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Gregory J. Martinez
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Department of the Army
Walla Walla District, Corps of Engineers
Boise Regulatory Office
720 East Park Blvd., Suite 245
Boise, Idaho 83712

APR 2 1 2016

Subject: Bayha Island Research Project, Owyhee County, Idaho—Biological Opinion
In Reply Refer to: 01EIFW00-2016-F-0393

Dear Mr. Martinez:

Enclosed are the U.S. Fish and Wildlife Service's (Service) Biological Opinion (Opinion) and concurrence with the Corps of Engineers' (Corps) determinations of effect on species listed under the Endangered Species Act (Act) of 1973, as amended, for the proposed Bayha Island Research Project in Owyhee County, Idaho. In a letter dated January 19, 2016, and received by the Service on January 19, 2016, the Corps requested formal consultation on the determination under section 7 of the Act that the proposed project is likely to adversely affect the Snake River physa (*Haitia* (*Physa*) *natricina*).

The enclosed Opinion and concurrence are based primarily on our review of the proposed action, as described in your January 19, 2016 Biological Assessment (Assessment), the anticipated effects of the action on listed species, and other pertinent information, and were prepared in accordance with section 7 of the Act. Our Opinion concludes that the proposed project will not jeopardize the survival and recovery of Snake River physa. A complete record of this consultation is on file at this office.

<u>Clean Water Act Requirement Language:</u>

This Opinion is also intended to address section 7 consultation requirements for the issuance of any project-related permits required under section 404 of the Clean Water Act. Use of this letter and associated Biological Opinion to document that the Army Corps of Engineers (Corps) has fulfilled its responsibilities under section 7 of the Act is contingent upon the following conditions:

1. The action considered by the Corps in their 404 permitting process must be consistent with the proposed project as described in the Assessment such that no detectable difference in the effects of the action on listed species will occur.
2. Any terms applied to the 404 permit must also be consistent with conservation measures and terms and conditions as described in the Assessment and addressed in this letter and Opinion

Thank you for your continued interest in the conservation of threatened and endangered species. Please contact Dwayne Winslow (208-378-5249) or Michael Morse (208-378-5261) of my staff if you have questions concerning this Opinion.

Sincerely,

for Dennis Mackey
Acting State Supervisor

cc:
NOAA, Mabe
IDFG, Ward
FWS, Casselman, de Knijf
IPC, Conner, Myers, Randolph
IDWR, Golart
The Freshwater Trust, McCollister

BIOLOGICAL OPINION
FOR THE
Bayha Island Research Project

Project Number: 01EIFW00-2016-F-0393

U.S. FISH AND WILDLIFE SERVICE
IDAHO FISH AND WILDLIFE OFFICE
BOISE, IDAHO

Supervisor Dennis Mackey acting State Supervisor

Date APR 21 2016

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1. BACKGROUND AND INFORMAL CONSULTATION

1.1 Introduction

The U.S. Fish and Wildlife Service (Service) has prepared this Biological Opinion (Opinion) of the effects of Idaho Power Company's proposed Bayha Island Research Project (project) on the Snake River physa (*Haitia* (*Physa*) *natricina*). In a letter dated January 19, 2016, and received by the Service on January 19, 2016, the U.S. Army Corps of Engineers (Corps) requested formal consultation with the Service under section 7 of the Endangered Species Act (Act) of 1973, as amended, for its proposal to authorize and administer the action. This action will require section 404 Clean Water Act and section 10 Rivers and Harbors permit authorization from the Corps for the placement of fill in Jurisdictional Waters and Navigable Waters of the U.S.

This Opinion is based on the Biological Assessment (Meridian Environmental, Inc. et al. 2015, entire) submitted by the Corps, together with its request for formal consultation; a sediment suitability memorandum provided by the Joint Sedimentation Evaluation Team; visits to the project area by the Service, the Idaho Power Company (Company, or IPC), and its partners and contractors (The Freshwater Trust, River Design Group, Inc., Meridian Environmental, Inc.); data collected by the Company, River Design Group, Inc. and its contractors and Service biologists; meetings, bi-weekly telephone calls, and other communication between Service biologists, the Corps, the Company, The Freshwater Trust and its contractors; and other available scientific and pertinent information.

