facilities and would consequently continue to affect habitat connectivity through fragmentation. This break in continuity has minor impacts, though.

Wahluke Unit

West Access. Alternatives B–F would result in adverse effects on connectivity through habitat loss from increased soil compaction, vegetation disturbance, introduction of non-native invasive plants, and increased risk of human-caused wildfire. However, with implementation of BMPs described in Section 4.0.1.2, adverse effects on habitat connectivity would be minor.

Auto Tour Route. Under Alternative D, development of an auto tour route would cause fragmentation between habitat areas on either side of the tour route. However, with implementation of BMPs described in Section 4.0.1.2, and because of the existing road corridor in this area, adverse effects are anticipated to be minor.

4.5.2.4.9 Permit System

Under Alternative F, implementation of a permit system is anticipated to have negligible effects on connectivity.

4.6 Effects on Cultural Resources

The Monument Proclamation specifies the protection and preservation of cultural resources along with other resources. Cultural resources are limited and non-renewable, unlike many

natural resources that can be preserved, restored and enhanced through adaptive management strategies.

The cultural history of the area is replete with a continuum of traditions for both Native American and Euro-American settlers. Time, functional elements, and the influx of people have changed the natural landscape, but the intangible values of the area remain intact for both cultural groups. This land has supported historical and spiritual experiences, as well as everyday uses and special ceremonies that may have meaning only to certain people or groups—such areas are TCPs (see Section 3.20.5) and involve consideration under the NHPA and specific regulations, especially 36 CFR 800 and 36 CFR 60. Although no TCPs have been officially designated in the Monument, two areas—the Saddle Mountains and Rattlesnake Mountain—have special significance to Native Americans in the region.¹²⁸ These areas are recognized and treated as if they are TCPs, and pursuit of official designation as such is a possibility under any of the proposed alternatives.

The protection, preservation and perpetuation of the remaining cultural resources, and minimization of further disturbance and destruction, are primary goals. Another potential goal that may be applicable in this context is the possibility of enhancing and regenerating Native American natural resources, such as foods, medicines and other utility material resources. Prior to the implementation of any proposed project or ground-disturbing activity, the appropriate level of cultural resource investigation will be undertaken in accordance with all applicable laws, procedures and protocols.

4.6.1 Assumptions

It is assumed that, prior to any project initiation, all management actions will utilize the best available information to avoid known cultural resource sites, implement a survey protocol in compliance with Section 106 of the NHPA, and analyze project effects on cultural resources through the NEPA process. Emergency actions, such as fire suppression, would use available information to protect cultural resources where possible.

Population control management actions, including trap and relocate efforts and government culling, will move wildlife across the landscape. The Monument is rich with cultural resources that have not been discovered or inventoried to date, and it is possible that cultural resources could be disturbed through herding, trampling, soil disturbance, and erosion following control efforts. However, mitigation actions as noted above would minimize disturbance of cultural sites in and around capture sites and handling facilities.

¹²⁸ The DOE is currently working with local tribes in delineating and assessing the eligibility of Rattlesnake Mountain and associated areas as a TCP.

4.6.2 Effects Analysis—Pre-Contact Resources

4.6.2.1 Effects Common to All Alternatives

Due to the non-renewable nature of cultural resources, all adverse effects would likely be irreversible and permanent. To avoid impacts, prior to implementing all ground-disturbing projects, the applicable cultural resource compliance investigation would be undertaken. If cultural resources are found, appropriate procedures and protocols would be followed to protect them. Wherever possible, resources would be avoided, or the effects would be mitigated. Mitigation options, in addition to relocating or redesigning facilities, would include data recovery, using either collection techniques or *in situ* site stabilization protection.

4.6.2.1.1 Restoration Activities

Section 4.0.3.1 presents a description of restoration and IPM techniques. Restoration activities carried out under all alternatives would be used primarily to restore degraded shrub-steppe habitats or disturbed areas to a natural range of native plant communities. Under all alternatives, direct effects on pre-contact cultural resources would be minor. All projects involving potential ground-disturbing activities would avoid cultural sites through Section 106 compliance reviews prior to project implementation. Any sites identified during the project reviews would be avoided. Project implementation would be monitored to mitigate adverse effects on undetected sites exposed during restoration activities.

Restoration activities on the summit of Rattlesnake Mountain would attempt to return portions of the site to pre-Manhattan Project conditions. Under all alternatives upland habitat would be improved through the demolition and disposal actions associated with scheduled DOE remediation activities on top of Rattlesnake Mountain. No foreseeable effects on pre-contact cultural resources are expected to result from implementation of restoration activities.

4.6.2.1.2 Wildland Fire and Fire Suppression Activities

Fire suppression activities, such as fireline construction and subsequent erosion, may have direct effects on pre-contact cultural resources. Some effects can be mitigated through BAER actions. With the use of trained personnel scouting and marking firelines ahead of equipment, the effects of the emergency use of equipment (e.g., discing equipment, bulldozers) on cultural resources can be reduced or avoided. The effects of wildland fire and suppression actions on pre-contact cultural resources would be moderate.

4.6.2.1.3 Public Use

Surface disturbance would result from development of visitor facilities such as trails, interpretive sites, boat launches, restrooms and parking areas. Visitor use on and around facilities would result in soil compaction, vegetation disturbance, and increased erosion, all of which could expose pre-contact resources if any are present. Exposure leaves resources susceptible to degradation from weather, as well as disturbance associated with animal activity, human foot traffic, vandalism and theft. In general, visitor use would likely entail some degree of effect through illegal collection, vandalism, crushing and scattering of cultural artifacts (Des Jean 2000; Hartley and Vawser 2004; MWALP 2004), with increased visitation implying an increase in effects (Ison et al. 1981 as cited in Des Jean 2000). Studies have shown little relationship between site remoteness and looting, although sites located close to trails and public facilities may receive less disturbance because of the increased chance of detection (Des Jean 2000). The presence of surface artifact scatter is one critical element that site looters use to identify site locations (Des Jean 2000). Cultural resources in the Monument are more visible following wildfire events and are thus more vulnerable to detection until vegetation becomes reestablished.

4.6.2.2 Effects of Biological Resource Management Actions

All projects involving potential ground-disturbing activities would avoid cultural sites through Section 106 compliance reviews prior to project implementation. Any sites identified during the project reviews would be avoided. Project implementation would be monitored to mitigate adverse effects on undetected sites exposed during restoration activities. Section 4.0.1.2 describes BMPs that will be implemented to ensure protection of pre-contact resources.

4.6.2.3 Effects of Visitor Services Management Actions— Interpretation and Education

4.6.2.3.1 Interpretive Site Development

Alternative A would have negligible effects on pre-contact cultural resources. Informational signs have been placed along major entry points and travel routes in the Monument that have previously been disturbed.

Under Alternatives B–F, interpretive sites would be located away from sensitive cultural resources to prevent disturbance by the visiting public. With implementation of BMPs described in Section 4.0.1.2, effects are anticipated to be negligible.

4.6.2.3.2 Interpretive Trail Systems

Under Alternative A, no interpretive trails are planned; accordingly, no effects on pre-contact cultural resources are anticipated.

Under Alternatives B–F, trailheads, parking areas, trail routes, and interpretive sign locations would be sited away from any sensitive cultural resources to prevent disturbance by the visiting public. With implementation of BMPs described in Section 4.0.1.2, effects are anticipated to be negligible.

4.6.2.4 Effects of Visitor Services Management Actions—Recreation

4.6.2.4.1 Hunting

Visitors pursuing big and upland game hunting activities in the Monument typically walk cross-country or follow game trails. These activities are dispersed across areas open to hunting, the extent of which varies by alternative. Adverse effects on pre-contact cultural resources resulting from big and upland game hunting activities are anticipated to be negligible due to the seasonal use and dispersed nature of travel.

Visitors pursuing waterfowl hunting activities in the Monument typically walk from a parking area to a desirable location, set up a blind, and remain stationary. In the past, hunters dug waterfowl pass-shooting depressions along bluffs in the Wahluke Unit; however, this activity is no longer allowed. Most waterfowl hunters tend to use common footpaths between parking areas and hunting locations, resulting in localized soil compaction and vegetation disturbance along the Columbia River in the Ringold Unit and around the WB-10 Ponds and along bluffs above the Columbia River in the Wahluke Unit. With implementation of BMPs described in Section 4.0.1.2, effects are anticipated to be minor.

4.6.2.4.2 Fishing

Wake-based erosion from motorboat-based fishing activities may exacerbate existing shoreline erosion that results from subsurface offsite irrigation drainage and water level fluctuations in the Columbia River. Shoreline erosion and landslides are presently causing major adverse effects on White Bluffs deposits near Locke Island at river mile 366. However, adverse effects caused by motorboat-based fishing are anticipated to be negligible, especially compared to the effects from sloughing of the White Bluffs and frequent water level fluctuations along the shorelines.

Bank fishing activities primarily occur in the Ringold and Columbia River Units. Visitors pursuing bank fishing activities typically walk from a parking area to one or more desirable locations along the Columbia River, resulting in localized soil compaction and vegetation disturbance along these routes. With implementation of BMPs described in Section 4.0.1.2, effects are anticipated to be negligible.

4.6.2.4.3 Wildlife Observation and Photography

Effects on pre-contact cultural resources would be similar to those described for geological resources, with minor, long-term adverse effects anticipated under Alternative A and minor, long-term, beneficial effects anticipated under Alternatives B–F.

4.6.2.4.4 Hiking

Alternative A would result in minor, long-term negative effects on pre-contact cultural resources primarily as a result of erosion where hiking occurs through areas in the Wahluke and Ringold Units. The effects may increase in severity over time as hiking activity increases in the Monument. The Alternatives B–F would result in minor, long-term beneficial effects on pre-contact cultural resources by concentrating use on designated trail systems and reducing cross-country foot traffic. Because sensitive resources would be avoided under the action alternatives, negligible adverse effects are anticipated from trail development.

4.6.2.4.5 Equestrian Use

Effects on pre-contact cultural resources would be similar to those described for geological resources, with minor, long-term, adverse effects anticipated under Alternative A and minor, long-term, beneficial effects anticipated under Alternatives B–F.

4.6.2.4.6 Boat Launches

Vernita

Under all alternatives, curtailing cross-country vehicle travel and dispersed boat launching activities in the Vernita Bridge area would result in minor, long-term beneficial effects to pre-contact cultural resources.

Under Alternatives C, D and E, construction activities associated with boat launch development could have adverse effects. In accordance with BMPs described in Section 4.0.1.2, resource

inventories would be conducted prior to boat launch development. If inventories indicate that pre-contact cultural resources cannot be avoided, data recovery efforts would be initiated. The potential dislocation of limited pre-contact cultural resources from their contextual site would be considered a moderate adverse effect.

White Bluffs

Under Alternatives A, B, D, E and F, continued visitor use in the launch area would have minor, long-term, adverse effects as described in Section 4.6.2.1.3. Alternative C would result in minor, long-term, beneficial effects to pre-contact cultural resources by limiting these disturbance factors. Closure of the launch under Alternative C would likely displace visitors to alternate developed launches at Ringold and Vernita, potentially resulting in increased effects at the alternate sites.

Under Alternative D, construction activities associated with boat launch improvements have the potential to adversely affect pre-contact cultural resources. In accordance with BMPs described in Section 4.0.1.2, resource inventories would be conducted prior to boat launch development. If inventories indicate that pre-contact cultural resources cannot be avoided, data recovery efforts would be initiated. The potential dislocation of limited pre-contact cultural resources from their contextual site would be considered a moderate adverse effect. In addition, improving the launch under Alternative D is expected to result in increased visitor use at this site. However, with implementation of BMPs described in Section 4.0.1.2, these additional effects would be negligible.

Ringold

Under Alternative A, continued use of the Ringold area as an unimproved launch is anticipated to have negligible effects. Under Alternatives B–F, an improved launch would result in increased visitor use at Ringold and decreased use at the Parking Lot 7 and White Bluffs Boat Launches. Construction activities associated with boat launch development have the potential to adversely affect pre-contact cultural resources. In accordance with BMPs described in Section 4.0.1.2, resource inventories would be conducted prior to boat launch development. If inventories indicate that pre-contact cultural resources cannot be avoided, data recovery efforts would be initiated. The potential dislocation of limited pre-contact cultural resources from their contextual site would be considered a moderate adverse effect.

South Shore

Under Alternative D, construction activities associated with boat launch and other site improvements (e.g., parking areas, toilets) have the potential to adversely affect pre-contact cultural resources. In accordance with BMPs described in Section 4.0.1.2, resource inventories would be conducted prior to boat launch development. If inventories indicate that pre-contact cultural resources cannot be avoided, data recovery efforts would be initiated. The potential

dislocation of limited pre-contact cultural resources from their contextual site would be considered a moderate adverse effect. Moreover, Alternative D would result in increased vehicle traffic, boat launching, and other activities in areas that are currently receiving very little use. However, with implementation of BMPs and management controls described in Section 4.0.1.2, Alternative D would result in minor adverse effects to pre-contact cultural resources.

4.6.2.4.7 Camping

Vernita

Alternative A would continue minor adverse effects to pre-contact cultural resources through disturbance factors described in Section 4.6.2.1.3. Alternatives B, C and F would have minor positive effects by limiting these disturbance factors. Under Alternatives D and E, construction activities associated with campground development have the potential to adversely affect pre-contact cultural resources. In accordance with BMPs described in Section 4.0.1.2, resource inventories would be conducted prior to boat launch development. If inventories indicate that pre-contact cultural resources cannot be avoided, data recovery efforts would be initiated. The potential dislocation of limited pre-contact cultural resources from their contextual site would be considered a moderate adverse effect. Under Alternatives D and E, the availability of camping opportunities in the Monument would likely lead to increased visitor use; however, with implementation of BMPs described in Section 4.0.1.2, adverse effects are expected to be minor.

Boat-In

Under Alternatives C, D and E, camping activities would result in minor, long-term, adverse effects to pre-contact cultural resources within a 1/4-mile radius of the campsites through factors described in Section 4.6.2.1.3. In addition, the availability of camping opportunities for non-motorized boaters is expected to result in increased non-motorized boat use on the Columbia River. However, with implementation of BMPs described in Section 4.0.1.2, Alternatives C, D, and E would result in minor effects to pre-contact cultural resources on river shorelines along the Hanford Reach.

Saddle Mountain

Under Alternative D, effects would be similar to those described for the Vernita Bridge campground development under Alternatives D and E.

4.6.2.4.8 Modified Public Access

Columbia River Unit

Vernita Bridge, South Shore. Alternatives A and E would continue to have moderate, long-term, adverse effects to pre-contact cultural resources through disturbance factors described in Section 4.6.2.1.3. Alternatives B, C, D and F would result in long-term, minor beneficial effects by removing these disturbance factors.

Sand Dunes. Under Alternatives C, D and E, adverse impacts would result from public use. However, with implementation of BMPs described in Section 4.0.1.2, effects are anticipated to be negligible.

South Shore. Under Alternatives C, D and E, effects would be similar to those described above for sand dune access.

North Shore. Under Alternatives D and E, effects would be similar to those described above for sand dune access.

Ringold

Parking Areas. Negligible effects to pre-contact resources are anticipated under all alternatives.

Auto Tour. Under Alternative D, establishment of an auto tour route would result in adverse effects within the travel corridor, as described in Section 4.6.2.1.3. However, with implementation of BMPs and management controls described in Section 4.0.1.2, adverse effects would be negligible.

Saddle Mountain

Under Alternatives A, D and E, access to the summit would continue to have adverse effects through disturbance factors described in Section 4.6.2.1.3; however, with implementation of BMPs described in Section 4.0.1.2, further adverse effects would be negligible. Alternative B would have a minor beneficial effect to pre-contact cultural resources by removing these sources of disturbance. While Alternatives C and F are expected to result in reduced visitation to the summit, the effects would be similar to those described for Alternatives A, D and E.

Wahluke

West Access. Under Alternatives B–F, public access would result in adverse effects as described in Section 4.6.2.1.3. However, with implementation of BMPs described in Section 4.0.1.2, adverse effects would be negligible.

Auto Tour. In Alternative D, establishment of an auto tour route would result in adverse effects within the travel corridor as described in Section 4.6.2.13. With implementation of BMPs described in Section 4.0.1.2 though, these adverse effects would be negligible.

4.6.2.4.9 Permit System

Under Alternative F, implementation of a permit system is anticipated to have negligible effects to pre-contact resources.

4.6.3 Effects Analysis—Post-Contact Resources

4.6.3.1 Effects Common to All Alternatives

Refer to Section 4.6.2.1 for a general discussion of common effects.

4.6.3.2 Effects of Biological Resource Management Actions

Section 4.0.3.1 presents a description of restoration and IPM techniques. Under all alternatives, restoration activities would be undertaken to restore degraded shrub-steppe habitats or disturbed areas to a natural range of native plant associations. Direct effects on post-contact resources would be minor under all alternatives, because most projects involving potential ground-disturbing activities would avoid cultural sites through Section 106 compliance reviews prior to project implementation. Project implementation would be monitored to mitigate adverse effects on undetected post-contact sites exposed during restoration activities. In some cases, shrub-steppe restoration activities would have moderate effects on post-contact resources, because previously disturbed sites (homestead areas, old fields, etc.) would be targeted to be restored back to native shrub-steppe habitats.

Riparian area restoration would be implemented in identified at-risk plant communities and aquatic areas. No active riparian restoration is proposed under Alternative A. Under Alternatives B–F, the restoration of riparian areas to proper functioning condition would be used primarily to restore degraded riparian habitats or disturbed areas to a natural range of native plant associations. Areas where historical post-contact sites exist within riparian zones (e.g. historic ferry crossings) would be avoided, and these features would be identified when sites to conduct riparian restoration are being determined.

4.6.3.3 Effects of Visitor Services Management Actions— Interpretation and Education

4.6.3.3.1 Interpretive Site Development

Alternative A would have negligible effects on post-contact cultural resources. Informational signs have been placed along major entry points and travel routes in the Monument that have previously been disturbed.

Under Alternatives B–F, interpretive sites would be located away from any sensitive post-contact cultural resources to prevent disturbance by the visiting public. Interpretive sites adjacent to post-contact cultural resources (e.g., potentially the White Bluffs historic cabin, Foster Homestead, Hanford High School, White Bluffs Bank) would be designed to assure long-term protection of the cultural resource with negligible adverse effects.

4.6.3.3.2 Interpretive Trail Systems

Under Alternative A, no interpretive trails are planned; accordingly, no effects on post-contact cultural resources are anticipated.

Under Alternatives B–F, trailheads, parking areas, trail routes, and interpretive sign locations would be sited away from any sensitive post-contact cultural resources to prevent disturbance by the visiting public. Interpretive trails that would follow, or be sited adjacent to, post-contact cultural resources (e.g., White Bluffs Road) would be designed to have minor long-term effects.

4.6.3.4 Effects of Visitor Services Management Actions—Recreation

4.6.3.4.1 Hunting

The effects of hunting activities would be similar to those described for pre-contact resources; anticipated effects would be minor.

4.6.3.4.2 Fishing

The effects of fishing activities would be similar to those described for pre-contact resources; anticipated effects would be minor.

4.6.3.4.3 Wildlife Observation and Photography

The effects of wildlife observation and photography would be similar to those described for geological resources, with minor, long-term, adverse effects anticipated under Alternative A and minor, long-term, beneficial effects anticipated under Alternatives B–F.

4.6.3.4.4 Hiking

The effects of hiking would be similar to those described for pre-contact resources, with minor, long-term, adverse effects anticipated under Alternative A and minor, long-term, beneficial effects anticipated under Alternatives B–F.

4.6.3.4.5 Equestrian Use

The effects of equestrian use would be similar to those described for geological resources, with minor, long-term, adverse effects anticipated under Alternative A and minor, long-term, beneficial effects anticipated under Alternatives B–F.

4.6.3.4.6 Boat Launches

The effects of all actions related to boat launches would be similar to those described for pre-contact resources.

4.6.3.4.7 Camping

The effects of all actions related to camping would be similar to those described for pre-contact resources.

4.6.3.4.8 Modified Public Access

The effects of all actions related to public access would be similar to those described for pre-contact resources.

4.6.3.4.9 Permit System

Under Alternative F, implementation of a permit system is anticipated to have negligible effects on post-contact resources.

4.6.4 Effects Analysis—Cultural Traditions

4.6.4.1 Effects Common to All Alternatives

In general, effects would include those described at 4.6.2.1 for Pre-Contact resources. Mitigation may include oral history gathering, as well as reestablishment and enhancement of root-growing areas or similar food and medicinal resources.

4.6.4.1.2 Public Use

In addition to the effects described at 4.6.2.1.3, increased visitor use could affect traditional use and sacred areas through degradation of aesthetics, increased noise levels, and loss of solitude.

4.6.4.2 Effects of Biological Resource Management Actions

Under all alternatives, restoration activities would be undertaken to restore degraded shrub-steppe habitats or disturbed areas to a natural range of native plant associations. Direct effects on cultural traditions would be minor under all alternatives, because all projects involving potential ground-disturbing activities would avoid cultural sites through Section 106 compliance reviews prior to project implementation. Project implementation would be monitored to mitigate adverse effects on undetected sites exposed during restoration activities. Shrub-steppe restoration activities would generally have long-term beneficial effects on cultural traditions, because improvements in plant community stability and species diversity would increase the abundance of food and medicinal plant species. However, some ground-disturbing restoration activities (e.g., the removal of non-native species such as Russian olive and salt cedar) may affect soils, hiding and thermal cover, ecotones and nesting habitat for plant and animal species associated with traditional cultural practices. Project implementation would be monitored to mitigate adverse effects on undetected sites exposed during restoration activities. No foreseeable long-term adverse effects on cultural traditions are anticipated to result from implementation of restoration activities.

Restoration activities on the summit of Rattlesnake Mountain would attempt to return portions of the site to pre-Manhattan Project conditions. Direct adverse effects on cultural traditions would be minor under all alternatives because all projects involving potential ground-disturbing activities would undergo Section 106 compliance reviews to avoid or minimize impact to sensitive resources. The return of portions of Rattlesnake Mountain to pre-Manhattan Project conditions would ultimately benefit resources associated with cultural traditions.

Direct effects on cultural traditions and plant resources may result from fire suppression activities (fireline construction) and erosion. These effects can be mitigated through BAER actions. With the use of trained personnel scouting and marking firelines ahead of equipment, the effects of the emergency use of equipment (e.g., disking equipment, bulldozers) on cultural resources can be reduced or avoided. The effects of wildland fire and fire suppression activities on cultural traditions would be minor.

4.6.4.3 Effects of Visitor Services Management Actions— Interpretation and Education

4.6.4.3.2 Interpretive Sites

Alternative A would have negligible effects on cultural traditions. Informational signs have been placed along major entry points and travel routes in the Monument that have previously been disturbed.

Under Alternatives B–F, interpretive sites would be located away from sensitive cultural resources to prevent disturbance by the visiting public. With implementation of BMPs described in Section 4.0.1.2, effects are anticipated to be negligible.

4.6.4.3.2 Interpretive Trail Systems

Under Alternative A, no interpretive trails are planned; accordingly, no effects on post-contact cultural resources are anticipated.

Under Alternatives B–F, trailheads, parking areas, trail routes, and interpretive sign locations would be sited away from any sensitive cultural resources to prevent disturbance by the visiting public. Negligible adverse effects are anticipated.

4.6.4.4 Effects of Visitor Services Management Actions—Recreation

4.6.4.4.1 Hunting

The effects of hunting activities would be similar to those described for pre-contact resources; anticipated effects would be minor.

4.6.4.4.2 Fishing

The effects of fishing activities would be similar to those described for pre-contact resources; anticipated effects would be minor.

4.6.4.4.3 Wildlife Observation and Photography

The effects of wildlife observation and photography would be similar to those described for geological resources, with minor, long-term, adverse effects anticipated under Alternative A and minor, long-term, beneficial effects anticipated under Alternatives B–F.

4.6.4.4.4 Hiking

The effects of hiking would be similar to those described for pre-contact resources, with minor, long-term adverse effects anticipated under Alternative A and minor, long-term beneficial effects anticipated under Alternatives B–F.

4.6.4.4.5 Equestrian Use

The effects of equestrian use would be similar to those described for geological resources, with minor, long-term adverse effects anticipated under Alternative A and minor, long-term, beneficial effects anticipated under Alternatives B–F.

4.6.4.4.6 Boat Launches

The effects of all actions related to boat launches would be similar to those described for pre-contact resources.

4.6.4.4.7 Camping

The effects of proposed actions on cultural traditions would be similar to those described for pre-contact resources. In addition, increased visitor use resulting from the availability of camping opportunities under Alternatives D and E near the Vernita Bridge; under Alternatives C, D and E for boat-in camping in the river corridor; and under Alternative D in the Saddle Mountain Unit, would have minor, long-term, adverse effects on cultural traditions by decreasing opportunities for solitude.

4.6.4.4.8 Modified Public Access

The effects of all actions related to public access would be similar to those described for pre-contact resources.

4.6.4.4.9 Permit System

Under Alternative F, implementation of a permit system is anticipated to have negligible effects on cultural traditions.

4.7 Effects on Interpretation and Education

Visitors to the national parks, monuments, wildlife refuges, and wildlands of America expect exposure to high-quality interpretation and education facilities and activities. The long-standing tradition of enjoying our natural and cultural resources while gaining insights and enlightenment is a major drawing point of public lands. However, ecotourism carries the risk of damage to vulnerable environments (Kimmel 1999). There has been limited research into the application of accepted environmental education principles in the development of models of effective environmental interpretation (Orams 1994).

Grant Sharpe's *Interpreting the Environment* (1982), perhaps the most widely used text in the field of environmental interpretation, cited the following major objectives of environmental interpreters: 1) to assist visitors in developing a keener awareness, appreciation and understanding of the areas they are visiting; 2) to accomplish management goals; and 3) to promote public understanding of an agency's goals and objectives.

Environmental interpretation has been defined and used in a variety of ways. Throughout its history, however, there has been a focus on changing people's behavior toward the environment.

It has been argued—but not empirically demonstrated—that environmental interpretation can and should influence visitors’ attitudes or behavior toward the use of natural resources. Such an influence presumably includes resources that are the immediate subjects of interpretation as well as those beyond the site (Tilden 1957; Brown 1971; Field and Wager 1973; Mahaffey 1973; Sharpe 1982; McAvoy 1984; Biggs and Roth 1986; Mackintosh 1986; NPS 1991; USFS 1991; Knapp et al. 1997).

Visitors come to experience the Monument’s unique history, its sweeping vistas, and its spectacular natural resources. They seek the solitude of floating past the White Bluffs or a battle with a Columbia River Chinook salmon. Many wish to learn the history of the area—not simply the nuclear story, but of the lives of the Native Americans and the homesteaders that made a sustainable existence in this sometimes harsh land. To maintain these experiential benefits, dedicated efforts must be made toward protecting and often restoring the Monument’s natural and cultural resources. Such efforts would benefit from high-quality, accessible and inspiring interpretation and education facilities, services and programs.

4.7.1 Assumptions

Since establishment of the Monument, there has been a steady increase in requests for interpretation and education programs and materials. In view of current outdoor recreation trends, a growing emphasis on environmental education in our schools and colleges, and the Monument’s status as one of the nation’s newest national monuments, demand for interpretation and education products will likely continue to rise.

Research has established that interpretation and education programs, facilities and materials can be pivotal in creating a sense of ownership in public lands and can help to instill conservation practices in students and the visiting public. Increasing numbers of schools are integrating hands-on, inquiry-oriented activities in their classrooms to offer students an opportunity to experience important concepts in science (Krapfel 1999). For example, stream and shrub-steppe monitoring and river studies afford excellent opportunities for students to investigate real-world problems associated with water quality and habitat restoration. Moreover, outdoor education programs such as these provide frequent opportunities to explore the *margins* of the classroom (Haley-Oliphant 1994; Palmberg and Kuru 2000).¹²⁹ These types of programs have had great success in their initial offerings at the Monument.

A step-down interpretation and education plan would be developed under all alternatives. The plan’s extent will depend on management direction selected in the final CCP. It is assumed that developing a range of interpretation and education facilities, materials and services that are

¹²⁹ *Margins* are places in curriculum where students and teachers explore concepts, ideas, and questions that give everyone the chance to take risks, to wonder, and to maintain curiosity and creativity.

appropriate to the Monument's natural and cultural resources will result in beneficial long-term effects to resources and the visiting public.

4.7.2 Effects Analysis—Interpretation and Education

4.7.2.1 Effects Common to All Alternatives

4.7.2.1.1 Control of Invasive Non-native Species

The control of non-native invasive species would have no foreseeable adverse effects on interpretation and education activities. Moderate, long-term, beneficial effects would include increased opportunities to convey the adverse effects of non-native invasive species, the difficulty of control, and strategies to reduce the spread of invasive non-native species.

4.7.2.1.2 Restoration

The implementation of restoration measures may result in short-term adverse impacts to education and interpretation through the temporary closure of areas during restoration activities. Minor, indirect, beneficial effects would include increased educational opportunities in ecosystem restoration for volunteers, schools and other interest groups.

4.7.2.1.3 Interpretive Site Development

As with all developments and improvements on a minimally altered landscape, both beneficial and adverse effects are likely to result from interpretation and education site developments. Long-term localized effects could result from the installation of interpretive sites. The visiting public would generally experience beneficial effects through their heightened awareness and enjoyment of the Monument's natural and cultural resources. Presumably, improved recreational practices and activities by an enlightened public with a deeper understanding of conservation and stewardship ethics would ultimately have beneficial effects on the resources.

4.7.2.1.4 Public Use

Visitor facility improvements would provide additional interpretation and education opportunities through the placement of signs and informational materials at access points.

4.7.2.2 Effects of Biological Resource Management Actions

Restoration activities on the summit of Rattlesnake Mountain would attempt to return portions of the site to pre-Manhattan Project conditions. Under all alternatives, upland habitat would be improved through the demolition and disposal actions associated with scheduled DOE remediation activities on top of Rattlesnake Mountain. Buildings identified for cleanup would be removed, and upland habitats would be restored. Restoration activities would remove all unnecessary structures, remove roads, recontour soils, and reestablish native vegetation. Ground-disturbing activities to remove building materials, asphalt, gravel, and concrete foundations would have negligible direct effects on educational experiences. Interpretation and education opportunities related to restoration science, shrub-steppe habitat interpretation, wildlife observation, photography, botany, and the historical and cultural values of Rattlesnake Mountain would be expected to have beneficial effects.

Alternatives B, C and F would entail the above mentioned cleanup efforts, with the additional removal of the observatory. The removal of the observatory would have minor adverse effects for educational institutions related to the study of astronomy. Restoration of Rattlesnake Mountain would have beneficial effects by providing additional interpretation and education opportunities related to past cultural and historical value of the mountain, restoration science, shrub-steppe habitat interpretation, wildlife observation, photography, geology and botany.

Alternatives A, D and E would entail all DOE scheduled demolition and disposal cleanup efforts as above, except the observatory would remain in place to be used for remote operation for possible educational purposes. Retention of the observatory could have minor beneficial effects for educational institutions related to the study of astronomy.

Wildland fire and fire suppression activities could have minor to major effects on educational experiences on the Monument, depending on local weather conditions and the extent of individual fire events. Fire danger and/or wildland fire would cause short-term adverse effects on interpretation and education opportunities through temporary land closures during periods of high fire danger; area restrictions during ongoing fire operations; damage to educational infrastructure (e.g., kiosks, trails); effects on long-term study plots; vegetation removal; and suppression activities (e.g., bulldozer lines, hand lines, staging areas). Wildland fire would have beneficial effects by creating a setting for educational experiences involving post-fire research, fire effects monitoring, public information on fire and ecosystem relationships, and post-fire shrub-steppe recovery.

4.7.2.3 Effects of Visitor Services Management Actions— Interpretation and Education

4.7.2.3.1 Interpretive Site Development

There are no interpretive site developments planned under Alternative A. This lack of developed sites would have a continued adverse effect on interpretation and education opportunities. Currently, the adverse effects include a resultant lack of general knowledge of the Monument and confusion over access points, Monument regulations, and available recreational opportunities. Threats to habitat, wildlife, and geological, paleontological and cultural resources result from a lack of available information on Monument regulations, habitat and wildlife sensitivity.

An increase in developed interpretive sites under Alternatives B–F would provide the visiting public with additional opportunities to learn about the Monument, its natural and cultural resources, and ongoing management activities to protect and enhance the environment. These added opportunities would aid the public in their knowledge of the FWS and its mission to protect and conserve wildlife and habitat, would raise awareness of Monument regulations, and would reduce instances of inappropriate activities, resulting in long-term beneficial effects to resources.

4.7.2.3.2 Interpretive Trail Systems

The impacts would be similar to those described above for Interpretive Sites.

4.7.2.4 Effects of Visitor Services Management Actions—Recreation

4.7.2.4.1 Hunting

Hunting activity under all alternatives would have minor adverse effects on interpretation and education opportunities through noise from weapon fire. However, the presence of hunting activity on the Monument can also provide opportunities for interpretation and education programs focusing on hunting history, its role in wildlife management, and changing societal views of hunting.

4.7.2.4.2 Fishing

The presence of fishing activity on the Monument can provide opportunities for interpretation and education programs focusing on fishing history and traditions.

4.7.2.4.3 Wildlife Observation and Photography

Alternatives B–F would result in moderate beneficial effects on I&E opportunities by providing additional opportunities for learning about wildlife and other Monument resources.

4.7.2.4.4 Hiking

Designated hiking trails would increase interpretation and education opportunities along the trail and at key sites, such as trailheads and scenic vistas. Alternatives B and F would result in minor beneficial effects, while Alternatives C, D and E would result in major beneficial effects by providing additional trails.

4.7.2.4.5 Equestrian Use

Designated equestrian trails would increase interpretation and education opportunities along the trail and at key sites, such as trailheads and scenic vistas. Alternatives B–F would result in moderate beneficial effects.

4.7.2.4.6 Boat Launches

Vernita

Alternatives B–F would result in minor beneficial effects by providing increased interpretation and education opportunities at this site.

White Bluffs

Alternatives A and B would have negligible effects on interpretation and education opportunities at the White Bluffs Boat Launch due to restrictions to access. Alternative C would have moderate adverse effects on those visitors wishing to visit this site by vehicle and moderate beneficial effects on visitors preferring a non-motorized setting. Alternative D would have minor beneficial effects on river-based interpretation and education opportunities by improving river access in this location. Alternatives E and F would have moderate adverse effects on

interpretation and education opportunities for visitors using motorized boats due to restrictions on access and minor beneficial effects on interpretation and education opportunities for visitors using non-motorized boats.

Ringold

Alternatives B–F would result in minor beneficial effects on I&E opportunities by increasing the ease of access to the river in this area and providing opportunities for visitors to learn about the Monument at the boat launch site.

South Shore

Alternative D would result in minor beneficial effects by providing increased opportunities for visitors to learn about the Monument at the boat launch site.

4.7.2.4.7 Camping

Vernita

Alternatives D and E would result in minor beneficial effects on interpretation and education opportunities in this area by providing increased opportunities to learn about the Monument at the developed campground.

Boat-In

Establishment of boat-in campsites under Alternatives C, D and E would result in moderate beneficial effects for non-motorized boaters pursuing interpretation and education opportunities on the Hanford Reach by providing access points for overnight use and increasing opportunities to learn about the Monument.

Saddle Mountain

Alternative D would result in moderate beneficial effects on visitors pursuing interpretation and education opportunities by providing increased opportunities to learn about the Monument at the new campground.

4.7.2.4.8 Modified Public Access

Columbia River Unit

Vernita Bridge, South Shore. Alternatives B, C, D and F would result in minor adverse effects on interpretation and education opportunities by reducing the available acreage open to the public. Alternative E would result in minor beneficial effects by providing opportunities for visitors to learn about the Monument at trailheads and other visitor improvement sites.

Sand Dunes. Alternatives C, D and E would provide access to the sand dunes, resulting in minor beneficial effects by providing additional interpretation and education opportunities for visitors to learn about the Monument.

South Shore. Alternatives C, D and E would provide access to the south shore, resulting in minor beneficial effects by providing additional interpretation and education opportunities for visitors to learn about the Monument.

North Shore. The effects under Alternatives D and E would be similar to those described for the South Shore.

Ringold Unit

Parking Lots. The effects on interpretation and education opportunities would be negligible.

Auto Tour. Alternative D would result in moderate beneficial effects by providing additional interpretation and education opportunities for visitors to learn about the Monument.

Saddle Mountain Unit

Under Alternatives A, D and E, effects on interpretation and education opportunities would be negligible. Alternative B would result in major adverse effects on interpretation and education opportunities by closing a destination area. Alternatives C and F would result in moderate adverse effects for visitors preferring motorized access and moderate beneficial effects for visitors preferring non-motorized access.

Wahluke Unit

West Access. Alternative B would result in minor beneficial effects by providing additional interpretation and education opportunities. Alternatives C, D, E and F would result in moderate beneficial effects by providing additional interpretation and education opportunities, including access to the Saddle Mountain Lakes and wetlands.

Auto Tour. The effects under Alternative D would be similar to those described for the Ringold auto tour route.

4.7.2.4.9 Permit System

Under Alternative F, visitors would be required to obtain an access permit prior to entering the Monument. This requirement could decrease the convenience of visiting the Monument, resulting in minor adverse effects on visitors seeking I&E opportunities. This could be offset, in part, by visitors having some form of contact with FWS staff or facilities, whereby Monument information could be conveyed.

4.8 Effects on Recreation and Public Use

Readily accessible by land and by water, the Monument provides many outdoor recreation opportunities. Most visitor facilities (e.g., roads, boat launches, and parking areas) are primitive. The Monument is open for day-use only, although this restriction has not been enforced in the Vernita Bridge boat launching area. This analysis examines effects on hunting, fishing, wildlife observation and photography, and other recreational activities (e.g., boating, equestrian use, hiking, and bicycling).

4.8.1 Assumptions

Facility improvements and increased access would result in increased visitation to the Monument. Byproducts of increased visitation could adversely affect visitor experiences to some degree through increased congestion, noise and litter, especially in popular public use areas. It is assumed that some visitors would be displaced from areas they may have traditionally used as a result of these factors, while others would adjust their visitation times and/or their expectations to accommodate the changes. It is assumed that with increased visitation, more people would learn about and appreciate the Monument.

An interpretation and education component would be integral to the Monument's visitor use program by providing information on the Monument's natural and cultural resources, recreational opportunities, rules and regulations.

The extent and depth to which interpretation and education facilities and programs are developed would vary under different alternatives. However, it is assumed that each action alternative would offer a variety of interpretive materials that would be complementary to the recreational

facilities and activities available. Interpretation and education materials would emphasize the need for resource protection and attempt to foster a sense of ownership and stewardship of the Monument's natural and cultural values.

4.8.2 Effects Analysis—Hunting

The Monument provides regionally significant opportunities for hunting waterfowl; upland birds, including quail, Hungarian (gray) partridge, pheasant, mourning dove, and chukar; and big game, including deer and elk. Hunting is only open during Washington State–designated hunting seasons. Non-toxic shot is required for all bird hunting activities, and big game hunting weapons are limited to archery, shotgun and muzzleloader.

4.8.2.1 Effects Common to All Alternatives

4.8.2.1.1 Invasive Non-native Species Control

The control of non-native invasive species under all alternatives would have no foreseeable adverse effects on hunting activities. Beneficial long-term effects on hunting would be improved habitat conditions and increased wildlife distribution on the landscape. These effects would range from minor to major, depending on the timing and extent of successful weed treatments and the wildlife species that use these habitats. Non-native invasive species control would improve gamebird and animal populations by improving plant community biodiversity, health, structure and function. Occasionally, temporary area closures may take place during hunting season to conduct invasive non-native species control efforts. These temporary closures are for the safety of the hunting public and would have negligible effects on hunting overall.

4.8.2.1.2 Wildland Fire and Fire Suppression Activities

Fire events may have adverse short-term effects on hunting through vegetation removal, short-term habitat loss, wildlife disturbance and displacement, suppression effects (bulldozer lines, hand lines, staging areas), and post-fire expansion of non-native invasive species that degrade wildlife habitat. The level of effects on hunting cannot be estimated because the number and size of fires vary from year to year. Wildland fire would have moderate, long-term effects on hunting.

4.8.2.1.3 Public Use

Hunting opportunities would benefit from increased access and improved visitor facilities, such as parking areas, hunting blinds, and boat launches. However, visitor facility and access improvements would result in increased visitation to the Monument, with subsequent adverse effects on hunting through increased habitat degradation, wildlife disturbance, risk of wildland fire, and crowding. In addition, visitor facility improvements could necessitate the need for no-shooting safety zones.

4.8.2.1.4 Interpretation and Education

Presently, only minimal interpretation and education materials address hunting. An uninformed public can account for many of the illegal and unauthorized hunting activities occurring in the Monument. It is anticipated that activities of this type would be reduced through the delivery of educational information and programs featuring hunting opportunities. Interpretation and education facilities and materials would have a moderate, long-term, beneficial effect on hunting.

4.8.2.2 Effects of Biological Resource Management Actions

Riparian area restoration would be implemented on identified at-risk plant communities and aquatic areas. No active riparian restoration is proposed under Alternative A.

Under Alternatives B–F, restoration treatments would entail the identification, prioritization and restoration of at-risk riparian areas to proper functioning condition. Adaptive management strategies and IPM techniques would be used to initiate treatment on sensitive and biologically diverse riparian plant communities. Direct effects would include short-term wildlife disturbance/displacement and soil disturbance, which would have negligible effects on hunting opportunities. Indirect beneficial effects of riparian restoration efforts include soil and streambank stabilization, reduction in sedimentation, improved fish and wildlife habitat, and improved wildlife diversity, all of which would have moderate long-term beneficial effects on hunting opportunities.

4.8.2.3 Effects of Visitor Services Management Actions— Interpretation and Education

4.8.2.3.1 Interpretive Site Development

Under Alternative A, interpretive sites would not be established in the Monument. Adverse effects on hunting opportunities in the Monument would continue from lack of site-specific information.

The interpretive site developments planned under Alternatives B–F may involve hunting by mentioning opportunities, area closures, game species, and management actions. Minor benefits to hunting would result from improving the ease of obtaining information about hunting opportunities.