The Corps determined that the proposed action is likely to adversely affect Snake River physa. As described in this Opinion, and based on the Biological Assessment (Assessment) submitted by the Corps and other pertinent information, the Service has concluded that the action, as proposed, is not likely to jeopardize the continued existence of Snake River physa.

1.2 Consultation History

The Service has maintained open communication with the Corps and the Company and its partners and contractors regarding the project since March 12, 2014. During that time, the Service has provided recommendations and forwarded information needs. The Company and its partners and contractors have responded to these requests, providing needed information in correspondence and telephone calls to the Service. Much of the coordination regarding project specifics was conducted during bi-weekly conference calls attended by the project team representing the Service, the Company, The Freshwater Trust, River Design Group, Inc. (River Design), the Corps, and Idaho State agency personnel.

March 13-14, 2014 The Company, The Freshwater Trust, River Design Group, and Meridian Environmental, Inc. (Meridian Environmental) present the Company's Snake River Stewardship Program (Stewardship Program) to the Service and other interested parties, with Bayha Island as a concept test site.

April 30, 2014	The Company, The Freshwater Trust, and the Service agree on bi-weekly conference calls to establish coordination and communication for outreach, environmental compliance, and project design and field work.
May 8, 2014	Company and Service biologists conduct preliminary Snake River physa habitat assessment at Bayha Island and Wright Island.
May 27, 2014	Email cc list developed for bi-weekly conference calls, including a representative from the Corps.
May 28, 2014	Company biologists collected additional substrate data at deep water sample sites, finding potentially suitable Snake River physa habitat.
June 26 & July 2, 2014	Company and Service biologists sampled for Snake River physa and suitable habitat at 18 sites within the project area.
July 1, 2014	The Service extended a meeting invitation to Corps divisions to present and discuss the project. At this time, due to Bayha and Wright islands being part of Deer Flat National Wildlife Refuge, the Service was considered the action agency pending resolution of ownership of proposed land to be accreted to the existing islands.
July 16, 2014	Receipt from the Company of taxonomic identification of Physa species collected during the June 26 and July 2, 2014 sampling efforts: two dead shells were identified as Snake River physa.
July 24, 2014	Meeting with several representatives from the Corps, The Freshwater Trust, River Design, Meridian Environmental, the Company, and the Service to ensure that Corps regulatory and permit issues and needs are taken into account during project planning.
August 1 & 5, 2014	The Service provided comments to an early annotated draft Assessment produced by Meridian Environmental et al. (2015).
December 17, 2014	An email exchange between the Service, and Meridian Environmental and The Freshwater Trust regarding section 7 formal and informal consultation as related to National Environmental Policy Act (NEPA) requirements.
January 26, 2015	Receipt from The Freshwater Trust and River Design Group of 60 percent design drawings for project dredging and island enhancement.
February 9, 2015	The Service provided comments to Meridian Environmental on a completed draft of the Assessment.
February 10, 2015	Receipt by the Service of a final draft of the Assessment.
April 30, 2015	The Service, the Company, The Freshwater Trust, River Design Group, and Meridian Environmental, met with the Idaho Department of Water Resources and the Corps at the latter's Boise office to present the draft Joint Permit Application (JPA), including the section 7 consultation.
June 30, 2015	Receipt of 90 percent design drawings from The Freshwater Trust and River Design for project dredging and island enhancement.