4.8.2.3.2 Interpretive Trail Systems

Under Alternative A, no interpretive trails are planned; accordingly, no effects on hunting opportunities are anticipated.

Interpretive trails would be developed under Alternatives B–F. Depending on the location of these trails, and whether the trails and surrounding habitat would be open to hunters, there would be a moderate beneficial effect on hunting by providing increased access points and opportunities for hunters to easily traverse the landscape. However, there is the possibility of conflicts arising between hunters and other recreational users of the trails. Certain trails may be closed during hunting season or closed to hunting for visitor protection if such closure is warranted.

4.8.2.4 Effects of Visitor Services Management Actions—Recreation

4.8.2.4.1 Hunting

It is anticipated that hunting opportunities would be enhanced through the completion of a step-down Hunting Plan and subsequent implementation of management actions aimed at addressing facility and access needs, safety and public outreach and education. Continuation of the waterfowl sanctuary on the upper Hanford Reach would benefit hunting opportunities on the lower portion of the river. Phasing out the pheasant stocking program at Ringold would be perceived in a negative light by some hunters and favorably by others. Hunters seeking pheasant

hunting opportunities would be displaced to other nearby pheasant release locations such as the Buckshot, Lower Crab Creek, Sunnyside, Big Flat, or Hollebeke sites (WDFW Eastern Washington Pheasant Enhancement Program 2005).

4.8.2.4.2 Fishing

The effects on hunting are anticipated to be negligible.

4.8.2.4.3 Wildlife Observation and Photography

Hunting opportunities would be slightly reduced if a need is identified to establish no-hunting safety buffer zones around developed observation and photography sites. Because of the minimal acreage that would be involved in such buffer zones, effects are anticipated to be minor.

4.8.2.4.4 Hiking

Under Alternatives B–F, hiking activities during hunting seasons could have minor adverse effects on hunting opportunities by flushing game animals.

4.8.2.4.5 Equestrian Use

Under Alternative A, effects on hunting are anticipated to be negligible. Under Alternatives B–F, equestrian travel routes would be established, and hunters could no longer hunt from horseback. Some visitors would perceive this positively, while some visitors preferring to hunt from horseback would be negatively impacted.

4.8.2.4.6 Boat Launches

Vernita

The effects on hunting are anticipated to be negligible due to the waterfowl hunting closure in the upper river and no shooting from boats for other wildlife.

White Bluffs

The effects on hunting are anticipated to be minor; any slight impacts would be associated with changes in access.

Ringold

Under Alternatives B–F, waterfowl hunters along the lower Hanford Reach could benefit from improved boat access.

South Shore

Under Alternative D, waterfowl hunters could benefit from additional boat access to the lower Hanford Reach.

4.8.2.4.7 Camping**Vernita**

Alternatives D and E would result in minor beneficial effects by reducing travel time to hunting areas for campground-based hunters.

Boat-In

There would be no foreseeable effects on hunting.

Saddle Mountain

Alternative D would result in minor benefits by reducing travel time to hunting areas for campground-based hunters.

4.8.2.4.8 Modified Public Access**Columbia River Unit**

Vernita Bridge, South Shore. The effects on hunting are anticipated to be negligible.

South Shore. The effects on hunting are anticipated to be negligible.

North Shore. The effects on hunting are anticipated to be negligible.

Sand Dunes. The effects on hunting are anticipated to be negligible.

Ringold Unit

Parking Lots. The effects on hunting are anticipated to be negligible.

Auto Tour. Hunting opportunities would be slightly reduced if a need is identified to establish a no-hunting safety buffer zone around the auto tour route. Increased wildlife disturbance resulting from visitor use of the auto tour route would result in minor adverse effects on hunting opportunities in this area.

Saddle Mountain Unit

No reasonably foreseeable effects on hunting would occur under Alternatives A and D. Under Alternative B, 2,644 acres along the Saddle Mountain crest would be closed to public use, resulting in minor adverse effects on hunting opportunities. Under Alternatives C and F, 2,644 acres along the Saddle Mountain crest would be accessible by foot or horseback only, resulting in minor beneficial effects for hunters preferring non-motorized hunting opportunities and minor adverse effects for hunters preferring vehicular access.

Wahluke Unit

West Access. Under Alternatives B–F, additional acreage would be opened to big and upland game hunting, resulting in moderate beneficial effects on hunting opportunities on the Monument.

Auto Tour. Because this area is currently closed to hunting and does not provide quality wildlife sanctuary habitat, there are no foreseeable effects on hunting.

4.8.2.4.9 Permit System

Under Alternative F, an access permit system would result in minor adverse effects by decreasing convenience in accessing the Monument.

4.8.3 Effects Analysis—Fishing

Fishing is the most popular activity in the Monument and occurs year-round on the Columbia River and the WB-10 Ponds. The Hanford Reach attracts anglers from around the Northwest, providing fishing opportunities for salmon, steelhead, sturgeon, whitefish and small-mouth bass. The Hanford Reach provides spawning habitat for approximately 80% of the remaining fall Chinook salmon runs on the main stem Columbia River, resulting in excellent fishing opportunities in the fall. Native American Tribes have fished in the Hanford Reach for

millennia. Columbia River fishing is regulated by the WDFW, while fishery resources are managed by multiple federal and state agencies.

4.8.3.1 Effects Common to All Alternatives

4.8.3.1.1 Control of Non-native Invasive Species

The treatment of non-native invasive species would have no foreseeable negative effects on fishing activities. Beneficial long-term effects on fishing would be anticipated to result from control of non-native invasive species. Benefits would be minor to major, depending on the extent of the infestation and the species involved, and would improve watershed health by enhancing plant community biodiversity, structure and function. Direct beneficial effects on fishing opportunities would result from improved upland health, reduced sedimentation, and improved hydrologic function.

4.8.3.1.2 Wildland Fire and Fire Suppression Activities

Fire events can have adverse short-term effects on fishing as a result of vegetation removal, suppression activities (e.g., bulldozer lines, hand lines, staging areas), changes in watershed response, nutrient transport (ash and silt), hydrologic function, and post-fire expansion of non-native invasive species that decrease upland health and increase sedimentation potential. The effects on fishing of wildland fire would be minor to moderate but of short duration and would depend on fire size, intensity and location.

4.8.3.1.3 Modified Public Access

Fishing opportunities would benefit from increased access and improved visitor facilities, such as parking areas, trails and boat launches. However, visitor facility and access improvements would result in increased visitation to the Monument, with subsequent adverse effects on fishing opportunities through increased habitat effects, congestion and noise.

4.8.3.2 Effects of Biological Resource Management Actions

No active riparian restoration is proposed under Alternative A.

Under Alternatives B–F, restoration treatments would entail the identification, prioritization, and restoration of at-risk riparian areas to proper functioning condition. Adaptive management strategies and integrated pest management techniques would be used to restore sensitive and biologically diverse riparian plant communities. Direct effects would include short-term soil disturbance, which would have negligible effects on fishing opportunities. Indirect beneficial effects of riparian restoration efforts include soil stabilization, streambank stabilization, reduction in sedimentation, improved fish habitat, and improved species diversity, all of which would have long-term beneficial effects on fishing opportunities.

4.8.3.3 Effects of Visitor Services Management Actions— Interpretation and Education

4.8.3.3.1 Interpretive Site Development

Under Alternative A, interpretive sites would not be established in the Monument; consequently, effects on fishing opportunities would be negligible.

The interpretive site developments planned under Alternatives B–F may involve fishing by mentioning opportunities, access points, available species, fishing methods (both modern and historical), and management actions. Minor adverse effects on fishing may include an increase in fishing pressure, increased congestion on the river and the river shore, increased use of boat ramp facilities, and more trash and litter at fishing access points. Messages in interpretive exhibits will attempt to mitigate these effects through education and the creation of a sense of ownership and stewardship of Monument resources.

4.8.3.3.2 Interpretive Trail Systems

Under Alternative A, no interpretive trails are planned; accordingly, no effects on fishing opportunities are anticipated.

The development of interpretive trails is not likely to include fishing activities as a component of the interpretive experience. Although trails may be sited along waterways, they are not anticipated to be associated with fishing facilities or activities. They may, however, provide travel corridors to fishing access points. Negligible effects are anticipated.

4.8.3.4 Effects of Visitor Services Management Actions—Recreation

4.8.3.4.1 Hunting

The effects on fishing are anticipated to be negligible.

4.8.3.4.2 Fishing

It is anticipated that fishing opportunities would be enhanced through the completion of a step-down Fishing Plan developed in coordination with agencies that have jurisdictional authority over the Columbia River, as well as through subsequent implementation of management actions aimed at addressing facility and access needs, safety and public outreach and education.

4.8.3.4.3 Wildlife Observation and Photography

The effects on fishing are anticipated to be negligible.

4.8.3.4.4 Hiking

The effects on fishing are anticipated to be negligible.

4.8.3.4.5 Equestrian Use

The effects on fishing are anticipated to be negligible.

4.8.3.4.6 Boat Launches

Vernita

Under Alternatives A, B and F, primitive conditions at the Vernita launch area would serve as a deterrent to some anglers, who would continue to seek river access elsewhere, such as the White Bluffs launch, the WDFW Ringold launch, or the developed launches in the Tri-Cities area. Alternatives C, D and E would result in moderate beneficial effects on motorized boat fishing opportunities by providing an improved boat launch and would result in moderate adverse effects for anglers preferring primitive settings. A developed boat launch under

Alternatives C, D and E is expected to increase visitor use in this area, resulting in minor adverse effects on fishing experiences caused by increased noise and congestion on the river, although obviously, access would be improved.

White Bluffs

Alternatives A and B are anticipated to have negligible effects on fishing opportunities. Alternative C would have an adverse effect on fishing opportunities by closing the boat launch. Alternatives E and F would result in moderate adverse effects on motorboat-based anglers seeking access in this area. Anglers would be displaced to alternate launch sites at Vernita, Ringold, or Tri-Cities area launches. Alternative D would have moderate beneficial effects for motorboat-based anglers preferring developed settings and would have moderate adverse effects on those preferring primitive settings. A developed boat launch under Alternative D is expected to increase visitor use in this area, resulting in minor adverse effects on fishing experiences caused by increased noise and congestion on the river, although obviously, access would be improved.

Ringold

Under Alternative A, the primitive conditions at the Ringold launch area would serve as a deterrent to some anglers, who would continue to seek river access elsewhere, such as the White Bluffs launch or the developed launches in the Tri-Cities area. Alternatives B–F would result in moderate beneficial effects on anglers preferring developed boat launches and moderate adverse effects on anglers preferring primitive launches. A developed launch at Ringold is anticipated to increase visitor use in this area, resulting in minor adverse effects on fishing experiences caused by increased noise and congestion on the river, although obviously, access would be improved.

South Shore

Alternative D would result in moderate beneficial effects on anglers by providing additional river access and boat launch sites. However, Alternative D would also result in moderate adverse effects on fishing experiences caused by increased noise and congestion on the river, although obviously, access would be improved.

4.8.3.4.7 Camping

Vernita

Alternative A is anticipated to have negligible effects on fishing opportunities. Alternatives B, C and F would result in moderate adverse effects on anglers wishing to camp in the Vernita

Bridge area, likely displacing them to alternate sites outside the Monument, such as the community of Desert Aire or Benton County's Horn Rapids Park. Alternatives D and E would result in moderate beneficial effects by reducing travel time to fishing areas for campground-based motorboat anglers.

Boat-In

Alternatives C, D and E would result in moderate beneficial benefits for anglers fishing from non-motorized boats by providing camping opportunities on the Hanford Reach.

Saddle Mountain

Alternatives A, B, C, E and F would require anglers to seek overnight accommodations outside the Monument. Alternative D would result in moderate beneficial effects on access for anglers by removing the need to travel off site for overnight accommodations.

4.8.3.4.8 Modified Public Access

Columbia River Unit

Vernita Bridge, South Shore. Alternatives A and E would have negligible effects on fishing opportunities. Alternatives B, C, D and F would result in minor adverse effects on fishing opportunities by reducing available shorelines open to the public for these activities.

Sand Dunes. The effects from this action are anticipated to be negligible.

South Shore. Alternatives C, D and E would result in moderate beneficial effects by increasing opportunities for fishing on the south shore.

North Shore. Alternatives D and E would provide access to the north shore, resulting in minor beneficial effects by increasing opportunities for fishing on the north shore.

Ringold Unit

Parking Lots. Alternatives B–E would have negligible effects on fishing opportunities. Alternative F would result in minor adverse effects on fishing opportunities by closing Parking Lot 7 and the existing primitive boat launch and by increasing the difficulty of access to bank shore fishing around Parking Lot 7.

Auto Tour. The effects on fishing are anticipated to be negligible.

Saddle Mountain Unit

The effects on fishing are anticipated to be negligible.

Wahluke Unit

West Access. The effects on fishing are anticipated to be negligible.

Auto Tour. The effects on fishing are anticipated to be negligible.

4.8.3.4.9 Permit System

Under Alternative F, an access permit system would result in minor adverse effects by decreasing convenience in accessing the Monument.

4.8.4 Effects Analysis—Wildlife Observation & Photography

The Monument offers excellent opportunities for wildlife observation and photography, including numerous plants and animals, the Columbia River, basalt ridgelines, cliffs, bluffs, sand dunes, and expansive landscapes. Currently, there are no special facilities (e.g., observation decks, trails, photography blinds) to support these activities.

4.8.4.1 Effects Common to All Alternatives

Interpretive planning will incorporate the best available designs to reduce adverse effects to the lowest level possible while providing visitors with a high-quality wildlife viewing experience. Design components may include viewing blinds, unobtrusive trail designs, and the identification and enforcement of seasonal closures of key areas to protect critical habitats.

Wildlife observation and photography opportunities would benefit from increased access and improved visitor facilities, such as parking areas, photography blinds, and boat launches. However, visitor facility and access improvements would also result in increased visitation to the Monument, with subsequent adverse effects associated with crowding, noise, risk of wildland fire, and wildlife disturbance.

4.8.4.2 Effects of Biological Resource Management Actions

Invasive non-native plant species pose a significant threat to native biodiversity, wildlife habitat, habitat connectivity, and wildlife observation. Under Alternative A, the use of IPM techniques (chemical, biological, cultural, and mechanical) would have minor effects on wildlife observation opportunities. Weeds would be treated annually along major transportation corridors to prevent their spread into adjacent upland plant communities. Spot spraying, hand pulling, and the release of biological control agents would be conducted on an annual basis on high-priority weed populations in off-road situations. Minor direct effects on wildlife observation include short-term wildlife disturbance, short-term wildlife habitat modification, and soil disturbance (with mechanical treatments). The early treatment of small weed populations and site restoration with native species will have indirect, long-term, beneficial effects on native habitats by protecting associated plant communities and wildlife habitat from further degradation. The control of non-native species would have an overall beneficial effect on wildlife habitat and wildlife observation opportunities.

Under Alternatives B–F, 11,000–18,000 acres would be mapped and treated to control noxious weeds. Weed populations would be prioritized and treated annually on the basis of threat analysis and the target population’s potential for offsite movement and infestation of adjacent lands. Minor direct effects on wildlife observation would include short-term wildlife disturbance, short-term habitat modification, and localized soil disturbance. Minor indirect effects would include the reduction or elimination of invasive species in native plant communities leading to improvement of resource conditions, wildlife habitat, wildlife observation opportunities, plant community stability, and habitat connectivity.

Under Alternative A, restoration activities on uplands would range from 0 to 10,000 acres annually and focus primarily on lands disturbed by wildfire events, maintenance-related project work, Hanford Site mitigation, and noxious weed control efforts. Minor direct effects on wildlife observation would include short-term disturbance (temporarily displacing wildlife from the project area) and potential effects on ground-dwelling wildlife by soil disturbance, crushing of burrows or dens, and compaction during drill seeding and harrowing operations. Moderate indirect effects would include improvement of wildlife observation opportunities through native plant reestablishment and the improvement of biodiversity, site health, and plant community structure and function.

Under Alternatives B–F, annual restoration activities on uplands would be conducted on 2,000–6,000 acres per year for fifteen years. Restoration methods would be used primarily to restore degraded shrub-steppe habitats or disturbed areas to a natural range of native plant communities. These activities would directly and indirectly improve the condition of native vegetation and wildlife habitat. Wildlife observation opportunities would, in turn, improve throughout the Monument as shrub-steppe habitats are restored. Minor direct effects on wildlife observation would include short-term disturbance (temporarily displacing wildlife from the

project area), as well as potential effects on viewable wildlife through soil disturbance or compaction during drill seeding and harrowing operations. Indirect effects include native plant reestablishment and the improvement of biodiversity, site health, and plant community structure and function; these effects would in turn greatly improve wildlife observation opportunities.

Under Alternatives B, C and D, riparian restoration treatments would entail the identification, prioritization and restoration of at-risk areas to proper functioning condition. Adaptive management strategies and IPM techniques would be used in treating sensitive and biologically diverse riparian plant communities. Some restoration activities (e.g., the removal of non-native species such as Russian olive and salt cedar) may disturb soils, hiding and thermal cover, ecotones and nesting habitat, resulting in minor effects on wildlife observation opportunities. Direct effects would include short-term wildlife disturbance/displacement and soil disturbance. Indirect beneficial effects of riparian restoration efforts include soil stabilization, streambank stabilization, reduction in sedimentation, improved fish and wildlife habitat, improved wildlife diversity, and improved wildlife viewing opportunities.

Restoration activities on the summit of Rattlesnake Mountain would attempt to return portions of the site to pre-Manhattan Project conditions. Buildings identified for cleanup currently serve as barriers to wildlife movement or artificial habitat for undesirable species such as rats and starlings. Buildings also serve as unnatural perch areas for raptors, increasing predation of rodent populations, while guy wires are known to cause mortality of birds and bats through accidental strikes. Removing the structures would have long-term beneficial effects on wildlife and wildlife observation opportunities. Under all alternatives, upland habitat would be improved through the demolition and disposal actions associated with scheduled DOE remediation activities on top of Rattlesnake Mountain. Short-term displacement and disturbance of wildlife would result from human activity during demolition work.

Fire is the chief threat to the health of shrub-steppe habitats in the Monument. Fire directly effects wildlife observation, both beneficially and adversely, through habitat destruction or modification. Many species depend on shrubs for breeding, rearing and foraging habitat. When plant community components are reduced or eliminated, these species must relocate to other suitable habitat; Wyoming big sagebrush and many other shrub species in the Monument do not resprout following fire. Shrub-steppe obligate species (wildlife species that require certain components of shrub/bunchgrass/forb plant associations for their survival) are thus directly affected by wildland fires. Loss of habitat also has a direct effect on species' reproduction capability, diversity and richness. Decreases in plant community structure and function lead to concomitant reductions in the diversity of wildlife species using these habitats, and thus reductions in wildlife viewing opportunities.

Direct effects on wildlife habitat from wildland fire can range from minor to major and include loss of thermal and hiding cover; loss of structure and function for nesting, roosting and rearing; effects on food supplies (plants, animals and insects); and effects on wildlife distribution (potential crowding), foraging and migration patterns. Elimination of vegetative cover also

exposes many species of wildlife to excessive predation, and can cause short-term suppression of prey populations. Many species abandon historic use areas (e.g., sage-grouse leks, burrows, dens) and seek out new habitat following fire. Indirect effects include the movement of wildlife into agricultural fields or onto adjacent lands with intact shrub-steppe habitat (e.g., Yakima Training Center), the loss of species diversity, decreased reproduction rates, and increased mortality. Consequently, fire is a major threat to wildlife habitat and thus to wildlife viewing opportunities in the Monument.

Wildland fire can also have beneficial effects on wildlife observation. These effects include habitat improvement, nutrient recycling, improved forage (forbs, insects, grasses), and increased edge effect. However, these benefits are short-term in nature and when combined with invasive species establishment in disturbed areas, such as burned sites, it is unlikely that these benefits would be significant in the Monument.

4.8.4.3 Effects of Visitor Services Management Actions— Interpretation and Education

4.8.4.3.1 Interpretive Site Development

Under Alternative A, interpretive sites would not be established in the Monument, so there would be no effects to wildlife observation opportunities.

Under Alternatives B–F, developing interpretive sites would enhance wildlife observation opportunities by providing information regarding the location of high-quality viewing sites, the times of day and seasons that are best for viewing, and what species can be observed across the seasons. Interpretive sites would be located at centers of visitor activity accessible to observation locations, but far enough removed from them to minimize adverse effects on wildlife. Interpretive sites established at selected wildlife viewing and photography locations would be designed to mitigate adverse effects on wildlife species, populations and habitats through unobtrusive design parameters.

4.8.4.3.2 Interpretive Trail Systems

Under Alternative A, interpretive sites would not be established in the Monument, so there would be no effects to wildlife observation and photography opportunities.

Under Alternatives B–F, an expanded interpretive trail system would provide the visiting public with increased opportunities for viewing and photographing the Monument's wildlife species in their native habitat. Many high-quality opportunities are presently accessible only by

primitive, unsigned trails. Development of interpretive trails would provide viewing and photography opportunities to a range of visitors who would otherwise be unable to hike overland or would be reluctant to do so due to the lack of signs. Coupling interpretive trails with established viewing blinds and stations along the route would have long-term beneficial effects on viewing and photography opportunities while minimizing adverse effects on wildlife.

4.8.4.4 Effects of Visitor Services Management Actions—Recreation

4.8.4.4.1 Hunting

Wildlife disturbance resulting from hunting activities would have an adverse effect on wildlife observation and photography opportunities during hunting seasons. Because of the seasonal nature of disturbance and the relatively large sanctuary areas in the Monument, adverse effects are anticipated to be minor.

4.8.4.4.2 Fishing

Riverine wildlife disturbance resulting from fishing activities would have an adverse effect on wildlife observation and photography opportunities during fishing seasons. However, with implementation of BMPs such as establishing area closures around sensitive habitats as needed, and because of the considerable escape area available for riverine species along forty-six miles of Columbia River within the Monument, adverse effects are anticipated to be minor. If boat traffic increases significantly, riverine wildlife disturbance may increase as well, with greater adverse impacts to observation and photography opportunities.

4.8.4.4.3 Wildlife Observation and Photography

Alternatives B and F would result in minor beneficial effects on wildlife observation and photography by providing additional opportunities. Alternatives C, D and E would result in moderate beneficial effects by providing even more opportunities.

4.8.4.4.4 Hiking

Alternative A is expected to have negligible effects on wildlife observation and photography opportunities. Alternatives B and F would result in moderate beneficial effects by providing new trail-based opportunities. Alternatives C, D and E would result in major beneficial effects

by providing a greater extent of trail-based opportunities, including trails in the previously closed Rattlesnake Unit.

4.8.4.4.5 Equestrian Use

Alternative A would result in negligible effects on wildlife observation and photography opportunities. Alternatives B–F would result in moderate beneficial effects on equestrian-based visitors seeking to pursue wildlife observation and photography opportunities on designated trail systems.

4.8.4.4.6 Boat Launches

Vernita

Alternatives A, B and F are anticipated to have negligible effects on wildlife observation and photography opportunities. Alternatives C, D and E would result in minor beneficial effects on motorboat-based visitors by improving boat access at this site. However, improved boat access for wildlife observation and photography opportunities could be offset by increasing use, congestion and noise in the area.

White Bluffs

Alternatives A and B would have negligible effects on wildlife observation and photography opportunities. Alternative C would result in moderate, site-specific, adverse effects for visitors preferring motorized access and moderate, site-specific, beneficial effects for visitors preferring non-motorized settings. Alternative D would result in moderate beneficial effects on motorboat-based wildlife observation and photography opportunities by improving river access in this location. However, improved boat access for wildlife observation and photography opportunities could be offset by increasing use, congestion and noise in the area. Alternatives E and F would result in moderate adverse effects on motorboat-based wildlife observation and photography opportunities and moderate beneficial effects on wildlife observation and photography opportunities using non-motorized boats.

Ringold

Under Alternative A, the primitive conditions at the Ringold launch area would serve as a deterrent to some visitors seeking wildlife observation and photography opportunities; they would continue to seek river access elsewhere, such as the White Bluffs Boat Launch or the developed launches in the Tri-Cities. Alternatives B–F would result in moderate beneficial effects on river-related wildlife observation and photography opportunities by increasing the

ease of access to the river in this area. However, improved boat access would also have minor adverse effects on wildlife observation and photography opportunities by increasing use, congestion, and noise in the area.

South Shore

Under Alternatives A, B, C, E and F, visitors seeking wildlife observation and photography opportunities by boat would continue to use launch sites on the north shore or use launches in the Tri-Cities to access the Monument. Alternative D would result in moderate beneficial effects on visitors seeking boat-based wildlife observation and photography opportunities by providing access on the south shore. However, improved boat access for wildlife observation and photography opportunities could be offset by increasing use, congestion and noise in the area.

4.8.4.4.7 Camping

Vernita

Alternative A is anticipated to have negligible effects on wildlife observation and photography opportunities. Alternatives B, C and F would result in moderate adverse effects on visitors wishing to camp in the Vernita Bridge area, likely displacing them to alternate sites outside the Monument (e.g., the community of Desert Aire, Benton County's Horn Rapids Park). Alternatives D and E would result in moderate beneficial effects by reducing travel time to various locations in the Monument for campground-based visitors. Campground activities, increased visitation, and associated wildlife disturbance in the Vernita Bridge vicinity would have minor adverse effects on wildlife observation and photography opportunities.

Boat-In

Under Alternatives C, D and E, establishment of boat-in campsites would result in major beneficial effects for non-motorized boaters by providing extended viewing and photography opportunities along the Hanford Reach.

Saddle Mountain

Alternative D would result in moderate beneficial effects on wildlife observation and photography opportunities by reducing travel time to various locations in the Monument for campground-based visitors.

4.8.4.4.8 Modified Public Access

Columbia River Unit

Vernita Bridge, South Shore. Alternatives A and E would have negligible effects on wildlife observation and photography opportunities. Alternatives B, C, D and F would result in minor adverse effects on wildlife observation and photography opportunities by reducing available acreage open to the public for these activities.

Sand Dunes. Alternatives C, D and E would result in major beneficial effects on wildlife observation and photography opportunities by providing access to this previously closed area.

South Shore. Alternatives C, D and E would have minor beneficial effects on wildlife observation and photography opportunities by providing access to this previously closed area.

North Shore. Alternatives D and E would have minor beneficial effects on wildlife observation and photography opportunities by providing access to new portions of this area.

Ringold Unit

Parking Lots. The effects on wildlife observation and photography opportunities are anticipated to be negligible.

Auto Tour. Alternative D would result in moderate, site-specific, beneficial effects on wildlife observation and photography opportunities for visitors preferring motorized access and minor adverse effects on visitors preferring non-motorized settings.

Saddle Mountain Unit

Under Alternatives A and D, the effects on wildlife observation and photography opportunities would be negligible. Alternative B would result in major adverse effects on wildlife observation and photography opportunities by closing a destination area for these activities. Alternatives C and F would result in moderate adverse effects on visitors preferring motorized access for wildlife observation and photography and moderate beneficial effects on visitors preferring non-motorized access. Alternative E would have minor adverse effects on wildlife observation and photography opportunities by increasing restrictions on activities.

Wahluke Unit

West Access. Alternative B would result in minor beneficial effects on wildlife observation and photography by providing additional opportunities. Alternatives C, D, E and F would result in major beneficial effects on wildlife observation and photography by providing additional

opportunities, including access to riparian species associated with the Saddle Mountain irrigation return lakes.

Auto Tour. Alternative D would result in moderate beneficial effects on wildlife observation and photography by providing new opportunities to pursue these activities in a previously closed area.

4.8.4.4.9 Permit System

Under Alternative F, visitors would be required to obtain an access permit prior to entering the Monument. This requirement would decrease the convenience of visiting the Monument, resulting in minor adverse effects on visitors seeking wildlife observation and photography opportunities.

4.8.5 Effects Analysis—Other Recreational Activities

In addition to hunting, fishing and wildlife observation/photography, the Monument provides opportunities for non-motorized and motorized boating, equestrian use, hiking and bicycling. There are no special-surface use regulations in place for boating on the Hanford Reach. Presently, there are no restrictions on cross-country hiking or equestrian use. Bicycles, however, are restricted to designated roads.

4.8.5.1 Effects Common to All Alternatives

4.8.5.1.1 Control of Non-native Invasive Species

No foreseeable effects on other recreational activities are anticipated through implementation of IPM actions.

4.8.5.1.2 Restoration Activities

No foreseeable effects on other recreational activities are anticipated through implementation of DOE's Rattlesnake Mountain restoration actions.

Riparian restoration treatments may affect some recreational activities, such as hiking or boating activities. Seasonal or intermittent area closures would be used to protect restoration activities

as needed in sensitive or fragile resource areas. Minor effects on other recreational activities would be expected under all alternatives.

4.8.5.1.3 Wildland Fire and Fire Suppression Activities

Other recreational activities in some portions of the Monument may be affected by fire precaution levels, ongoing wildland fire, fire suppression operations, fire effects, or fire restoration actions. These effects could include temporary suspension of all use by the general public, modified use through road or area closures, area closures due to high or extreme fire danger, and emergency evacuations due to threats to public safety. Effects on other recreational activities would be similar under all alternatives and would be governed solely by the extent of fire danger or ongoing fire operations on the Monument at the time. It is anticipated that effects on other recreational activities would be minor to moderate and periodic or short-term.

4.8.5.1.4 Modified Public Access

Visitors would benefit from increased access and improved visitor facilities, such as parking areas, trails and boat launches. However, visitor facility and access improvements would increase visitation to the Monument, resulting in adverse effects by increasing user conflicts, crowding, noise, litter and the risk of wildland fire.

4.8.5.2 Effects of Biological Resource Management Actions

Shrub-steppe restoration is a high priority for the protection of Monument Proclamation resources under all alternatives. Minor effects on recreational activities would be expected under all alternatives. Seasonal or intermittent area closures of restoration treatment areas would affect some recreational activities, such as hiking, horseback riding, or other activities that could potentially interfere with restoration efforts.

4.8.5.3 Effects of Visitor Services Management Actions— Interpretation and Education

4.8.5.3.1 Interpretive Site Development

Under Alternative A, interpretive sites would not be established in the Monument. Under Alternatives B–F, interpretive site development would have long-term beneficial effects on other

recreational opportunities by informing the public of the availability of such opportunities and how they can be enjoyed safely while protecting Monument resources. Messages would include information on safe boating practices, staying on trails designated as hiking and/or horseback riding, and bicycling only on established roadways. The threat of invasive species spread would be stressed, and any special closures or stock feed requirements would be addressed and explained. These messages would have a moderate, long-term, beneficial effect on visitors' experiences and protection of Monument resources.

4.8.5.3.2 Interpretive Trail Systems

Under Alternative A, no interpretive trails are planned. Under Alternatives B–F, the development of interpretive trail systems would have a moderate long-term beneficial effect on hiking in the Monument. Many trail users are reluctant to traverse unknown trails or open country; directional and interpretive signs would make these trail systems user friendly. Such a trail system would open Monument resources to a much wider range of visitors who desire to experience the Monument on foot while learning about its unique resources. Because interpretive trails would not likely be open to horses, no effects are anticipated related to equestrian use.

4.8.5.4 Effects of Visitor Services Management Actions—Recreation

4.8.5.4.1 Hunting

Hunting activities and the presence and noise of guns would adversely affect some visitors pursuing recreational activities such as boating, equestrian use, hiking, and bicycling. Because of the seasonal nature of this disturbance, adverse effects are anticipated to be minor.

4.8.5.4.2 Fishing

Fishing activities and associated congestion and noise during popular sportfishing seasons would have minor adverse effects on boaters and potentially other recreationists within sight and sound of the river.

4.8.5.4.3 Wildlife Observation and Photography

Alternatives B–F would have minor beneficial effects on visitors pursuing other recreational activities who would use wildlife observation and photography sites opportunistically.

4.8.5.4.4 Hiking

Alternative A would have negligible effects on hiking opportunities. Alternatives B and F would result in moderate beneficial effects on hiking opportunities in the Monument. Alternatives C, D and E would result in major beneficial effects by providing a greater extent of trail-based opportunities, including trails in the previously closed Rattlesnake Unit.

4.8.5.4.5 Equestrian Use

Alternative A would result in negligible effects on equestrian opportunities. Alternatives B–F would result in moderate beneficial effects on equestrian users by providing designated trail systems. For some non-equestrian users, equestrian use would have an adverse effect by increasing erosion effects of horse travel and by introducing horse excrement, odor, flies and trail encounters with horses to the visitor experience (Newsome et al. 2004).

4.8.5.4.6 Boat Launches

Vernita

Alternatives A, B and F are anticipated to have negligible effects on other recreational activities. Alternatives C, D and E would result in minor beneficial effects to motorboat-based visitors by improving boat access at this site. However, improved boat access would have minor adverse effects on other recreational activities by increasing use, congestion and noise in the area.

White Bluffs

Under Alternatives A and B, effects on other recreational activities would be negligible. Alternative C would result in major adverse effects on boaters preferring to launch at White Bluffs. Closing the launch and access road would have moderate beneficial effects on other recreationists using the river in this area by reducing sights and sounds of other visitors and vehicles. Land-based visitors seeking non-motorized recreational opportunities, such as hikers and equestrians, would also benefit from the closure of the access road. Under Alternative D, improving the White Bluffs Boat Launch would result in moderate beneficial effects on boaters by increasing the ease of river access. Alternatives E and F would result in moderate beneficial effects on non-motorized boaters and moderate adverse effects on motorized boaters as described for Alternative C.

Ringold

Under Alternative A, the primitive conditions at the Ringold launch area would serve as a deterrent to some visitors, who would continue to seek river access elsewhere, such as the White Bluffs Boat Launch or the developed launches in the Tri-Cities. Alternatives B–F would result in moderate beneficial effects by increasing the ease of access to the river in this area. However, improved boat access would have minor adverse effects on other recreational activities by increasing use, congestion and noise in the area.

South Shore

Alternative D would result in moderate beneficial effects on boating opportunities by providing one to two additional boat launches on the south shore. However, improved boat access would have minor adverse effects on other recreational activities by increasing use, congestion and noise in the area.

4.8.5.4.7 Camping

Vernita

Alternative A is anticipated to have negligible effects on other recreational activities. Alternatives B, C and F would result in moderate adverse effects on visitors wishing to camp in the Vernita Bridge area, likely displacing them to alternate sites outside the Monument (e.g., the community of Desert Aire, Benton County's Horn Rapids Park). Alternatives D and E would result in moderate beneficial effects by reducing travel time to various locations in the Monument for campground-based visitors. Campground activities, increased visitation, and associated noise and congestion would have minor adverse effects on other recreational activities in the Vernita Bridge vicinity.

Boat-In

Under Alternatives A, B and F, non-motorized boaters seeking to float the entire Hanford Reach would have no options for overnight stays in the Monument. Most non-motorized boaters would continue to divide the trip into two segments, leaving the river in mid-journey, traveling off-site for overnight accommodations, and completing an additional vehicle shuttle for the remaining segment. Establishment of boat-in campsites under Alternatives C, D and E would have major beneficial effects for non-motorized boaters seeking to float the entire Hanford Reach by providing access points for overnight use and removing the need to divide the trip into two separate trips.

Saddle Mountain

Under Alternatives A, B, C, E and F, visitors seeking camping opportunities would be required to leave the Monument, with some options available at sites near the Monument. Alternative D would result in major beneficial effects on visitors seeking to stay more than one day at the Monument by providing for overnight use.

4.8.5.4.8 Modified Public Access

Columbia River Unit

Vernita Bridge, South Shore. Alternatives A and E would result in negligible effects on other recreational activities. Alternatives B, C, D and F would result in minor adverse effects by reducing the acreage open to public use in this area.

Sand Dunes. Alternatives C, D and E would result in moderate beneficial effects on non-motorized recreation opportunities through increased access.

South Shore. Alternatives C, D and E would provide access to the south shore, resulting in moderate beneficial effects on other recreational activities through increased access.

North Shore. Alternatives D and E would provide additional access to the north shore, resulting in moderate beneficial effects on other recreational activities through increased access.

Ringold Unit

Parking Lots. Alternatives B, C, D and E would result in negligible effects on other recreational activities. Alternative F would result in minor adverse effects on other recreational activities by increasing the difficulty of access to areas surrounding Parking Lot 7.

Auto Tour. Alternative D would result in moderate beneficial effects on motorized recreational opportunities by increasing vehicle access and providing for through travel between the Ringold and Wahluke Units. Expanded vehicle access in the Ringold Unit would have minor adverse effects on non-motorized recreational activities.

Saddle Mountain Unit

Alternatives A and D would result in negligible effects on other recreational activities in the Saddle Mountain summit area. Alternative B would result in moderate adverse effects on other recreational activities by reducing the amount of land open to public access. Alternatives C and F would result in moderate beneficial effects on non-motorized recreational activities by

increasing the amount of land available for them and moderate adverse effects on motorized recreational activities by decreasing the acreage available for them. Alternative E would result in minor adverse effects by increasing the restrictions on allowable activities.

Wahluke Unit

West Access. Alternative B would result in minor beneficial effects on recreational activities, such as hiking and horseback riding, by providing public access. Alternatives C, D E, and F would result in moderate beneficial effects on recreational activities, such as hiking and horseback riding, by providing access to the Saddle Mountain Lakes.

Auto Tour. Alternative D would result in moderate beneficial effects on recreational activities, such as driving for pleasure and sightseeing, by increasing the road mileage open to public access.

4.8.5.4.9 Permit System

Under Alternative F, visitors would be required to obtain an access permit prior to entering the Monument. This requirement would decrease the convenience of visiting the Monument, resulting in minor adverse effects on visitors seeking other recreational opportunities.

4.9 Effects on Aesthetics and Solitude

The Monument offers some of the most dramatic landscapes in the Mid-Columbia Basin, characterized by basaltic mountains and ridgelines, rolling uplands, shifting sand dunes, White Bluffs flood deposits, and the Columbia River. Visible human modifications include historic homestead trees; Cold War defense and weapons production facilities; and modern power lines, communication towers, irrigation canals, and wasteways. Even with today's human influences, the Monument's landscapes offer a look into the past, before dam construction and the impounding of the Columbia River. The semi-pristine viewscape is enhanced by the immense feeling of solitude one feels when visiting the Monument. Such aesthetics and opportunities for solitude in a natural environment exist at few other places in the region. It is important that management actions strive to retain both the aesthetic value and the sense of solitude engendered by the open space and remoteness of the Monument.

4.9.1 Assumptions

All facility design would consider the viewscape and use color and topographic contours to hide facilities from long-range view and minimize effects on aesthetics to the greatest extent possible.

4.9.2 Effects Analysis—Aesthetics

4.9.2.1 Effects Common to All Alternatives

4.9.2.1.1 Wildland Fire and Fire Suppression Activities

Fire events lead to an increased likelihood for moderate short and long-term adverse effects on aesthetics through vegetation removal, suppression activities (bulldozer lines, hand lines, staging areas), and post-fire expansion of non-native invasive species. Natural fires (i.e., under natural fire regimes) can have moderate long-term beneficial effects on aesthetics. Fire can promote the establishment of diverse native plant communities, provide a mosaic plant community appearance, and help reduce the presence of non-native invasive species.

4.9.2.1.2 Public Use

Opening new areas to public access and improving visitor facilities would result in increased visitation. Larger numbers of visitors can adversely affect aesthetics through littering, vandalism, increased risk of wildfire, and spread of non-native invasive species. In addition, visitor facilities and signage can potentially degrade aesthetics by clashing with surrounding landscapes.

4.9.2.2 Effects of Biological Resource Management Actions

Minor, long-term, beneficial effects would result from IPM activities. A more diverse and visually pleasing natural landscape would develop through the control of non-native invasive plants. This effect would be most noticeable during the wildflower bloom in the spring through the reduction of non-native invasive species and the improvement of shrub-steppe habitat health and biodiversity.

Under Alternative A, rehabilitation activities would range from 0 to 10,000 acres annually and focus primarily on lands disturbed by wildfire events, maintenance-related project work,

Hanford Site mitigation, and control of non-native invasive plants species. Under Alternatives B–F, annual restoration activities would be conducted on 2,000–6,000 acres over 15 years. Restoration methods would be used primarily to restore degraded shrub-steppe habitats or disturbed areas to a natural range of native plant communities. Treatments could involve the use of prescribed fire to reduce the extent of non-native invasive species and minor ground disturbance associated with drill seeding and planting of native grasses, forbs and shrubs. Minor, short-term, adverse effects on aesthetics could result from these treatments, particularly the use of fire. The restoration of native grasses, forbs, and shrubs in areas now dominated by annual species such as cheatgrass and tumble weed would have moderate, long-term, beneficial effects on aesthetics.

Restoration activities on the summit of Rattlesnake Mountain would attempt to return portions of the site to pre–Manhattan Project conditions. The removal of buildings, towers and other infrastructure and subsequent restoration would have major beneficial effects on aesthetics in the Rattlesnake Mountain crest area. Under Alternatives A, D and E, the observatory structure would remain in place, with continuing moderate adverse effects to the immediate area on the crest of Rattlesnake Mountain, while the removal of the observatory under Alternatives B, C and F would have moderate beneficial effects.

Riparian restoration activities (removing non-native species, ground-disturbance, and planting and seeding) could have minor, localized, short-term, adverse effects on aesthetics. The reestablishment of native trees, shrubs, grasses, and forbs in riparian and wetland areas would have moderate, long-term, beneficial effects on the aesthetics of the Monument.

4.9.2.3 Effects of Visitor Services Management Actions— Interpretation and Education

4.9.2.3.1 Interpretive Site Development

Under Alternative A, interpretive sites would not be established in the Monument. Under Alternatives B–F, facilities and signage associated with interpretive sites would be designed to blend with the environment (e.g., framing, support, colors); however, they would still have some amount of adverse effect. Alternatives B and F, with limited site development, would have minor to negligible, long-term, adverse effects on the aesthetic environment. Alternative D, with the greatest number of developed sites, would have a minor, long-term, adverse effect. Under Alternatives C and E, facilities would be concentrated along the perimeters of the Monument and centers of activity, reducing the number of facilities in the interior. This approach to maintaining the native viewscape would have minor to negligible, long-term, adverse effects on the aesthetic environment.