July 8, 2015	Receipt of the Bayha Island Enhancement Design Report from The Freshwater Trust and River Design. Included 90 percent design drawings, and modeling of projected Snake River physa habitat at 7,942, 10,146, and 11,700 cfs.
July 15, 2015	The Service requested that River Design model projected Snake River physa habitat at 3,900 cfs, the minimum average daily flow the Company can release upstream from Swan Falls Dam during the irrigation season.
July 22, 2015	The Company and the Service provided the Corps with a background overview of the Stewardship Program to clarify the relationship between the stand-alone project addressed in this Opinion and any similar future projects the Company and The Freshwater Trust may choose to undertake for the Stewardship Program.
July 31, 2015	Receipt from The Freshwater Trust and River Design of projected Snake River physa habitat modeled at 3,900 cfs.
August 18, 2015	Letter from Department of Interior, Fish and Wildlife Service, to Idaho Power Company, in which the Service agrees that fill material for island enhancement will be placed below the ordinary high water mark and adjacent to [but not on] Federal islands managed by the Deer Flat National Wildlife Refuge (Refuge); and so implicitly agrees that ownership status of the Federal islands will not be changed by such placement of fill material.
September 3, 2015	Receipt from The Freshwater Trust and River Design of the Sediment Sampling and Analysis Report for the Bayha Island Enhancement Research Project. Included results of testing sediment samples for contaminants of concern in accordance with the 2009 Sediment Evaluation Framework for the Pacific Northwest.
September 8, 2015	The Service provided The Freshwater Trust with a copy of the proposed action from the draft Opinion, at their request.
October 20, 2015	Letter from the State of Idaho, Office of the Attorney General, to Albert Barker, attorney representing Idaho Power Company, in which the State agrees that ownership of fill material placed below the ordinary high water mark does not change State ownership of the bed of the Snake River, and that the fill becomes impressed with the State public trust. The letter from Department of Interior, Fish and Wildlife Service dated August 18, 2015, together with this letter from the State establish that ownership/trust responsibilities of Federal islands and of the Snake River bed below the ordinary high water mark, managed by the Deer Flat National Wildlife Refuge and the State of Idaho, respectively, will not change as a result of the proposed project. Therefore, the proposed action will not occur on Refuge managed land, relieving the Service as the action agency. Remaining Federal nexus for ESA section 7 consultation becomes the Corps' permitting of the proposed action under the Clean Water Act and the Rivers and Harbors Act authorities.

December 1, 2015	The Freshwater Trust delivered the Biological Assessment to the Corps, along with the Joint Permit Application.
January 19, 2016	Receipt of Biological Assessment and request for section 7 consultation from the Corps.
February 10, 2016	Receipt from The Freshwater Trust of 100 percent project design drawings.
February 22, 2016	Service email to the Corps, indicating the Biological Assessment contains sufficient information to proceed with the section 7 consultation, with the Opinion to be delivered on or before June 1, 2016.
February 23, 2016	The Corps advised of a change to the proposed action during a project conference call, wherein silt curtains will be used during placement of fill in the north and east channels around Bayha Island to minimize turbidity. The change was made in response to concerns raised by the Idaho Department of Environmental Quality during their review of the project.
February 25, 2016	Receipt (cc) from the Company of a revised drawing of in-water work isolation areas, showing use of silt curtains in the north and east channels around Bayha Islands.
March 11 and 14, 2016	The Service transmits for draft Opinion for review and comment to the Company, The Freshwater Trust, River Design, Idaho Department of Water Resources, the Corps, and the Deer Flat National Wildlife Refuge.
March 22, 2016	Receipt of comments on the draft Opinion from the Company.
March 23, 2016	Receipt of comments on the draft Opinion from the Deer Flat National Wildlife Refuge. The Service responded to Refuge comments, incorporating the suggested change.
March 24, 2016	Receipt of comments on the draft Opinion from the Corps. Service response to Company comments: incorporating some changes; requesting clarification on additional changes.
March 25, 2016	Incorporated Corps' suggested changes in the draft Opinion; advised the project team of the changes.
March 30, 2016	Receipt of clarification and final comments from The Freshwater Trust and the Company. Incorporated suggested changes into the draft Opinion. All comments received were addressed as of this date.

2. BIOLOGICAL OPINION

2.1 Description of the Proposed Action

This section describes the proposed Federal action, including any measures that may avoid, minimize, or mitigate adverse effects to listed species or critical habitat, and the extent of the geographic area affected by the action (i.e., the action area). The term "action" is defined in the implementing regulations for section 7 as "all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies in the United States or upon the high seas." The term "action area" is defined in the regulations as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action."

The Company is developing a number of partnerships as part of its Snake River Stewardship Program (IPC *in litt*. 2014). One portion of the Stewardship Program includes a partnership with The Freshwater Trust, with the Service participating as a collaborating agency, for the purpose of enhancing water quality (temperature) and cold water aquatic habitats in the Snake River from Swan Falls Dam through the Hells Canyon Complex. As a stand-alone demonstration project to research the effectiveness of habitat restoration treatments, The Freshwater Trust and the Company are proposing to implement the Bayha Island Research Project to determine if the treatments result in the desired positive environmental effects. The habitat restoration treatments are designed to increase depth and velocity, reduce water surface area, and increase riparian shading with the goal to reduce summer water temperature, while also improving habitat conditions for native fish species and the Snake River physa. Pre-and post-project monitoring will evaluate localized temperature effects. The earthwork portion of the project is scheduled to occur from July through September, 2016; and re-vegetation work will be conducted in 2016 and 2017.