4.9.2.3.2 Interpretive Trail Systems

Under Alternative A, no interpretive trails are planned. Under Alternatives B–F, from two to six interpretive trails are planned. Potential adverse effects would increase with the number of trails developed; conversely, the opportunity for visitors to experience the Monument’s aesthetic environment would also increase. Facilities and signage associated with interpretive trails would be designed to blend with the environment to reduce overall minor adverse effects.

4.9.2.4 Effects of Visitor Services Management Actions—Recreation

4.9.2.4.1 Hunting

Under all alternatives, hunting would have varying effects on the Monument’s aesthetic environment; responses to hunting are highly subjective. Some visitors, especially non-hunters, could experience adverse effects associated with hunting activities. The sight of orange safety garments typically worn by hunters would stand out on the landscape in some areas of the Monument. The sight of animals being killed and/or dead animals could be a major adverse effect for some visitors. Hunting-related litter, such as empty bullet casings, would also contribute to adverse effects. Adverse effects would be minor to major for some visitors and negligible for others.

4.9.2.4.2 Fishing

Under all alternatives, fishing activities would have varying effects on the aesthetic environment; responses are highly subjective. Fishing-related litter, such as discarded fishing line and fish entrails, would be an adverse effect on aesthetics for some visitors. Adverse effects would be minor to major for some visitors and negligible for others.

4.9.2.4.3 Wildlife Observation and Photography

Alternatives B–F would provide varying amounts of new viewing opportunities, including the construction of new facilities. However, with implementation of BMPs described in Section 4.0.1.2, the effects would have negligible to minor effects on the aesthetic environment.

4.9.2.4.4 Hiking

Under Alternative A, there would be no change to existing viewing opportunities. Under Alternatives B–F, new viewing opportunities would be available to visitors because of the creation of designated trails. Potential adverse effects would increase with the number of trails developed; however, facilities and signage associated with interpretive trails would be designed with to blend with the environment.

4.9.2.4.5 Equestrian Use

Under Alternative A, equestrian use would have negligible effects on the aesthetic environment. Under Alternatives B–F, designated trails and roadways would likely result in increased use of the Monument by equestrians, leading to an increased number of viewing opportunities. Horse excrement and flies on trails could constitute an adverse effect on aesthetics for some users. Adverse effects would be minor to major for some visitors and negligible for others.

4.9.2.4.6 Boat Launches

Vernita

Alternative A would have negligible effects on the aesthetic environment of the Vernita Bridge area. Under Alternatives B–F, limited changes to the area would have minor, long-term, beneficial effects on the aesthetic environment by modifying the current use patterns (and resulting damage) that occur in the Vernita Bridge area. Construction of a developed boat launch under Alternatives C, D and E would have minor, short-term, localized effects on aesthetics as a result of construction-related traffic, noise and dust.

White Bluffs

Alternatives A, B, E and F would have negligible effects on the aesthetic environment of the White Bluffs Boat Launch area. Alternative C would result in fewer viewers, but would still allow public access. Under Alternative C, visitors viewing this site from the Columbia River and other vantages would no longer see vehicles in this area; this would be a minor, long-term, beneficial effect. Alternative D would result in limited changes to the area. Any construction activities would have minor, short-term, localized, adverse effects on aesthetics as a result of construction-related traffic, noise and dust.

Ringold

Alternative A would have negligible effects on the aesthetic environment of the Ringold Fish Hatchery area and on viewing opportunities. Alternatives B–F would result in limited changes to the area and would have minor, long-term, beneficial effects on the aesthetic environment by improving the existing condition of the launch area. Construction activities would have minor, short-term, localized, adverse effects on aesthetics as a result of construction-related traffic, noise and dust.

South Shore

Alternatives A, B, C, E and F would have negligible effects on the aesthetic environment. Under Alternative D, a boat launch on the south shore would have minor, long-term, adverse effects on the surrounding aesthetic environment. Construction activities would have minor short-term, localized, adverse effects on aesthetics as a result of construction-related traffic, noise and dust.

4.9.2.4.7 Camping

Vernita

Alternative A would have negligible effects on the aesthetic environment of the Vernita Bridge area and on viewing opportunities. Alternatives B–F would result in limited changes to the area and would have minor, long-term, beneficial effects on aesthetics by changing the current use patterns (and resulting damage) in the Vernita Bridge area. Alternatives D and E would also provide a developed campground; construction activities would have minor, short-term, localized, adverse effects on aesthetics as a result of construction-related traffic, noise and dust.

Boat-In

Alternatives A, B and F would have negligible effects on aesthetics. With implementation of BMPs described in Section 4.0.1.2, Alternatives C, D and E would also have negligible effects on the aesthetic environment of the Hanford Reach.

Saddle Mountain

Alternatives A, B, C, E and F would have negligible effects on the aesthetic environment of the Saddle Mountain Unit. The campground associated with Alternative D would have a moderate, long-term, adverse effect on the aesthetic environment near it. Construction activities would have minor, short-term, localized, adverse effects on aesthetics as a result of construction-related traffic, noise and dust.

4.9.2.4.8 Modified Public Access

Columbia River Unit

Vernita Bridge, South Shore. Alternative A would have negligible effects on the existing aesthetic environment of the area. Alternatives B, C, D and F would result in minor, long-term, beneficial effects on the aesthetic environment by removing existing activities such as off-road vehicle use, littering, dumping and vandalism. This action would likely displace recreational users to the north side of the river; this modified use pattern could increase site damage and have long-term adverse effects on the aesthetic environment there. Alternative E would result in minor, long-term, beneficial effects by establishing designated roads and trails for visitor use.

Sand Dunes. Alternatives A, B and F would have negligible effects on the existing aesthetic environment of the portion of the Columbia River Unit near the sand dunes. Alternatives C, D and E would provide access to the dunes and more viewing opportunities for the public. However, alternatives C, D and E would have minor, long-term, adverse effects on the aesthetic environment through vegetation disturbance, introduction of non-native invasive plant species, and increased risk of human-caused wildfire.

South Shore. Alternatives A, B, and F would have negligible effects on the aesthetic environment of the south shore and on viewing opportunities. Under Alternatives C, D and E, increased visitation would result in minor, long-term, adverse effects on the aesthetic environment, including vegetation disturbance, introduction of non-native invasive plant species, and increased risk of human-caused wildfire. Alternatives C, D and E would also provide more viewing opportunities for the public along the south shore.

North Shore. Alternatives A, B, C and F would have negligible effects on the aesthetic environment of the north shore and on viewing opportunities. Increased visitation under Alternatives D and E would have minor, long-term, adverse effects on aesthetics through vegetation disturbance, introduction of non-native invasive plant species, and increased risk of human-caused wildfire. Alternatives D and E would also provide more viewing opportunities for the public along the north shore.

Ringold Unit

Parking Lots. Alternative A would have negligible effects on the existing aesthetic environment in the vicinity of the existing parking lots. Under Alternatives B–F, closing and rehabilitating parking lots would have minor, long-term, beneficial effects on aesthetics.

Auto Tour. Alternatives A, B, C, E and F would result in negligible effects on the aesthetic environment of the Ringold Unit. An auto tour route under Alternative D would have minor, long-term, adverse effects on aesthetics; however, additional viewing opportunities and

information regarding the natural and cultural history of the Ringold Unit and the Monument in general would increase visitors' appreciation of the aesthetic environment. Road improvement activities would have minor, short-term, adverse effects on aesthetics near the areas that would be upgraded as a result of traffic, noise and dust related to construction.

Saddle Mountain Unit

Alternative A would have negligible long-term effects on the existing aesthetic environment and would not result in changes to existing viewing opportunities. Alternative B would have minor, long-term, beneficial effects on aesthetics by allowing areas near the summit to recover from prolonged littering, trampling and vandalism; however, because the entire Saddle Mountain Road would be closed to the public, the public would no longer be able to view this portion of the unit. Under Alternatives C and F, increasing the difficulty of access would have minor beneficial effects on aesthetics by reducing adverse effects (e.g., litter, trampling, vandalism) in the summit area. Under Alternatives D and E, increased visitor use over time could have minor, long-term, adverse effects on aesthetics as a result of increased litter, damage to vegetation from trampling, the introduction of non-native invasive species, and the increased risk of human-caused wildfire.

Wahluke Unit

West Access. Alternative A would have negligible effects on the aesthetic environment. Alternatives B–F would provide new access points, open additional areas to visit, and offer new viewing opportunities for the public. Construction of the new access points would have minor, short-term, localized, adverse effects on aesthetics resulting from construction-related traffic, noise and dust. However, with implementation of BMPs described in Section 4.0.1.2, new access points in these areas would likely have negligible to minor long-term effects on the aesthetic environment. Increased visitation in the area would have minor, long-term, adverse effects on the aesthetic environment as a result of increased litter, damage to vegetation from trampling, the introduction of non-native invasive species, and the increased risk of human-caused wildfire.

Auto Tour. Alternatives A, B, C, E and F would have negligible effects on the aesthetic environment. Under Alternative D, effects would be similar to those described for the Ringold Unit auto tour above.

4.9.2.4.9 Permit System

Under Alternative F, an access permit system would result in negligible adverse effects on aesthetics.

4.9.3 Effects Analysis—Solitude

4.9.3.1 Effects Common to All Alternatives

Adverse effects on solitude would result from increased visitor use on the lands and waters of the Monument. Under all alternatives, these effects would be ameliorated by informing visitors about typical use patterns in the Monument, such as the seasons and locations that tend to receive high visitation and those that receive low visitation. Visitors seeking solitude could use such information in trip planning to increase the likelihood of experiencing solitude. Additionally, outside of hunting seasons, visitors would be encouraged to use natural-colored equipment and clothing to minimize their visibility to others.

4.9.3.2 Effects of Biological Resource Management Actions

Minor adverse effects on solitude can be expected through the implementation of IPM techniques and restoration activities. Effects would be localized and would vary seasonally and annually with scheduled work activities to control non-native invasive species and restore shrub-steppe habitats. Direct effects are anticipated to include increased noise, dust, vehicle traffic, and visibility reduction for visitors near specific project areas.

4.9.3.3 Effects of Visitor Services Management Actions— Interpretation and Education

4.9.3.3.1 Interpretive Site Development

As interpretive sites are developed, it is hoped that the number of visitors who use them will increase. This increase would have a minor, long-term, adverse effect on solitude but would be very localized. Because minimal interpretive sites are planned for the interior of the Monument, most use of such facilities would occur along transportation routes already established. Interpretive site development will mitigate the adverse effects of visitors using the backcountry by increasing their awareness and appreciation of Monument resources, and the concentration of site development in previously established use areas will help to maintain the sense of solitude in the shrub-steppe environment.

4.9.3.3.2 Interpretive Trail Systems

Under Alternatives B–F, from two to six interpretive trails are planned. The loss of solitude would increase with the number of trails developed. All trails would be sited to minimize visual effects and to avoid congestion. The interpretive trails would likely range from 0.5 to 1.5 miles in length and would be sited near notable Monument resources, some of which already receive considerable visitation.

4.9.3.4 Effects of Visitor Services Management Actions—Recreation

4.9.3.4.1 Hunting

Under all alternatives, hunting activities—especially the sound of weapons—result in seasonal, minor adverse effects on solitude in the Monument. Under Alternatives B–F, development and implementation of a step-down Hunting Plan is anticipated to result in negligible effects on solitude opportunities in the Monument.

4.9.3.4.2 Fishing

Under all alternatives, fishing activities result in seasonal, moderate adverse effects on solitude opportunities within range of the Hanford Reach through increased visitation during sportfishing seasons. Under Alternatives B–F, development and implementation of a step-down Fishing Plan is anticipated to result in negligible effects on solitude in the Monument.

4.9.3.4.3 Wildlife Observation and Photography

Alternatives B–F would result in increased use of the Monument for wildlife observation and photography, resulting in minor, long-term, adverse effects on solitude.

4.9.3.4.4 Hiking

Alternative A would not affect existing solitude opportunities. Alternatives B–F would result in increased use of the Monument for hiking, resulting in minor adverse effects on solitude for hikers.

4.9.3.4.5 Equestrian Use

Alternative A would result in negligible effects on solitude opportunities. Alternatives B–F would result in increased equestrian use of the Monument, resulting in minor adverse effects on solitude opportunities.

4.9.3.4.6 Boat Launches

Vernita

Under Alternative A, opportunities for solitude in the Vernita Bridge area would continue to be minimal during sportfishing seasons and northern pikeminnow Washington State reward seasons. Alternatives B and F would result in negligible effects on solitude opportunities. Under Alternative C, a developed boat launch would draw increased visitor use, resulting in moderate adverse effects on solitude opportunities at this site and within the river corridor. A developed boat launch under Alternatives D and E would result in moderate adverse effects on solitude due to increased visitor numbers and increased lengths of stay for the average visitor.

White Bluffs

Under Alternatives A and B, solitude opportunities at the White Bluffs Boat Launch would continue to vary seasonally, with minimal opportunities during sportfishing seasons. Alternative C would result in moderate beneficial effects on solitude opportunities in this area by increasing the difficulty of access and decreasing the number of visitors, as well as by removing the sight and sound of vehicles. Alternative D would result in moderate adverse effects on solitude opportunities by increasing visitor use related to boating. Alternatives E and F would result in negligible effects on solitude opportunities in this area.

Ringold

Alternative A would have no foreseeable effect on solitude. Under Alternatives B–F, a developed boat launch in this area is anticipated to have minor adverse effects on solitude in the river corridor by improving the ease and convenience of launching boats here.

South Shore

Solitude opportunities would not be affected under Alternatives A, B, C, E and F. Alternative D would result in minor adverse effects on solitude opportunities on the river due to increased visitor use that would result from increasing the ease and convenience of boat access from the south end of the Monument.

4.9.3.4.7 Camping

Vernita

Under Alternative A, opportunities for solitude in the Vernita Bridge area would continue to be minimal during sportfishing seasons and northern pikeminnow reward seasons. Alternatives B, C and F would result in negligible effects on solitude opportunities. A developed campground under Alternatives D and E is anticipated to result in minor adverse effects on solitude opportunities in the Monument due to increased visitor numbers and increased lengths of stay for the average visitor.

Boat-In

Alternatives A, B and F would have no foreseeable effect on solitude opportunities. Alternatives C, D and E would result in minor adverse effects on solitude on the river due to increased visitation by non-motorized boaters. Alternatives C, D and E would also result in moderate beneficial effects on solitude opportunities for non-motorized boaters by providing previously unavailable opportunities to camp along the river corridor.

Saddle Mountain

Alternatives A, B, C, E and F would have no foreseeable effects on solitude. Alternative D would result in minor adverse effects on solitude due to increased visitor numbers and increased lengths of stay for the average visitor.

4.9.3.4.8 Modified Public Access

Columbia River Unit

Vernita Bridge, South Shore. Alternatives A and E would have negligible effects on solitude opportunities. Alternatives B, C, D and F would result in minor adverse effects on solitude opportunities by reducing the lands available for public access.

Sand Dunes. Under Alternatives A, B and F, boaters on the river in the sand dunes area would not encounter the sights or sounds of visitors on the uplands. Under these alternatives, there would be negligible effects on solitude opportunities. Alternatives C, D and E would result in minor adverse effects on solitude opportunities for boaters in the sand dunes area, and minor beneficial effects on solitude opportunities by opening an additional area of the Monument to public access, thus absorbing visitation pressure from existing public use areas and providing access to a remote area.

South Shore. Under Alternatives A, B and F, boaters on the river would not encounter the sights or sounds of visitors on the south shore. Under these alternatives, solitude opportunities would not be affected. Alternatives C, D and E would result in minor adverse effects on solitude opportunities for boaters on the river near the south shore access points and minor beneficial effects on solitude opportunities by opening additional access points in the Monument.

North Shore. Under Alternatives A, B, C and F, boaters on the river would not encounter the sights or sounds of visitors on the north shore in this area. Under these alternatives, solitude opportunities would not be affected. Alternatives D and E would result in minor adverse effects on solitude opportunities for boaters on the river near the north shore access points. Alternative D would result in minor beneficial effects on solitude opportunities by opening additional access points in the Monument.

Ringold Unit

Parking Lots. Alternative A would result in negligible effects on solitude. Alternatives B, C, D and E would result in negligible effects on solitude, because rarely used parking areas would be closed. Alternative F would result in moderate beneficial effects on solitude opportunities in the vicinity of Parking Lot 7 by increasing the difficulty of accessing lands in the immediate vicinity. Alternative F would also in effect eliminate the use of the primitive boat launch at parking Lot 7, thus reducing vehicle traffic along the Ringold road.

Auto Tour. Alternatives A, B, C, E and F would result in negligible effects on solitude opportunities in the Ringold Unit. Under Alternative D, an auto tour route connecting the Ringold Unit with the Wahluke Unit would draw visitor use, as well as increase the convenience of travel between the Ringold and Wahluke Units. Moderate, long-term, adverse effects on solitude opportunities in the auto tour route area are anticipated.

Saddle Mountain Unit

With increased visitor use, Alternatives A, D and E would result in minor to moderate, long-term, adverse effects on solitude opportunities in the Saddle Mountain summit area. Alternative B would result in minor adverse effects on solitude opportunities in this area by decreasing the number of acres available for public use. Alternatives C and F would result in moderate beneficial effects on solitude opportunities in the area by increasing the difficulty of access and decreasing visitor use in this area.

Wahluke Unit

West Access. Under Alternative A, boaters would not encounter the sights or sounds of visitors on the uplands on the north side of the river between the Vernita Bridge and the White Bluffs Boat Launch. Under this alternative, existing opportunities for solitude for boaters in this area would be maintained. Alternatives B–F would result in minor adverse effects on solitude

opportunities for boaters using the river between the Vernita Bridge and the White Bluffs Boat Launch, with lesser effects resulting from Alternative B and greater effects resulting from Alternatives C, D, E and F. Alternatives B–F would also have minor beneficial effects on solitude opportunities for upland visitors by opening additional lands to public access, thus absorbing visitation pressure from existing public use areas.

Auto Tour. Alternatives A, B, C, E and F would have negligible effects on solitude. Under Alternative D, an auto tour route would attract visitor use throughout the year; however, opportunities for solitude would still be available outside popular use periods. Alternative D would result in minor beneficial effects on solitude opportunities by opening an additional area to public access, thus absorbing visitation pressure from existing public use areas.

4.9.3.4.9 Permit System

Under Alternative F, an access permit system would result in negligible adverse effects on solitude.

4.10 Effects on Special Area Designations

The Monument contains several areas that have been recognized for their special resource values by various designations—an Important Bird Area, a Research Natural Area, National Register Historic Districts, Washington Heritage Sites, eligible Traditional Cultural Properties, and a river corridor found eligible and suitable for designation as a national wild and scenic river.

4.10.1 Assumptions

Individual step-down management plans will be designed to retain the resource values of all special area designations. In addition, certain designations may require specific management plans.

4.10.2 Effects Analysis—Special Area Designations

4.10.2.1 Effects Common to All Alternatives

4.10.2.1.1 Management Actions

No foreseeable effects on special area designations are anticipated through the implementation of IPM plan actions, shrub-steppe and riparian restoration activities, restoration activities on ridgetops or lithosol soils, or fire management activities.

Inventories prescribed under this CCP would benefit special area designations by increasing knowledge and understanding of specific resources, locations and special conservation needs. Management actions to restore habitat and control non-native invasive species would improve resource conditions and thus benefit special area designations. Improved visitor facilities and increased public access would adversely affect special area designations by increasing the risk of wildlife disturbance, wildfire, vandalism, theft and accidental or purposeful disturbance of research projects.

4.10.2.1.2 Interpretation and Education

Interpretation and educational materials will include information on special area designations, their purpose, and any special regulations that apply, with the goal of enhancing public understanding and support for their protection. Research activities and research results will be featured in interpretive messages to further educate visitors on the importance of special designation areas.

The interpretation and education program would have long-term, beneficial effects by serving to educate visitors about the natural and cultural significance and sensitivity of such areas, as well as help direct public use patterns to minimize potential adverse effects.

4.10.2.2 Effects of Biological Resource Management Actions

No proposed resource management actions will affect special area designations.

4.10.2.3 Effects of Visitor Services Management Actions— Interpretation and Education

4.10.2.3.1 Interpretive Site Development

Any interpretive sites established on or adjacent to special designation areas will have the same effects as those described in the corresponding geological/paleontological, upland, aquatic and cultural resource sections.

4.10.2.3.2 Interpretive Trail Systems

Any interpretive trails established on or adjacent to special designation areas will have the same effects as those described in the corresponding geological/paleontological, upland, aquatic and cultural resource sections.

4.10.2.4 Effects of Visitor Services Management Actions— Recreation

4.10.2.4.1 Hunting

Under Alternatives B–F, hunting activities could occur in several special designation areas—IBA, National Register sites, eligible TCPs, and an eligible national wild and scenic river corridor. However, with implementation of BMPs described in Section 4.0.1.2, adverse effects are anticipated to be minor.

4.10.2.4.2 Fishing

The effects would be similar to those described above for hunting.

4.10.2.4.3 Wildlife Observation and Photography

Under Alternatives B–F, any development in the river corridor, such as access points, trails and visitor facilities, would have to be in compliance with the intent and provisions of the Wild and Scenic Rivers Act. Depending on the location of developed sites, increased human activity in the river corridor and concomitant disturbance could adversely affect breeding, foraging,

migration and wintering habitat values of an IBA. Also depending on the location of developed sites, increased public use carries a risk of adverse effects on the resource values of several National Register sites (Archaeological Districts). However, with implementation of BMPs described in Section 4.0.1.2, adverse effects on these special designation areas would be minor.

4.10.2.4.4 Hiking

Under Alternatives B–F, any development in the river corridor, such as access points, trails and visitor facilities, would have to be in compliance with the intent and provisions of the Wild and Scenic Rivers Act. Depending on the location of developed sites, increased human activity in the river corridor and concomitant disturbance could adversely affect breeding, foraging, migration and wintering habitat values of an IBA. Also depending on the location of developed sites, increased public use carries a risk of adverse effects on the resource values of several National Register sites (Archaeological Districts). Under Alternatives C, D and E, providing public access in the RNA would result in increased risk of accidental or purposeful disturbance of research projects. However, with implementation of BMPs described in Section 4.0.1.2, adverse effects on these special designation areas would be minor.

4.10.2.4.5 Equestrian Use

The effects would be similar to those described above for hiking activities.

4.10.2.4.6 Boat Launches

For all management actions related to boat launch development, any development in the river corridor, such as access points, trails, and visitor facilities, would have to be in compliance with the intent and provisions of the Wild and Scenic Rivers Act. No foreseeable effect on wild and scenic river eligibility is anticipated. Depending on the location of developed sites, increased human activity in the river corridor and concomitant disturbance could adversely affect breeding, foraging, migration and wintering habitat values of an IBA. Also depending on the location of developed sites, increased public use carries a risk of adverse effects on the resource values of several National Register sites (Archaeological Districts). However, with implementation of BMPs described in Section 4.0.1.2, adverse effects on these special designation areas would be minor.

4.10.2.4.7 Camping

Vernita

Under Alternatives D and E, campground development would have to be in compliance with the intent and provisions of the Wild and Scenic Rivers Act. No foreseeable effect on wild and scenic river eligibility is anticipated. Increased visitor use in the river corridor and concomitant disturbance could have minor adverse effects on breeding, foraging, migration and wintering habitat values of an IBA and carries a risk of adverse effects on the resource values of several National Register sites (Archaeological Districts). However, with implementation of BMPs described in Section 4.0.1.2, adverse effects on these special designation areas would be minor.

Boat-In

Any development in the river corridor, such as access points, trails, and visitor facilities, would have to be in compliance with the intent and provisions of the Wild and Scenic Rivers Act. No foreseeable effect on wild and scenic river eligibility is anticipated. Under Alternatives C, D and E, increased human activity in the river corridor and concomitant disturbance could have minor adverse effects on breeding, foraging, migration and wintering habitat values of an IBA and carries a risk of adverse effects on the resource values of several National Register sites (Archaeological Districts). However, with implementation of BMPs described in Section 4.0.1.2, adverse effects on these special designation areas would be minor.

Saddle Mountain

Because there are no special area designations in this unit, there are no foreseeable effects.

4.10.2.4.8 Modified Public Access

Columbia River Unit

Vernita Bridge, South Shore. Under Alternatives A and E, any developments associated with public access would have to be in compliance with the intent and provisions of the Wild and Scenic Rivers Act. No foreseeable effect on wild and scenic river eligibility is anticipated. Under Alternatives A and E, human activity in this area and concomitant disturbance could adversely effect breeding, foraging, migration and wintering habitat values of an IBA. Under Alternatives A and E, public access in this area carries a risk of adverse effects on the resource values of a National Register (Archaeological District) site. However, with implementation of BMPs described in Section 4.0.1.2, adverse effects on these special designation areas would be minor.

Sand Dunes. Any development associated with this action, such as access points, trails and visitor facilities, would have to be in compliance with the intent and provisions of the Wild and Scenic Rivers Act. No foreseeable effect on wild and scenic river eligibility is anticipated.

South Shore. Under Alternatives C, D and E, any development associated with this action, such as access points, trails and visitor facilities, would have to be in compliance with the intent and provisions of the Wild and Scenic Rivers Act. No foreseeable effect on wild and scenic river eligibility is anticipated. Increased human activity on the south shore and concomitant disturbance could adversely effect breeding, foraging, migration and wintering habitat values of an IBA. In addition, public access in this area carries a risk of adverse effects on the resource values of a National Register (Archaeological District) site. However, with implementation of BMPs described in Section 4.0.1.2, adverse effects on these special designation areas would be minor.

North Shore. The effects under Alternatives D and E would be similar to those described above for the south shore.

Ringold Unit

Parking Lots. Because there are no special area designations in this unit, there are no foreseeable effects.

Auto Tour. Because there are no special area designations in this unit, there are no foreseeable effects.

Saddle Mountain Unit

Because there are no special area designations in this unit, there are no foreseeable effects.

Wahluke Unit

West Access. Under Alternatives B, C, D and E, providing public access in this area would result in increased risk of disturbance of the resource values of a National Register (Archaeological District) site. With implementation of BMPs described in Section 4.0.1.2, adverse effects on this special designation area would be minor.

Auto Tour. Because there are no special area designations in this unit, there are no foreseeable effects.

4.10.2.4.9 Permit System

Under Alternative F, an access permit system would not result in foreseeable effects on special area designations.

4.11 Effects on Islands

The Columbia River Corridor Unit includes nineteen islands upstream of Richland, Washington. Six islands are in the McNary National Wildlife Refuge (McNary Islands) and thirteen are in the Hanford Reach National Monument (Hanford Islands). These islands are natural features of the Columbia River system; they were not constructed through dredging or development activities. The islands are considered highly significant due to their cultural and natural resources (Section 3.14).

Islands provide nesting and foraging habitat and escape cover for many species of birds and mammals. Shoreline riparian communities are seasonally important for a variety of species. Willows trap food for waterfowl and birds that use shoreline habitat (e.g., Forster's terns), as well as providing nesting habitat for passerines. Terrestrial and aquatic insects are abundant in emergent grasses and provide food for fish, waterfowl and shorebirds.

Islands in the Hanford Reach are considered important breeding areas for waterfowl and other migratory waterbirds; these islands support breeding of several groups of species, including shorebirds, colonial waterbirds, geese and ducks. Wildlife (e.g., mule deer) likely seek out the islands as calving habitat to avoid predators.

The islands were historically used by Native Americans and contain regionally and nationally significant cultural resources. Recorded archaeological sites demonstrate extensive use by Native American tribes, with the majority of site inventories representative of a wide range of Native American site types—pit house villages, campsites, fishing stations, root gathering and resource processing camps, caches, hunting blinds, rock cairns, talus pits, hearth features, sacred locations, cemeteries, quarries, and lithic tool production sites. The vicinity of the islands also serves as an important habitat for salmon spawning and rearing; salmon is a culturally significant resource to area Native American tribes.

Historically, all McNary Islands have been closed to the public above the mean high water mark, except for islands 14-18 during the Washington State waterfowl season. Hunters could access and hunt from those McNary Islands located upstream from the city limits of Richland, Washington, from October to January of each year. All other islands in the Hanford Reach have been closed to the public since 1943.

4.11.1 Assumptions

Present-day effects on islands result directly and indirectly from disturbances attributed to Columbia River flow fluctuations, erosion, and the removal of vegetation; from the construction and maintenance of facilities (e.g., research, Hanford warning systems, power transmission); from trespass activities; and through wildlife disturbance. Daily fluctuations in water levels affects island plant communities, shoreline integrity, and aquatic habitats. These fluctuations change the composition of vegetative associations by causing surface disturbance and non-native invasive species invasion; increase erosion along shorelines; and increase sediment deposition into riparian plant communities, leading to habitat degradation. However, addressing impacts to islands from the flow regime is outside the scope of this CCP.

4.11.2 Effects Analysis—Islands

4.11.2.1 Effects Common to All Alternatives

4.11.2.1.1 Interpretation and Education

The Hanford Islands are unique in their natural and cultural resources and their connection with regional history. Interpretation and educational efforts will focus on informing visitors of the sensitivity of island resources and the regulations in place to protect those resources. There are no impacts to islands anticipated through interpretation and education actions.

4.11.2.1.2 Recreational Activities

Under all alternatives, a year-round closure of all islands would be maintained. Waterfowl hunting activities, which have historically occurred above and below the mean high water mark of the McNary Islands, would not be allowed above that line.¹³⁰ Impacts to waterfowl hunting opportunities would be minor to negligible, as most waterfowl hunting activity occurs on the shorelines below the mean high water mark.

¹³⁰ Below the mean (or ordinary) high water mark, the state of Washington has jurisdiction. Waterfowl hunting and associated activities (e.g., decoy placement) around the upper-most five McNary Islands would still be allowed, subject to state regulations.

4.11.2.2 Effects of Biological Resource Management Actions

Restoration on the islands would include both upland and riparian restoration. Under alternatives B, C and F, restoration efforts could take place on islands. Under alternatives A, D and E, restoration, including any activities on the islands, would be conducted in response to disturbance events. Minor to moderate direct effects of restoration activities would include changing plant community structure and function from mid-seral to early seral successional processes; wildlife disturbance; soil disturbance; increased sedimentation during peak flow periods; and short-term effects on aesthetics. Moderate indirect effects would include habitat improvement for colonial nesting species, shorebirds and waterfowl; decreasing the presence or abundance of non-native invasive species; and increasing populations of native species, including rare and endangered plants.

4.11.2.3 Effects of Visitor Service Management Actions— Interpretation and Education

4.11.2.3.1 Interpretive Site Development

No interpretive sites are planned for development on islands under any alternative. The islands' natural and cultural history stories will be addressed through interpretive themes in exhibits located on mainland shores. No adverse effects on island resources are thus anticipated. Moderate long-term beneficial effects are expected to result from increased visitor understanding of island resources and support for their protection.

4.11.2.3.2 Interpretive Trail Systems

Because interpretive trails are not planned for the islands, there will be no effects on island resources.

4.11.2.4 Effects of Visitor Service Management Actions— Recreation

Because no proposed visitor services management actions would involve the islands, there are no foreseeable effects. Effects on riverine wildlife and plants are addressed in Section 4.3.

4.12 Population Management of Elk

Under Alternative C, controlled elk hunting on the Rattlesnake Unit of the Monument would be conducted to assist the WDFW in achieving its Rattlesnake Hills Elk Herd objectives as identified in existing plans (WDFW 2002).¹³¹ Elk hunting activities on the Rattlesnake Unit would be managed based on factors such as herd size and movements, monitoring data, and ongoing DOE and FWS activities on the Rattlesnake Unit (e.g., research, monitoring, education).

4.12.1 Assumptions

Under Alternative C, controlled elk hunting could take place on the Rattlesnake Unit from September through March, as necessary, to meet WDFW herd harvest objectives; hunting would occur only when there are more than 350 elk in the Rattlesnake Hills Elk Herd. Modern firearms would be used to maximize harvest rates.¹³² There would be approximately 42,000 acres (52% of the Rattlesnake Unit) available for elk population control through hunting. Based upon elk movement patterns and the time of year that hunting would occur, it is anticipated that less than 25% of the 42,000 acres would have reoccurring hunting. Initially, up to ten hunters would be used during specific ten-day periods to minimize alteration of typical elk distribution and behavior patterns. These periods would be implemented only when there is a high likelihood of harvesting elk. For these reasons and those listed below, it is anticipated that there would be no or very little population control hunting on the Rattlesnake Unit in either the early or late parts of the Washington State hunting season. More effort would likely be expended during the winter months (December–February) to maximize elk harvest. The FWS would consult with the WDFW in using an adaptive management approach to adjust the number of hunters and the number and length of hunting periods, considering: the numbers and locations of elk; harvest rates; movement patterns and behavior of elk in response to hunting; the ongoing management activities by the FWS, DOE and their agents on the Rattlesnake Unit; and weather.

Stipulations for this hunt are listed in the draft Compatibility Determination for Hunting in Appendix M.

¹³¹ The DOE has determined that hunting in the Rattlesnake Unit is not consistent with its current mission. As the mission of the DOE changes, or as the current ownership situation changes, hunting may be desirable and possible for elk population management. As noted, this possibility is addressed under Alternative C.

¹³² Using center-fire rifles here would be different than any other location on the Monument open to hunting. Elsewhere, only archery, shotguns and muzzleloaders are allowed.

4.12.2 Effects on Geological and Paleontological Resources

Hunters pursuing elk on the Rattlesnake Unit would walk cross-country or follow game trails. Such activity is anticipated to have negligible effects on soil erosion and associated impacts to geological and paleontologic resources because of the limited number of hunters and the size of the area involved.

4.12.3 Effects on Shrub-Steppe and Other Upland Resources

4.12.3.1 Effects on Wildlife and Habitat

Hunting activity would result in individual elk mortality. In addition, hunting activity, such as stalking and firearm discharge, would result in wildlife disturbance of other species using the area (e.g., mule deer, coyote, and various bird species). There would also be adverse effects on wildlife habitat through vegetation trampling, soil compaction, introduction of invasive plant species, and increased risk of wildfire. However, because of the limited hunting seasons, the dispersed nature of disturbance, and the availability of adjacent escape areas, minor adverse effects on individual animals and their habitat, and negligible effects on wildlife populations, are anticipated.

4.12.3.2 Effects on Microbiotic Crust

Hunting activities on the Rattlesnake Unit would cause some localized disturbance of microbiotic crust from foot traffic and elk retrieval actions. However, because of the limited number of hunters and dispersed nature of travel by hunters, impacts are anticipated to be minor.

4.12.3.3 Effects on Sensitive Plant Communities

Hunting activities would affect sensitive plant communities, primarily through the introduction and spread of invasive species and through human-caused wildfire events. The spread of non-native invasive species in remote areas of the Monument is of particular concern, because populations may become established within sensitive plant communities before they are detected and treated. In addition, such species can increase the fuel loads and flammability of sensitive plant communities, thus increasing the severity of wildfire events. However, with hunting stipulations and implementation of BMPs described in Section 4.0.1.2, adverse effects on sensitive plant communities are anticipated to be minor.

4.12.3.4 Effects on Threatened, Endangered, and Sensitive Species

Adverse effects of visitor-related activities on TE&S species would result primarily from loss or modification of habitat, including changes in vegetation community structure and composition, soil compaction, and establishment of invasive species. There is also possible disturbance and modification of diurnal and seasonal wildlife behavioral patterns caused by the visible and audible presence of hunters. In addition, severe impacts could result from human-caused wildfire. Hunting activities could also result in the take of TE&S species through illegal poaching, although because of the controlled nature of the hunt, poaching incidents would be highly unlikely. With the hunting stipulations and implementation of BMPs described in Section 4.0.1.2, adverse effects to TE&S species are anticipated to be minor.

4.12.4 Effects on Riverine, Other Aquatic/Wetland Resources

4.12.4.1 Effects on Wildlife and Habitat

The proposed hunting area surrounds several springs and short sections of surface streams. Hunting activities could cause disturbance to migrating bird species using riparian areas, although disturbance is anticipated to have minor adverse impacts due to the limited number of hunters and dispersed nature of hunting activities. Impacts could still occur through invasive species spread and wildfire as discussed above; however, with hunting stipulations, adverse effects are anticipated to be minor.

4.12.4.2 Effects on Sensitive Plant Communities

The effects would be similar to those described at 4.12.3.3 above.

4.12.4.3 Effects on Threatened, Endangered, and Sensitive Species

The effects would be similar to those described at 4.12.3.4 above.

4.12.5 Effects on Invasive Species

Hunting activities may contribute to the spread of non-native invasive plant species which could be transported in on vehicles, hunting equipment, clothing and footwear. However, the

introduction and spread of invasive plants would be minimized through the use of existing roads and parking areas for vehicles, and all hunters and their assistants would be required to annually attend an orientation session, where they would be briefed regarding measures to minimize the introduction and spread of invasive plants.

4.12.6 Effects on Habitat Connectivity

With the limited number of hunters and because are no facilities are associated with proposed hunting activities, impacts to connectivity are anticipated to be negligible.

4.12.7 Effects on Cultural Resources

4.12.7.1 Effects on Pre-Contact Cultural Resources

Hunting activities could result in soil compaction, vegetation disturbance, and increased erosion, all of which could expose pre-contact resources if any are present in the hunting areas; these impacts are anticipated to be minor due to the limited number of hunters and the dispersed nature of the hunting activity. Providing access to this area may result in some degree of impact through illegal collection. Impacts are anticipated to be minor, however, due to the hunting stipulations and controlled nature of the hunt. In addition, an orientation training session covering sensitive resources and associated rules would be required for all hunters.

4.12.7.2 Effects on Post-Contact Cultural Resources

The anticipated impacts to post-contact cultural resources would be similar to those described above under Pre-contact Resources.

4.12.7.3 Effects on Cultural Traditions

Hunting activity can result in soil compaction; potential disturbance of traditional food, medicinal and utilitarian plants; increased erosion; and potential exposure of pre-contact resources. Exposure leaves resources susceptible to degradation from the elements of weather, as well as disturbance associated with animal activity and human foot traffic, vandalism and theft. In addition, increased visitor use can affect traditional use and sacred areas through degradation of aesthetics, increased noise levels, and loss of solitude. However, with the limited number of hunters and hunting stipulations, adverse impacts are anticipated to be minor.

4.12.8 Effects on Interpretation and Education

Permitted information and education trips occur infrequently within the Rattlesnake Unit, most often in the spring (March–May, depending on weather) to view wildflowers. Because little or no elk hunting is expected during this time, impacts are anticipated to be negligible.

4.12.9 Effects on Recreation and Public Use

4.12.9.1 Effects on Hunting

Under Alternative C, hunting opportunities would be expanded for a limited number of hunters taking part in the elk population control effort, with minor beneficial impacts to overall hunting opportunities on the Monument.

4.12.9.2 Effects on Wildlife Observation and Photography

Controlled hunting activities will reduce the elk herd and potentially disrupt or alter elk movement patterns which typically provide observation and photography opportunities from highway pullouts along State Route 240. Also, Alternative C provides for observation and photography opportunities from hiking trails within the Rattlesnake Unit. Depending upon elk response to disturbance, animals could move farther away from highway pullouts and/or the trail system. Due to the short-term nature of disturbance, impacts are anticipated to be minor, though.

4.12.9.3 Effects on Other Recreational Activities

Under Alternative C, hiking trails would be established within the Rattlesnake Unit. Depending upon the location of the elk herd and hunting activities in relationship to the established trails, short term trail closures may take place, with minor adverse impacts to hiking opportunities.

4.12.10 Effects on Aesthetics and Solitude

Under Alternative C, while localized gunshots might be heard during the hours when elk hunting is ongoing, adverse effects on the aesthetic environment and solitude opportunities are anticipated to be negligible, especially as the area is generally closed to public access.

4.12.11 Effects on Special Area Designations

Under Alternative C, hunting activities would have impacts on natural and cultural resources as described in the above sections. However, based upon hunting stipulations and the controlled nature of the hunt, impacts to the values underlying the RNA, IBA and NERP designations are anticipated to be negligible.

4.12.12 Effects on Infrastructure

Under Alternative C, operation of the controlled hunt would require the installation of additional emergency evacuation sirens for use in case of a Hanford Site emergency event. This installation would have minor long-term impacts to natural or cultural resources.

4.12.13 Effects on Transportation

Under Alternative C, disturbance from hunting activities could push elk towards public roads adjacent to the Rattlesnake Unit, possibly leading to elk-car interactions. If this occurs all hunting activities would be suspended until this issue can be resolved.

4.12.14 Effects on Economics

Rocky Mountain elk have both beneficial and adverse effects on the local economy. Many complaints have been received by the WDFW about elk damage to agricultural crops adjacent to the Rattlesnake Unit. Elk can damaged orchards, crops, tree farms, and residential landscaping through herbivory, trampling, shredding and rubbing. Other adverse effects include elk-vehicle collisions and damage to fences, allowing domestic livestock to escape. Positive economic effects can result from elk viewing and photography; however, these effects are believed to be minor at this time as viewing opportunities occur only seasonally and are limited to a vehicle pullout along State Route 240. Under Alternative C, hunters would spend money locally on lodging, food, fuel, equipment and ammunition. However, due to the low numbers of hunters needed for population control, and the likelihood that many of these hunters would be local, economic effects are anticipated to be minor.

4.13 Effects on Social, Economic, and Infrastructure Resources

4.13.1 Effects Analysis—Infrastructure

The following infrastructure currently exists in and related to the Monument.

- State highways.
- Boat launches.
- Highway rest stop.
- Electric power substations.
- Irrigation return canals.
- Emergency sirens.
- County roads.
- Parking areas.
- Transmission lines.
- Communication towers.
- Pumphouses.

Infrastructure in and related to the Monument is operated and maintained by a variety of federal, state, and local government agencies and private interests. (Infrastructure specifically related to transportation is discussed in Section 4.13.2.)

4.13.1.1 Effects Common to All Alternatives

Increased visitation is anticipated to occur under all alternatives; the greatest increase would occur under Alternative D, followed in decreasing order by Alternatives E, C, B, F and A. Visitation increases will place new demands on infrastructure that would be directly used by the public, such as state highways, the Horn Rapids County Park, the Vernita Rest Area, and the Monument's transportation system. Increased visitation would also place higher demands on local emergency services. Given the undeveloped nature of the Monument, these impacts are anticipated to be moderate.