The Freshwater Trust, under contract with the Company, retained the River Design Group, Inc. (River Design) to plan and develop river enhancement strategies. The Freshwater Trust and River Design have previously cooperated to design and complete a similar enhancement on the Kootenai River in northern Idaho. In the Snake River, these strategies are intended to promote natural river processes and improve the overall trajectory of the reach of the Snake River between Walters Ferry and the confluence of the Boise River with the Snake River (hereafter called the Walters Ferry Reach) towards habitat that will support a diversity of native fish species, which in turn is expected to improve water quality and cold water habitats in the Snake River between Swan Falls Dam and through the Hells Canyon Complex. The restoration planning level concept was reviewed by the Company, The Freshwater Trust, and the Service. The concept uses process-based restoration strategies to support long-term sustainable objectives: increase depth and velocity; reduce water surface area; and reduce summer water temperature. The conceptual design was refined based on multiple inputs including feedback from stakeholders, hydraulic modeling of proposed channel modifications, and ecological improvement potential.

2.1.1 Action Area

The project site is located in the Snake River immediately alongside of Bayha and Wright islands, within Section 6 of Township 1 South, Range 2 West, at latitude 43.3698° N and longitude -116.6262° W, near Walters Ferry, Owyhee County, Idaho.

The action area is defined as the project area (Figure 1), which includes:

- All habitat restoration areas on or adjoining Bayha and Wright Islands, including the river channel, staging areas, and also access roads on the south side of the Snake River located between Young Lane and the south side of the river adjacent to Bayha and Wright Islands; and,
- From 0.25 mile upstream and downstream of the project site, or about between river miles (RM) 439 and 440 (Figure 2).

Based on past experience of The Freshwater Trust, River Design, and Meridian Environmental conducting projects of similar scope and size, 0.25 mile upstream and downstream of the work area is greater than the distance where potential short-term impacts to water quality (such as increased turbidity) may occur during construction (e.g., areas that may be indirectly affected by the proposed action).