4.13.1.2 Effects of Biological Resource Management Actions

No foreseeable effects on infrastructure are anticipated through implementation of biological resource actions. The FWS would partner with facility operators to conduct non-native invasive

species control across all areas of infrastructure across the Monument, as these areas are likely corridors for weed establishment and spread. Under Alternative C, a potential elk population control hunt would require the installation of additional emergency evacuation sirens for use in case of an emergency event.

4.13.1.3 Effects of Visitor Services Management Actions— Recreation

4.13.1.3.1 Hiking

Under Alternatives C, D and E, providing hiking trails in the Rattlesnake Unit would require the installation of additional emergency evacuation sirens for use in case of an emergency event.

4.13.1.3.2 Boat Launches

Ringold

Under Alternatives B–F, improvement of the Ringold area and resulting increased visitor use of this area would result in an increased risk of adverse effects on utility facilities.

4.13.1.3.3 Modified Public Access

Columbia River Unit

Sand Dunes. Alternatives C, D and E would provide trail access to the sand dunes, resulting in an increased risk of vandalism to Energy Northwest's pumphouse and to transmission line facilities in the area. Opening this area to public use would require the installation of additional emergency evacuation sirens for use in case of an emergency event.

Rattlesnake Unit

Under Alternatives C, D and E, opening this area to public use would require the installation of additional emergency evacuation sirens for use in case of an emergency event.

Ringold Unit

Under Alternatives B–F, the FWS would work with partners to provide a developed boat launch adjacent to the Monument boundary in the WDFW’s Ringold Fish Hatchery area. Improvement of the Ringold launch and resulting increased visitor use of this area would lead to an increased risk of adverse effects on utility facilities. Impacts have been addresses throughout this EIS.

4.13.2 Effects Analysis—Transportation

The environmental consequences related to transportation include potential impacts on traffic volume, LOS, parking, access, safety, circulation and non-motorized travel. This section considers the potential effects of each of the proposed alternatives and recommends mitigation to address effects that are potentially significant.

4.13.2.1 Effects Common to All Alternatives

Increased access and improved visitor facilities would likely attract increased visitor use under all alternatives. Increased visitor use would result in increased traffic volumes and increased maintenance requirements for public roads and parking areas. Upgrades to any transportation facilities would be designed to WSDOT specifications in coordination with the appropriate agencies.

4.13.2.2 Methodology

4.13.2.2.1 Baseline Traffic Volumes

Traffic volumes were projected to 2025 to be consistent with the timelines of typical long-range transportation planning efforts in the state of Washington. This timeline is conservative because it extends beyond the life of the project alternatives.

Before assessing the impacts of the alternatives on traffic conditions, the baseline average daily traffic (ADT) volumes were estimated for the planning year 2025. These projected ADT volumes reflect the traffic growth expected to occur based on typical growth in the region. Typical traffic growth on state highways in the project area was calculated using WSDOT data collected between 1996 and 2002 (WSDOT 1997, 2004), resulting in an average annual growth rate of approximately 4%. This growth rate was applied to existing traffic volumes at key locations in the study area to estimate baseline ADT volumes in 2025. Projected traffic volumes

on major highways throughout the area are well below maximum ADT volumes that would maintain LOS C or better. (See below for a detailed description of LOS.) Table 4.2 summarizes the projected 2025 baseline ADT volumes.

Table 4.2. Baseline Traffic Projections.

Highway	Location	Existing Average Daily Traffic ¹	Projected 2025 Volume ²	Maximum ADT To Maintain LOS C ³
State Route 24	West of SR 240	2,900	6,900	12,000
State Route 24	North of SR 240	3,500	8,300	10,000
State Route 24	At Vernita Bridge	3,400	8,100	12,000
State Route 24	East of SR 243	830	2,000	11,000
State Route 240	North of SR 225	3,200	7,600	12,000
State Route 240	North of I-82	18,000	42,700	62,000

¹ Source: WSDOT 2003.
² Based on average annual traffic growth rate of 4% per year.
³ Based on Highway Capacity Manual (TRB 2000) highway LOS procedures.

4.13.2.2.2 Trip Estimates for Alternatives

Traffic volumes were estimated for each alternative based on the range of visitor projections summarized in Table 4.3. These projections are conservative estimates. Annual vehicle volumes for each alternative were developed by dividing the total number of projected annual visitors by an average of 2.3 persons per vehicle, as summarized in Table 4.3.

Table 4.3. Annual Visitor Estimates Used for Traffic Projections and Annual Vehicle Estimates.

Alternative	Visitor Projection (Average Per Year)	Traffic Generation (Average Vehicles/Year)
A	63,000	24,400
B	85,000	37,000
C	110,000	47,800
D	135,000	58,700
E	125,500	54,600
F	85,000	37,000

The projected annual vehicle volume was further broken down into projected monthly volumes by applying the observed monthly traffic volumes collected by the WSDOT on State Route 240 just south of State Route 24 (Table 4.4). As shown in the table, the highest level of traffic occurs during October.

The WSDOT has also collected data at this location that can be used to calculate the percentages of weekly traffic that occur on a typical weekday and a typical weekend day. Based on daily traffic variations, 13.1% of weekly traffic occurs on a typical weekday (Monday–Thursday), and 15.9% of weekly traffic occurs on a typical weekend day (Friday–Sunday).

Table 4.4. Monthly Traffic Percentages in Study Area.

Month	Percentage of Annual Traffic
January	6.2%
February	6.3%
March	7.6%
April	7.8%
May	8.3%
June	8.8%
July	9.6%
August	10.2%
September	10.0%
October	10.4%
November	8.0%
December	6.8%

Peak daily traffic was estimated for each alternative by applying the monthly and weekly percentage breakdowns to the projected annual totals (Table 4.5). As shown in the table, the maximum number of vehicles projected under this range of visitor assumptions is 219 vehicles per weekend day (under Alternative D). To assess the adequacy of the highways in the study area, the projected maximum vehicle volume of 219 was doubled, to account for round trips, resulting in a projected total of 440 trips per peak weekend day potentially related to Monument traffic.

Using this method, an increase of 10,000 annual visitors projected beyond the 135,000 maximum already projected would translate into an additional sixteen vehicles, or thirty-two trips, per day.

Table 4.5. Annual Vehicle Estimates by Alternative.

Alternative	Annual	Peak Month ¹	Peak Week ²	Peak Weekday ³	Peak Weekend Day ⁴
Existing Conditions	27,400	2,850	643	84	102
A	37,000	3,848	869	114	138
B	37,000	3,848	869	114	138
C	47,800	4,971	1,123	147	178
D	58,700	6,105	1,379	181	219
E	54,600	5,678	1,282	168	204
F	37,000	3,848	869	114	138

¹ Existing traffic data indicates that October is the peak month, with 10.4% of total annual traffic. Peak monthly volume = Annual volume x 10.4%.
² Peak week volume = Peak month volume / 31 days per month x 7 days per week.
³ Peak weekday volume = Peak week volume x 13.1%.
⁴ Peak weekend volume = Peak week volume x 15.9%.

4.13.2.2.3 Trip Distribution

The derived trips were distributed on the basis of data obtained from a market analysis completed for the planned Visitor Center (EcoNorthwest 2003), which included population estimates within 120 miles of the Tri-Cities, as well as farther away in Washington and Oregon (Table 4.6). These estimates indicate that most visitors to the Monument will arrive from population areas within 120 miles of the site. Trips were assigned to various access points based on the proportional share of population closest to that access point within a 120-mile radius, as shown in the table. The “Rest of Washington” percentage was based on the same rationale, with 6% dispersed to the north approach to reflect I-90 access.

Table 4.6. Traffic Volume Distribution.

Area	Population Percentage ¹	West Approach SR 24	North Approach SR 243	East Approach SR 24	South Approach SR 240
Benton County	18%				18%
Franklin County	6%			3%	3%
Yakima County	27%	27%			
Rest of Washington	21%	5%	6%	1%	9%
Oregon	28%				28%
Totals	100%	33%	6%	4%	60%

¹ Population within 120 miles of the Tri-Cities (further dispersed between Benton, Franklin and Yakima Counties) and in Washington and Oregon (EcoNorthwest 2003).

4.13.2.2.4 Roadway LOS Assessment

LOS designations are qualitative measures of congestion that describe operational conditions within a traffic stream; they take into consideration factors such as volume, speed, travel time, and delay. Level of service is represented by letter grades A–F, which represent progressively worsening traffic and congestion conditions. (See Section 3.18.2.4 for descriptions of the LOS grades.) To determine LOS conditions that might result from Monument management, the 440 project-generated trips identified above were added to the projected baseline volumes at each of the study locations. Table 4.7 summarizes the maximum daily volumes that were projected for 2025 under the highest traffic alternative. To be conservative, the projected trips were not distributed between State Route 24 and 240 according to the percentages summarized in Table 4.6. Instead, all trips were conservatively assumed to travel the length of the highways within the study area, so the maximum projection of 440 vehicle trips was added to each of the projected daily baseline totals.

As shown in Table 4.7, under this maximum volume assessment, the total projected traffic volumes are well below what would be allowed to maintain LOS C on these highways. Therefore, under all alternatives, projected traffic volumes are not expected to have a significant effect on roadway operations in the study area.

Table 4.7. LOS Assessment Under Alternative D (Highest Projected Traffic Volume).

Highway	Location	Projected 2025 Baseline Volume ¹	Maximum Projected Peak Daily Volume ²	Total Projected 2025 Volume Alternative D	Maximum ADT to Maintain LOS C ³
State Route 24	West of SR 240	6,900	440	6,340	12,000
State Route 24	North of SR 240	8,300	440	8,740	10,000
State Route 24	At Vernita Bridge	8,100	440	8,540	12,000
State Route 24	East of SR 243	2,000	440	2,440	11,000
State Route 240	North of SR 225	7,600	440	8,040	12,000
State Route 240	North of I-82	42,700	440	43,140	62,000

¹ See Table 4.2.
² Based on the conservative assumption that 100% of projected traffic under Alternative D.
³ Based on Highway Capacity Manual (TRB 2000) highway LOS procedures.

4.13.2.2.5 Parking

The parking demand projected under each alternative is summarized in Table 4.8. This projection conservatively assumes that all projected peak weekend day vehicles will park at the same time. As shown in the table, the total number of parking spaces incorporated into each alternative is adequate to accommodate this conservative estimate of parking demand. The parking supply summarized in Section 3.18.2 indicates an existing supply of approximately 100 parking spaces in the Monument. This should be adequate to serve existing parking needs, but this will likely need to be increased under the higher levels of use defined under the project alternatives.

Table 4.8. Maximum Daily Parking Estimates.

Alternative	Maximum Parking Demand
Existing Conditions	102
A	138
B	138
C	178
D	219
E	204
F	138

4.13.2.2.6 Access, Safety, and Circulation

Access Control of State Highways

As discussed in Section 3.18.2, the highways in the Monument's vicinity are classified as limited-access highways and specifically fall under the definition of partial access-control facilities. No new intersecting access roadways are being proposed as part of this project, but upgrades of existing access points/intersections are being proposed under each alternative.

Under the maximum use of Alternative D, only two or three upgrades of access points are proposed across the length of the highways in the vicinity of the Monument, and these would be spaced more than one mile apart. The FWS will need to obtain approval from the WSDOT (North Central Region, north of the Columbia River; and South Central Region, south of the Columbia River) for proposed upgrades to existing access roadways and work very closely with the WSDOT to identify the appropriate design characteristics, consistent with WSDOT design standards, at these locations.

Easements for State Highways and Intersecting Roads

The WSDOT has easements from the DOE for all state highways crossing the Monument and the rest of the Hanford Site. These easements were granted by the DOE and are subject to revocation if necessary, although this is very unlikely considering the revised mission of the DOE on the Hanford Site. All other roads in the Monument are either DOE roads or allowed through agreements and/or easements by the DOE to a third party for an express purpose (e.g., irrigation canal maintenance, utility corridors, research access).

Safety

Historical accident data presented in Section 3.18.2 indicate that the rate of accidents in the project area is lower than the statewide average. Increased traffic volumes and increased recreational traffic (which tends to travel more slowly), mixed with the commute and freight traffic that currently predominates in the area (and which tends to travel more quickly), have the potential to result in more accidents in the area. Upgraded access points into the Monument will need to include features such as acceleration/deceleration lanes, consistent with WSDOT design standards, that allow recreational traffic to more safely enter and exit the main traffic stream. The FWS will need to work closely with the WSDOT to determine the appropriate design characteristics at intersections.

Internal Circulation

The maximum daily traffic volumes projected under each alternative can be easily accommodated by a basic two-lane roadway. A minimum design standard for two-lane

roadways (i.e., eighteen-foot width with six-foot shoulders on one or both sides) will need to be incorporated into Monument step-down plans.

4.13.2.2.7 Roadway Maintenance

Increased traffic due to higher recreational use in the Monument would be expected to increase maintenance needs in the area. For example, increased use also increases the potential for increased roadside litter and abandoned vehicles. However, the increases in traffic attributable to the Monument would be a small portion of the overall traffic on the road system, and therefore the impacts would be minor.

4.13.2.2.8 Non-Motorized Travel

Non-motorized travel in the Monument is expected to increase under all alternatives; recreational activity in the area is expected to generate pedestrian, bicycle and equestrian traffic in areas of the Monument that are open to the public. To accommodate non-motorized traffic, access roadways will need to be designed within the Monument to include either shoulders on one or both sides or parallel trails. Providing roadway shoulders or trails, where appropriate, would separate non-motorized traffic from vehicular traffic, allowing pedestrian, bicycle and equestrian traffic to be safely accommodated. Because non-motorized considerations will be incorporated into facility design under the selected alternative, this would be a minor effect.

4.13.2.3 Effects and Mitigation

It would be expected that Alternative D would have the greatest effect on the transportation system and Alternative A would have the least. However, any amount of increased recreational use is expected to have some level of effect. Accordingly, the following effects and mitigation discussion applies to all alternatives.

4.13.2.3.1 Traffic Volume and Level of Service

Total traffic volume in the study area is expected to increase under any of the alternatives. However, analysis presented in the previous section shows that the maximum daily traffic volumes projected in addition to the baseline levels determined for 2025 will not cause level of service on the highways to exceed LOS C. Therefore, this effect is negligible.

4.13.2.3.2 *Parking*

Total parking demand in the Monument is expected to increase as a result of implementing any alternative. More parking spaces will eventually need to be provided to accommodate increased parking needs for the selected alternative. This is a minor effect.

4.13.2.3.3 *Highway Access and Safety*

Recreational traffic in the Monument will likely increase, necessitating changes at the proposed Monument access points.

Once a final alternative is selected, the FWS will work with the WSDOT (North Central Region, north of the Columbia River; and South Central Region, south of the Columbia River) to identify any necessary roadway upgrades needed to facilitate increased visitation. The FWS will work very closely with the WSDOT to identify appropriate roadway design characteristics, consistent with WSDOT design standards. In addition to meeting the requirements of limited-access highway (minor arterial with partially controlled access), the design will include safety considerations to address Monument-generated traffic entering and exiting the highway traffic stream. With implementation of these activities, this would be a minor effect.

4.13.3 *Effects Analysis—Economics*

Environmental consequences related to economics comprise the direct, indirect and induced economic effects that changes in employment and recreation use are expected to incur under the project alternatives.

4.13.3.1 *Effects Common to All Alternatives*

Increased visitor use would result in a projected increase of funds circulating throughout the local economy. These expenditures would be in the form of additional jobs and typical visitor expenses such as lodging, food and drink, and transportation. The greatest increase of visitor use would be expected to occur under Alternative D, followed in decreasing order by Alternatives E, C, B, F and A.

4.13.3.2 Methodology

4.13.3.2.1 Economic Analysis Study Area

The Monument is located in Adams, Benton, Franklin and Grant Counties. A perimeter of sixty miles surrounding the Monument encompasses portions of Kittitas, Walla Walla, and Yakima Counties. These seven counties are considered to comprise the affected economic region and were accordingly included in the economic impact analysis.

4.13.3.2.2 Activity Levels for Alternatives

The alternatives, described in detail in Chapter 2, vary primarily in the level of public use that would be allowed and encouraged in the Monument. The differing levels of use among the alternatives are expected to be a result of the number of acres open to public use and Monument expenditures on facilities, infrastructure, staffing and information dissemination. For purposes of economic analysis, the different alternatives must be translated into specific projections of staffing, project expenditures, and expected numbers of visitors. The projections developed for this analysis are described in the following sections.

4.13.3.2.3 Economic Impact Analysis

Economic impact analysis is an assessment of the change in overall economic activity as a result of some change in one or more economic activities (Minnesota IMPLAN Group 2004). For the Monument, analysis involves determining the overall change in economic activity in the seven-county study area expected to result from changes in economic activities associated with the Monument (i.e., implementation of the different alternatives).

Description of Input-Output Model

An input-output model was developed for this study utilizing IMPLAN (Impact Analysis for Planning) software. Input-output models measure the direct and indirect economic relationships within a regional economy in terms of additional industry output, jobs and income. An input-output model also measures the economy by compiling and tracking the transactions of businesses and industries in more than 500 sectors. It is considered a secondary system in that it does not employ survey-based data. Instead, IMPLAN is based on national average relationships between industries to which regional relationships are added.

The IMPLAN model developed was used to estimate the effects on the local economy of spending by recreational visitors to the Monument and of the employment, capital expenditures,

and operating expenditures of the Monument. The potential regional economic impacts of these expenditures were evaluated for each alternative, as well as for existing conditions. The change of economic activity from existing conditions is considered the economic impact.

4.13.3.2.4 Inputs to Economic Analysis

The following sections describe the data that were developed for the project alternatives; this is the input into the economic model.

Refuge Staffing and Expenditures. Table 4.9 summarizes the Monument staffing needs that have been projected for each alternative. Table 4.10 summarizes the approximate annual non-salary expenditures that are projected with implementation of each alternative.

Table 4.9. Projected Annual Staffing Expenditures by Alternative.

Alternative	Number of Employees (2020)¹
Alternative A	26
Alternative B	45
Alternative C	45
Alternative D	45
Alternative E	45
Alternative F	45
1 - Under Alternative A, fourteen employees are covered by base funding, and the salaries of other employees are covered by other sources. Under Alternatives B–F, all salaries are covered by base funding.	

Table 4.10. Projected Non-salary Expenditures by Alternative.

Alternative	Average Annual Expenditure (2020)¹
Alternative A	\$17,240
Alternative B	\$661,106
Alternative C	\$662,625
Alternative D	\$653,685
Alternative E	\$662,625
Alternative F	\$654,854
1 - Expenditures from base funding.	

Usage Forecasts for Alternatives. The number of annual visitors to each potential recreation type is summarized in Table 4.11. The projections are based on existing visitor counts and visitation of other national wildlife refuges with similar uses.

For purposes of economic analysis, visitor counts are measured according to recreational visitor-days, which is defined as an eight-hour day (Caudill et al. 2003). Thus, a person participating in an activity for four hours would be counted as spending one-half of a visitor-day. This prevents over-estimation of spending attributable to the Monument that would result if brief visits were counted the same as extended stays.

In a given day, a visitor may engage in more than one recreational activity. To count that person once under each activity would result in an over-estimation of the total number of visitors and, in turn, an over-estimation of spending attributed to those visitors. Thus, for purposes of economic analysis, visitors are counted once according to their primary activity.

Table 4.11. Projected Annual Monument Visitation by Alternative.

Primary Activity	Annual Visitor Days by Alternative						
	Existing	Alt A	Alt B	Alt C	Alt D	Alt E	Alt F
Big game hunting	200	180	180	200	204	200	180
Upland game hunting	400	360	360	360	360	360	360
Waterfowl hunting	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Fishing	20,000	23,000	23,000	24,000	25,000	24,500	23,000
Wildlife observation	500	600	650	700	750	725	625
Wildlife photography	70	74	77	84	91	87	75
Education/Interpretation	250	250	275	2,750	5,250	3,750	260
Hiking	330	1,980	4,290	6,930	8,250	7,500	3,500
Non-motorized boating	670	2,680	4,690	7,370	8,710	8,000	3,600
Motorized boating	2,000	2,400	2,460	2,500	2,800	2,600	2,430
Commercial river trips	1,880	2,162	2,162	2,256	2,350	2,300	2,162
Primitive camping	2,700	3,105	0	3,450	3,450	3,450	0
Equestrian use	330	380	363	406	406	406	340
Developed camping	0	0	0	0	33,350	23,000	0
Driving for pleasure	330	3,630	6,930	10,230	13,530	11,000	5,500
Totals	30,660	41,801	46,437	62,236	105,501	88,878	43,032

Resident and Non-Resident Visitors. The estimated visitors summarized in Table 4.11 were further categorized as resident or non-resident. Residents are defined as visitors who live within thirty miles of the Monument, and non-residents are visitors who live beyond the thirty-mile radius. Making the distinction between resident and non-resident visitors is important in economic analysis because each group has different spending characteristics. Non-residents typically spend more than residents, as is shown in the following section.

Table 4.12. Projected Annual Monument Visitation by Alternative.