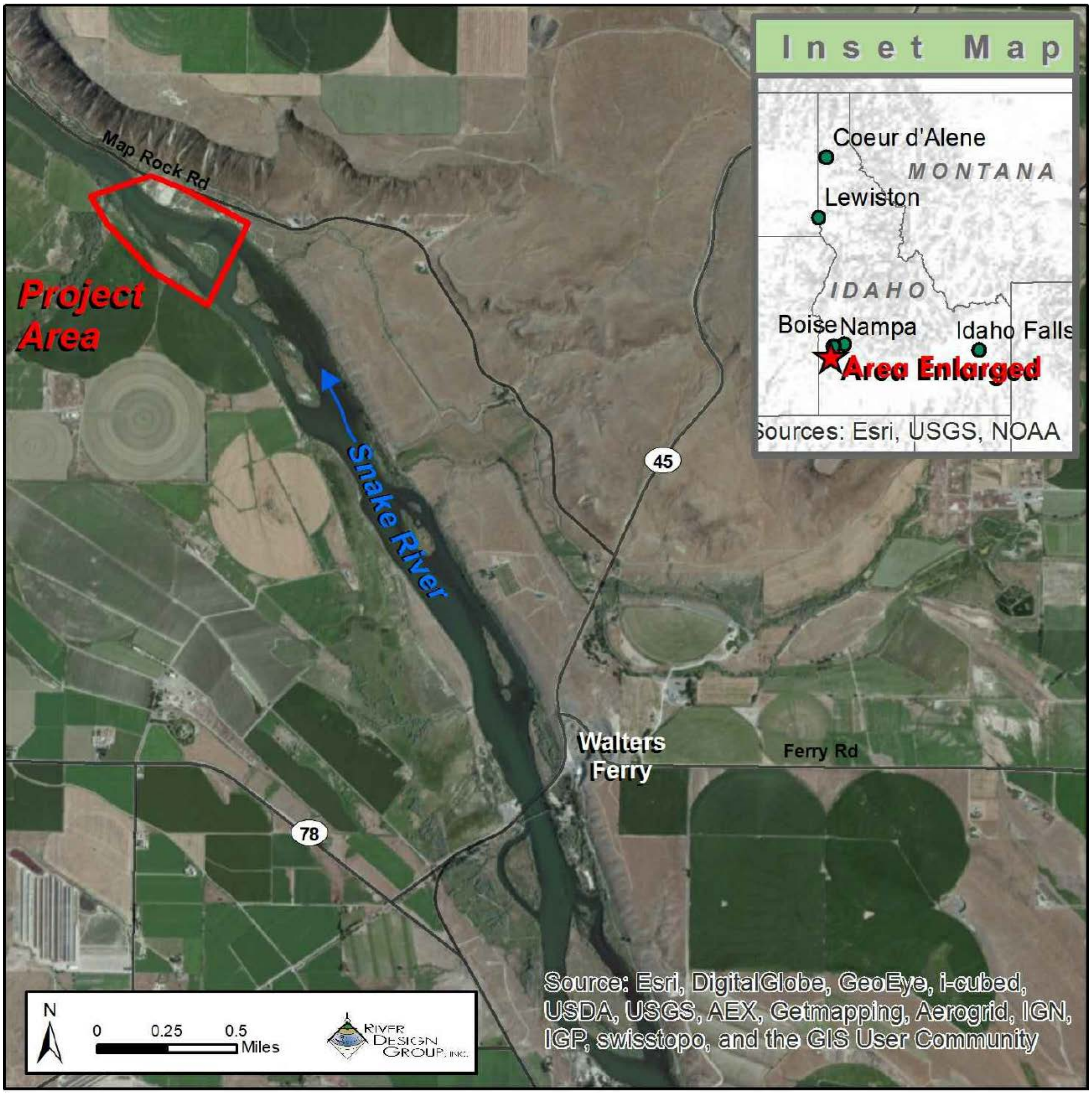


Figure 1. Bayha Island Research Project vicinity map: action area and project site.