Primary Activity	Resident	Non-Resident	Source
Big game hunting	25%	75%	1
Upland game hunting	75%	25%	1
Waterfowl hunting	50%	50%	1
Fishing	70%	30%	1
Wildlife observation	65%	35%	1
Wildlife photography	65%	35%	1
Education/Interpretation	90%	10%	2
Hiking	90%	10%	1
Non-motorized boating	65%	35%	2
Motorized boating	65%	35%	2
Commercial river trips	35%	65%	3
Primitive camping	75%	25%	2
Equestrian use	90%	10%	2
Developed camping	50%	50%	2
Driving for pleasure	35%	65%	3
1 - Based on observed percentages for same activity at the Umatilla National Wildlife Refuge (Caudill et al. 2003). 2 - Based on observed percentages for similar type of non-consumptive activity at the Umatilla National Wildlife Refuge (Caudill et al. 2003). 3 - Based on assumption that a greater number of non-resident visitors than resident visitors would participate in tourist-oriented activities.			

Table 4.12 summarizes the estimated percentages of residents versus non-residents. Most values are based on data that were recorded for similar activities at the Umatilla National Wildlife Refuge, located in Morrow County, Oregon, and Benton and Franklin Counties, Washington (Caudill et al. 2003). Caudill did not provide data that could be used to estimate percentages for “Driving for Pleasure” or “Commercial River Trip” activities. In both cases, the assumption was

made that, because these tend to be more tourist-oriented activities, a greater number of non-resident visitors than resident visitors would participate.

Average Annual Visitor Expenditures. Table 4.13 summarizes the estimated average daily expenditures for the primary recreational activities as defined by the Monument alternatives. Expenditures were developed for both resident and non-resident recreational visitor-days. Expenditure information was developed according to the following four categories.

Lodging. Overnight lodging at hotels and motels.

Food and drink. Purchases from grocery stores as well as restaurants.

Transportation. Gas and oil purchase, automobile maintenance and repair, and air transportation.

Other. All other miscellaneous purchases associated with recreational use, such as clothing, sporting goods, and photographic services.

The primary source of spending information used for this analysis was obtained from *Banking on Nature 2002* (Caudill et al. 2003), which is based on compiled data from the FWS National Survey of Fishing, Hunting and Wildlife-Associated Recreation and the FWS Refuge Management Information System (RMIS). These data were further refined with information from refuge staff, regional tourism agencies, and other recreation providers (Caudill 2003). Data from these sources were combined to develop profiles of refuge spending in local communities.

The other primary source of expenditure data that was used for this analysis is *Spending Profiles of National Forest Visitors, 2002 Update* (Stynes and White 2004). This report presents national forest visitor spending profiles developed from the National Visitor Use Monitoring Project surveys collected between 2000 and 2002. This report provided more explicit information on some non-consumptive activities, such as hiking and driving for pleasure, that were not covered in the *Banking on Nature* report.

Values obtained from these two sources were based on 2001 dollars and adjusted using the Consumer Price Index (CPI). The CPI is a measure of the average change over time in the prices paid by urban consumers for a market basket of consumer goods and services; it can be used as a means of adjusting dollar values. Based on the CPI, the 2001 values were adjusted to reflect 2005 dollars by applying a multiplier of 1.08 (U.S. Department of Labor 2005).

The average expenditures per person per resident and non-resident visitor day were applied to the visitor projections summarized in Table 4.11, resulting in estimates of average annual expenditures in each of the four categories—lodging, food/drink, transportation and other.

Table 4.13. Average Expenditure per Person per Visitor-Day (2001 \$).

Primary Activity	Lodging		Food/Drink		Transportation		Other		Source
	R	NR	R	NR	R	NR	R	NR	
Big Game Hunting	\$1.78	\$3.05	\$16.00	\$18.99	\$14.14	\$37.36	\$4.23	\$29.04	1
Small Game Hunting	\$3.52	\$6.85	\$9.19	\$18.99	\$10.25	\$46.44	\$2.84	\$5.17	1
Waterfowl Hunting	\$0.45	\$9.80	\$7.80	\$38.56	\$6.74	\$91.71	\$13.35	\$14.06	1
Fishing	\$3.47	\$8.21	\$8.68	\$17.51	\$8.11	\$29.50	\$9.09	\$7.39	1
Wildlife Observation	\$5.17	\$35.10	\$7.45	\$27.25	\$6.59	\$41.91	\$1.52	\$3.81	2
Wildlife Photography	\$5.17	\$35.10	\$7.45	\$27.25	\$6.59	\$41.91	\$1.52	\$3.81	2
Interpretation	\$0.45	\$3.05	\$3.26	\$6.50	\$3.38	\$5.63	\$0.85	\$1.34	4
Hiking	\$0.45	\$3.05	\$3.26	\$6.50	\$3.38	\$5.63	\$0.85	\$1.34	3
Non-Motorized Boating	\$5.17	\$35.10	\$7.45	\$27.25	\$6.59	\$41.91	\$1.52	\$3.81	2
Motorized Boating	\$5.17	\$35.10	\$7.45	\$27.25	\$6.59	\$41.91	\$1.52	\$3.81	2
Commercial River Trips	\$5.17	\$35.10	\$7.45	\$27.25	\$6.59	\$41.91	\$1.52	\$3.81	2
Primitive Camping	\$0.00	\$0.00	\$4.63	\$18.53	\$3.12	\$18.73	\$4.29	\$10.72	5
Equestrian Use	\$0.45	\$3.05	\$3.26	\$6.50	\$3.38	\$5.63	\$0.85	\$1.34	4
Developed Camping	\$0.00	\$0.00	\$10.24	\$40.95	\$5.03	\$30.20	\$4.37	\$10.94	5
Driving For Pleasure	\$0.45	\$3.05	\$3.26	\$6.50	\$3.38	\$5.63	\$0.85	\$1.34	3

1 - Obtained directly from Caudill et al. (2003) for the specified activity for the region of the United States that includes Washington, Oregon, Idaho, Nevada and California.

2 - Obtained directly from Caudill et al. (2003) for non-consumptive activities for the region of the United States that includes Washington, Oregon, Idaho, Nevada and California.

3 - Obtained from Stynes and White (2003) for the specified activity. Expenditure data was provided as the average per party per visitor-day and was divided by 2.3 to estimate the average per person per visitor-day.

4 - Estimated based on data from Stynes and White (2004) and based on activities with participants that are expected to have a similar expenditure profile.

5 - Estimated based on camping data from Stynes and Sun (2003) and non-consumptive use data from Caudill (2003).

Allocation of Expenditure Data to IMPLAN Sectors. Table 4.14 presents the allocations to IMPLAN sectors of the annual expenditure data. These allocations are based on typical allocations per activity/sector for national wildlife refuges, as presented by Caudill et al. (2003).

Table 4.14. Allocation of Annual Visitor Expenditures to IMPLAN Sectors/Activities.

Category	Sector	Activity	Resident	Non-Resident
Lodging	479	Hotels	100%	100%
Food/Drink	481	Restaurant meals	35%	65%
	405	Groceries	65%	35%
Transportation	407	Gas/oil	90%	85%
	483	Car repairs	10%	10%
	391	Airline	0%	5%
Other	409	Sporting goods	40%	40%
	405	Tobacco	1%	1%
	405	Alcohol	1%	1%
	408	Shoes	8%	8%
	408	Clothing, women	8%	8%
	408	Clothing, men	8%	8%
	411	Personal/misc.	8%	8%
	411	Toiletries	8%	8%
	422	Telephone	6%	6%
	398	Postage	6%	6%
	448	Film	6%	6%

Summary of Inputs to IMPLAN Model

Tables 4.15 and 4.16 summarize the visitor and Monument expenditures and employment information that were estimated according to the procedures described above. These values were the input into the IMPLAN input-output model.

Table 4.15. Summary of Estimated Annual Visitor Expenditures by Sector (2005 \$).

Description	Alternatives						
	Existing	A	B	C	D	E	F
Air transportation	\$18,313	\$22,811	\$24,447	\$28,841	\$56,706	\$47,288	\$23,251
Postal service	\$14,033	\$16,544	\$16,138	\$18,903	\$35,511	\$30,011	\$15,815
Food and beverage stores	\$192,769	\$244,398	\$259,837	\$319,741	\$710,306	\$578,815	\$246,594
Gasoline stations	\$452,552	\$565,296	\$605,694	\$723,377	\$1,299,995	\$1,100,380	\$576,662
Clothing and accessories	\$56,133	\$66,177	\$64,554	\$75,612	\$142,044	\$120,042	\$63,258
Sporting goods	\$93,557	\$110,294	\$107,588	\$126,022	\$236,738	\$200,071	\$105,430
Miscellaneous store retailers	\$37,422	\$44,118	\$43,036	\$50,408	\$94,696	\$80,028	\$42,172
Telecommunications	\$14,033	\$16,544	\$16,138	\$18,903	\$35,511	\$30,011	\$15,815
Photographic services	\$14,033	\$16,544	\$16,138	\$18,903	\$35,511	\$30,011	\$15,815
Hotels and motels	\$215,850	\$288,934	\$333,415	\$398,495	\$444,723	\$417,731	\$310,500
Food services/ drinking places	\$202,603	\$259,820	\$279,050	\$343,126	\$885,034	\$705,298	\$263,394
Automotive repair	\$52,318	\$65,345	\$70,016	\$83,580	\$150,745	\$127,519	\$66,657
Totals	\$1,363,616	\$1,716,825	\$1,836,051	\$2,205,911	\$4,127,520	\$3,467,205	\$1,745,363

Table 4.16. Summary of Estimated Monument Annual Staffing and Expenditures.

Description	Alternatives						
	Current	A	B	C	D	E	F
Federal staffing	26	26	45	45	45	45	45
Federal expenditures	\$17,240	\$17,240	\$661,106	\$662,625	\$653,685	\$662,625	\$654,854
Totals	\$1,363,616	\$1,716,825	\$1,836,051	\$2,205,911	\$4,127,520	\$3,467,205	\$1,745,363

4.13.3.3 Economic Effects Analysis

Regional economic analysis considered the direct, indirect and induced economic effects of the expenditures within the region that are expected to result from recreational use of the Monument.

Direct effects are changes in the industry to which a final demand change was made (e.g., increased Monument staffing has a direct effect of increased federal non-military employment).

Indirect effects are changes in inter-industry purchases as they respond to the new demands of the directly affected industries (e.g., increased Monument staffing has an indirect effect of higher demand for food and housing spending).

Induced effects typically reflect changes in spending from households as income increases or decreases as a result of the changes in production.

Table 4.17 summarizes the direct, indirect and induced economic impacts of increased visitor and Monument spending that are expected to result from each of the proposed alternatives, based on the input-output model developed for this project. Table 4.18 summarizes the direct, indirect and induced employment effects estimated for each alternative.

The tables show that the proposed uses under Alternative A would be expected to have economic and employment effects very similar to existing conditions. Alternatives B, C and D are expected to produce respectively increasing economic and employment benefits. This is in line with the increased recreational activity levels that are expected under each of these alternatives, with the highest economic benefit resulting from Alternative D. Alternative E is expected to result in economic benefits between those of Alternatives C and D, while Alternative F has economic benefits approximating those of Alternative B.

Table 4.17. Summary of Annual Economic Effects Under Projected 2020 Conditions (2005 \$).

Description	Alternatives						
	Current	A	B	C	D	E	F
Direct	\$3,715,762	\$4,064,431	\$6,546,730	\$6,914,249	\$8,823,062	\$8,173,070	\$6,451,439
Indirect	\$330,133	\$414,122	\$440,450	\$529,849	\$1,041,432	\$867,110	\$419,296
Induced	\$2,711,092	\$2,908,930	\$4,926,345	\$5,134,549	\$6,185,377	\$5,828,257	\$4,870,382
Totals	\$6,756,987	\$7,387,483	\$11,913,525	\$12,578,647	\$16,049,871	\$14,868,437	\$11,741,117

Table 4.18. Summary of Economic Effects Under Projected 2020 Conditions (Jobs).

Description	Alternatives						
	Current	A	B	C	D	E	F
Direct	51	58	85	92	131	118	83
Indirect	4	5	5	6	13	11	5
Induced	36	39	66	69	83	78	65
Totals	91	102	156	167	227	207	153

4.14 Cumulative, Long-Term, and Irreversible Effects

Council on Environmental Quality (CEQ) regulations, which implement the provisions of the NEPA, define several different types of effects that should be evaluated in an EIS, including direct, indirect and cumulative effects. Direct effects are addressed in the resource-specific sections of this chapter (Sections 4.1 through 4.12). This section addresses indirect and cumulative effects.

The CEQ (40 CFR § 1508.7) (CEQ 1997) provides the following definition of indirect effects.

[Impacts that are] caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems including ecosystems.

The CEQ (40 CFR § 1508.7) (CEQ 1997) provides the following definition of cumulative effects.

The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions.

4.14.1 Indirect and Cumulative Effects

4.14.1.1 Potential Adverse Indirect and Cumulative Effects

4.14.1.1.1 Increased Public Use

Three projects that are currently in planning and/or study phases, if completed, are expected to result in individual and cumulative impacts to public use levels on the Monument.

Hanford Reach National Monument Heritage and Visitor Center

The Visitor Center is a non-FWS facility being constructed through the City of Richland Public Facilities District. Located along the Columbia River downstream from the Monument, this project has been designed and partially funded and is currently undergoing environmental review. The Visitor Center is intended to serve as the primary contact station for visitors seeking information, education and interpretation opportunities related to the Monument and would also promote heritage tourism for the Tri-Cities and surrounding region. The Visitor Center is expected to attract from 85,000 to 135,000 visitors per year.

B Reactor

The NPS was directed by Public Law 108-340 to study sites across the nation related to the Manhattan Project and America's development and construction of the atomic bomb. The B Reactor and Chemical Separations Building (T-Plant) sites at Hanford are being studied to determine whether they meet suitability and feasibility requirements for addition to the National Park System. If they meet the criteria, the NPS will recommend the best manner to preserve them, such as designating a National Historic Site or Historical Park. The B Reactor is located within the Hanford Site adjacent to the Monument near the Vernita Bridge and could become available for public visitation in the future. Access, via either the highway or the Columbia River, would be on the Monument, as would much of the off-site interpretive facilities. Besides additional visitation to the Monument, this project would likely result in increased congestion in the Vernita Bridge vicinity.

Ice Age Floods Trail

Legislation to designate the Ice Age Floods National Geologic Trail has passed both the U.S. House of Representatives and Senate, although the two bills are different and still need to be rectified. If established, the Ice Age Floods National Geologic Trail would be administered by the NPS, and as the Monument falls within the central pathway of the floods, it contains many associated features that would attract floods-related visitation.

The by-products of developing the Visitor Center, designation of B-Reactor as a National Historic Site, and/or the establishment of the Ice Age Floods National Geologic Trail would be increased public use in and around the Monument. This would be additive to the increase in visitation that would likely result from implementing any of the action alternatives, all of which would provide some level of improved visitor facilities on the Monument. Increased public use could lead to increased degradation of natural and cultural resources through spread of invasive species, fire, vandalism, theft and wildlife disturbance, as well as other impacts associated with visitor use described in previous sections. In addition, start-up of private commercial enterprises, such as guided tours and outfitting services, may result from increased demand for visitor services on the Monument. Such services would further contribute to increased public use and amplification of impacts.

Increased visitation and traffic through the Monument would increase the need for maintenance of roads and visitor facilities in addition to the standard maintenance and IPM programs already being implemented in the Monument. Additional public use would likely require both onsite and adjacent land managers to increase use of chemical controls for invasive species. Additional chemical use for maintaining facilities and roads would have an additive effect with nearby agricultural chemical use. These maintenance activities could potentially result in bioaccumulation of toxins in fish and wildlife species and Native American food plants.

4.14.1.1.2 DOE Hanford Site Remediation Activities

Past and current development activities—agricultural, industrial and residential—have contributed to the loss of natural and cultural resources in the Columbia Basin region, elevating the importance of resources preserved within the Monument. Ongoing DOE remediation activities—such as the decommissioning of production reactors, development of new waste facilities or expansion of existing facilities, and excavation of basalt, sand, gravel and silt/loam for use as fill and capping materials—would result in impacts to geologic, cultural, wildlife, habitat and aesthetic resources that are located adjacent to the Monument. The further loss or decline of such resources within the Columbia Basin would amplify the significance of impacts from Monument actions proposed in this plan.

4.14.1.1.3 White Bluffs Landslides

Continuing landslides within the White Bluffs formation are resulting in the loss of cultural, paleontologic and geologic resources and salmon spawning habitat, as well as having adverse impacts to aesthetic resources. These impacts will likely continue into the foreseeable future, and would be additive to impacts from Monument actions proposed in this plan.

4.14.1.2 Potential Beneficial Indirect and Cumulative Effects

In addition to potential adverse indirect and cumulative effects, all alternatives could result in beneficial indirect and cumulative effects on the local economy. An increase in visitation to the Monument would have a beneficial effect on the local economy. This beneficial effect would also affect the economy in an additive manner when combined with other economic impacts in the region, such as increased industry and tourism not associated with the Monument.

4.14.2 Potential Irretrievable and Irreversible Commitments

Establishing concentrated areas of public use, including the potential construction of trail systems, parking lots, and facilities, may result in irreversible and irretrievable effects on resources, such as a reduction in biological and cultural resources in the vicinity of the public use areas. The magnitude of such reductions would depend on the alternative being implemented. The protection/restoration emphasis of Alternatives B and F would limit the likelihood of potential irretrievable and irreversible effects on biological and cultural resources. Alternative C, which focuses on concentrating public use areas and facilities in common areas, would localize any potential irretrievable and irreversible effects; these effects would be mitigated by focusing development of public use facilities in areas with no or few natural or cultural resources. Alternatives D and E would provide more opportunities for public use and would increase the potential for irretrievable and irreversible effects on biological and cultural resources, although these effects could be somewhat reduced by concentrating public use in sites with few natural or cultural resources of significance.

Specifically, implementation of the following reasonable foreseeable actions may result in the irretrievable and irreversible commitments described below.

4.14.2.1 Establishing Two Campgrounds (Alternatives D and E)

The proposed Saddle Mountain campground would encompass approximately two acres under Alternative D. The proposed Vernita Bridge and Ringold area campgrounds would encompass approximately six acres under Alternatives D and E.

4.14.2.2 Improving Three Boat Launches (Alternatives C, D, and E)

Approximately two acres would be dedicated to the Vernita Bridge boat launch under Alternatives C, D and E. A boat launch proposed on the south shore would require

approximately one acre under Alternative D. The White Bluffs Boat Launch would increase in size by one acre under Alternative D.

4.14.2.3 Developing Parking Lots (Alternatives B–F)

4.14.2.3.1 Alternative B

The total number of parking lots would not change from existing conditions—two new lots would be created, but two old lots would be restored to native habitat. In addition, a one-acre scenic overlook with parking would be added.

4.14.2.3.2 Alternative C

Compared to existing conditions, the total number of parking lots would increase by two (1/2 acre each)—four new lots would be created, but two old lots would be restored to native habitat. In addition, a one-acre scenic overlook with parking would be added.

4.14.2.3.3 Alternative D

Compared to existing conditions, the total number of parking lots would increase by four (1/2 acre each)—six new lots would be created, but two old lots would be restored to native habitat. In addition, a one-acre scenic overlook with parking would be added.

4.14.2.3.4 Alternative E

Compared to existing conditions, the total number of parking lots would increase by two (1/2 acre each)—four new lots would be created, but two old lots would be restored to native habitat. In addition, a one-acre scenic overlook with parking would be added.

4.14.2.3.5 Alternative F

The total number of parking lots would not change from existing conditions—two new lots would be created, but two old lots would be restored to native habitat. In addition, a one-acre scenic overlook with parking would be added.

4.14.2.4 Creating an Auto Tour Route (Alternative D)

Rerouting the closed section of the Ringold Road to accommodate an auto tour route would redirect approximately three miles of the existing two-lane road away from the face of the bluffs over the top of the bluffs. The effects associated with these commitments could potentially include the loss of riparian and upland habitat; destruction of microbiotic crust; adverse effects on aesthetics; increased vandalism, littering, fire and looting; disturbance of wildlife (including nesting birds); spread of invasive species; and decreased opportunities for solitude. These effects are discussed in greater detail throughout this chapter.

4.14.3 Relationship Between Short-Term Uses of the Human Environment and Enhancement of Long-Term Productivity

Long-term productivity in the Monument will likely be focused on upland, riparian and wetland habitats. Short-term uses that enhance long-term productivity within the Monument are primarily related to habitat restoration and fire management.

The following habitat restoration activities would be undertaken under all alternatives.

- Discing in preparation of seeding.
- Recontouring the landscape.
- Removing vegetation—usually invasive species—through prescribed fire or chemical or physical means (e.g., mowing, discing, chopping).

The short-term effects of these activities would include temporary effects on aesthetics, connectivity and localized wildlife use of the site.

Fire and its control—both firefighting and prevention—have major effects on the landscape. In the event of a fire, fire lines may be disced across the Monument. Under all alternatives, disced firebreaks would be maintained along state highways (averaging thirty-two feet wide and forty-one miles long) and administrative roads (sixteen feet wide and fifty-nine miles long). Prescribed fire would be used under all alternatives to reduce hazardous fuels and to remove invasive species. This activity would be conducted on an as-needed basis and as resources allow. Short-term effects associated with these activities would include temporary effects on aesthetics, connectivity and localized wildlife use of the site.