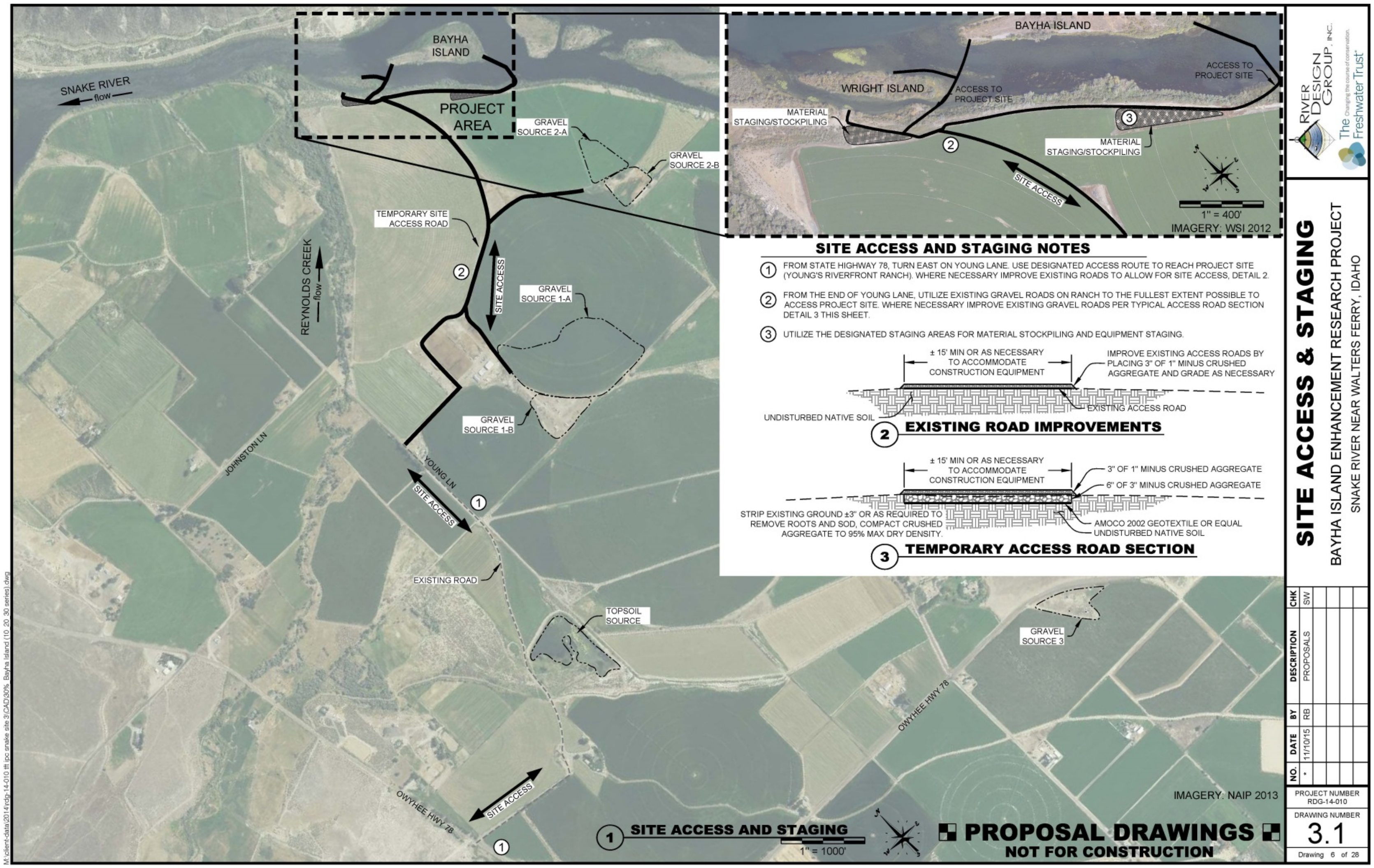


Figure 2. Staging areas and roads.

2.1.2 Proposed Action

The proposed action site is at RM 439.5 of the Snake River, approximately 2.5 miles downstream of Walters Ferry in Owyhee County, Idaho. The project site consists of Bayha and Wright islands and the adjacent river channels. In general, the river in this area is wide and shallow with a dominance of invasive aquatic macrophytes and substrate impacted with fine sediments. Riparian vegetation is primarily herbaceous and provides little shade. The mainstem Snake River has been heavily altered as a result of changes in flow due to upstream water uses, increased inputs of nutrients and fine sediments from agricultural runoff, increased water temperature due to reduced flows and velocities, proliferation of invasive vascular aquatic macrophytes that trap sediment and further reduce water velocity, and static morphological conditions. The static nature of the river channel is due in part to altered land uses and hydrology, but also to the epic Pleistocene Bonneville Flood event approximately 15,000 years ago (Malde 1968), which created an over-large river channel compared to the current flow regime. Detailed site conditions are presented in Section 2.4 (Environmental Baseline).

To increase depth and velocity and reduce water surface area, the river bed will be excavated and the excavated material will be used to enlarge the islands below the ordinary high water mark (creating a deeper and narrower channel). To increase riparian shading, the enlarged islands will be enhanced with riparian vegetation (including trees and shrubs) along with weed treatment. Newly created floodplains will include wood roughness (small logs and brush) elements to increase habitat structural diversity. This strategy has proved successful on the Kootenai River in northern Idaho (a similar large-scale river).

All access to the project will be from the south side of the Snake River. From Young Lane, access to the project sites will be via existing gravel roads currently in place and used by the landowner for farming access. Existing gravel roads will be used and improved to accomplish site access and staging to the fullest extent possible. Three staging areas are proposed, two for material staging/stockpiling, and one for vehicle/fueling staging (Figure 2). Final location of the vehicle/fueling staging area will be in one of the three areas designated in Figure 2, and will be indicated on final design drawings for construction. Best management practices (BMPs) for fueling and fuel storage will follow all local, state, and Federal regulations and BMPs.

The proposed action will be implemented from July through September, 2016. Flow conditions during construction are expected to be between 6,200 cubic feet per second (cfs) and 7,950 cfs. Water surface elevations are expected to be between 2240 feet and 2244 feet. Based on the expected depths and velocities at these discharges and stage height (water level), two methods/phases are proposed to isolate excavation and earth work from flowing water.

2.1.2.1 General Project Design

Phase 1 Work Area Isolation

To conduct the southern portion of excavation, the work area between the south bank of Bayha Island and the south (left) river bank and on the north (right) bank of Wright Island will be isolated from flowing water with a bulk bag cofferdam (or approved alternative), as shown in Figure 3. Bulk bags will be installed across the upstream end of the side (left) channel between Bayha Island and the Snake River bank, completely blocking the channel from flowing water. Bulk bags will be placed using a hydraulic crane or trackhoe. The channel will be excavated, and excavated material will be placed adjacent along Bayha and Wright Islands and adjacent to the excavated areas (Figure 4). Floating silt curtains will be installed at the downstream extent of the disturbance area to trap turbid water within the side channel work zone (Figure 3). De-watering of the channel is not proposed. This method has very successfully contained turbid water during similar large in-water habitat construction within side channels of the Kootenai River in northern Idaho. Fish will be removed and relocated from the isolated work area. Excavation and fill will be accomplished using long-arm excavators working primarily from dry surfaces.

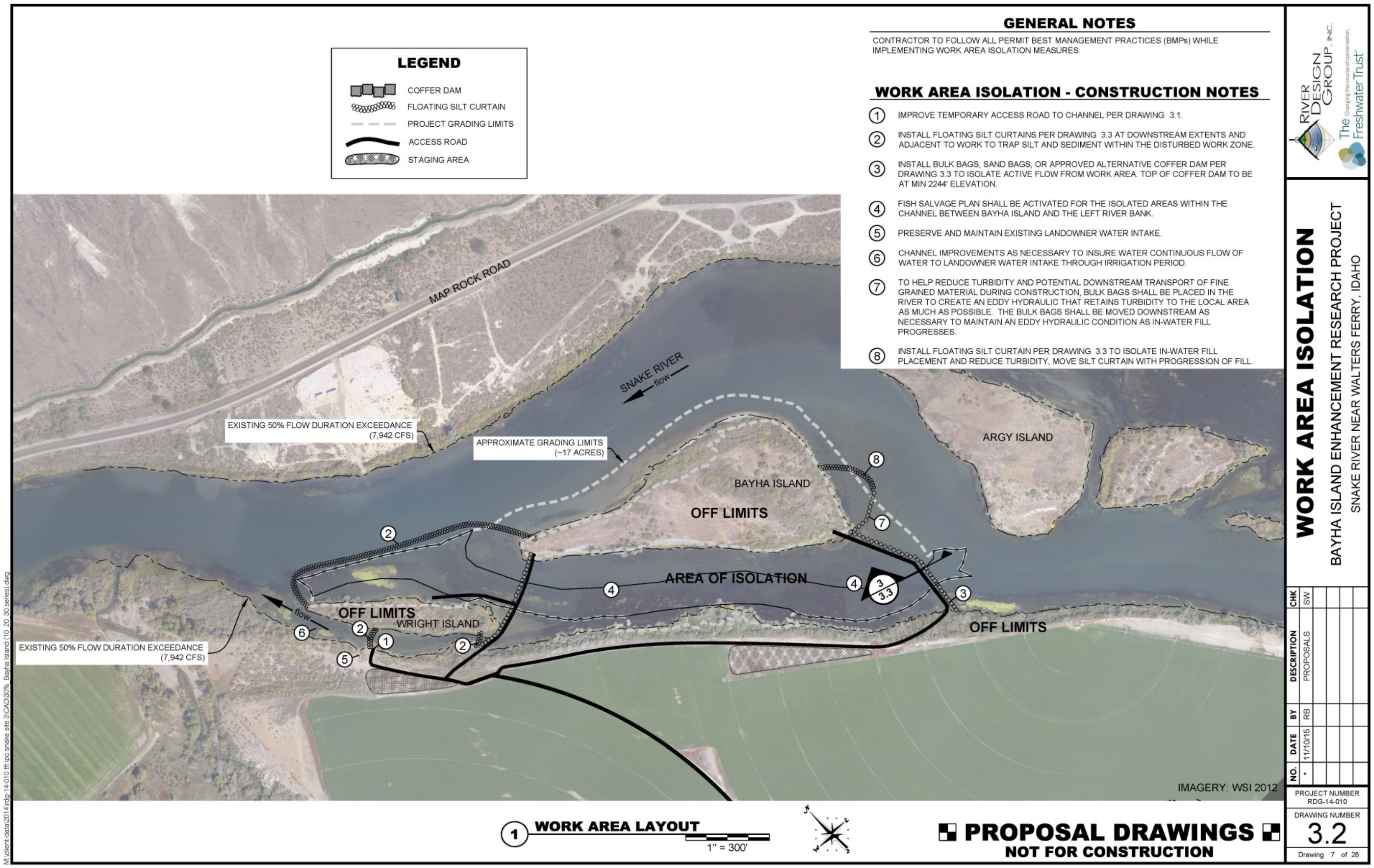


Figure 3. In-water work isolation areas.

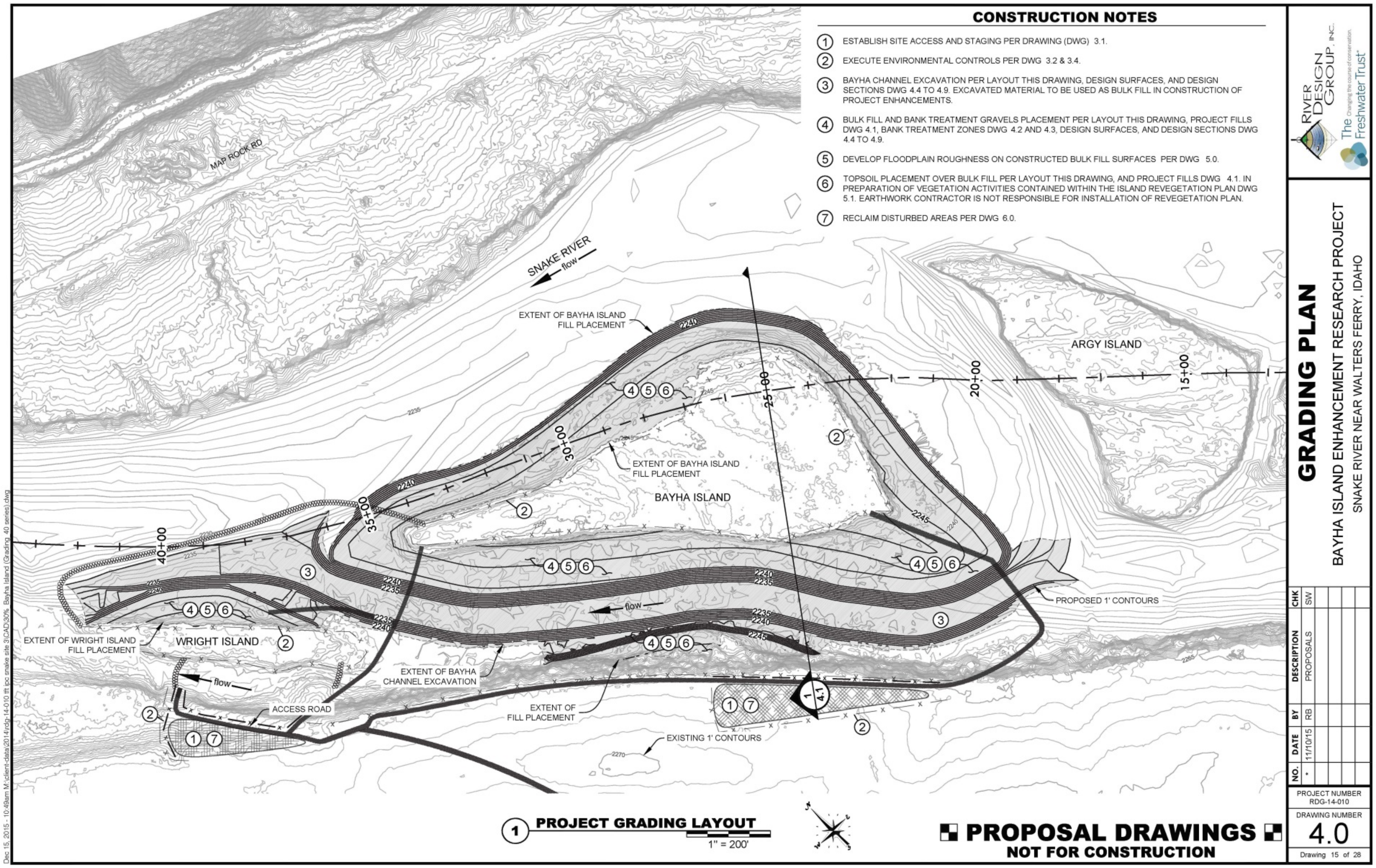


Figure 4. Excavation and fill areas.

Phase 2 Work Area Isolation

Phase 2 involves construction on the north and east sides of Bayha Island. The work areas on the north and east sides cannot be isolated from active flow using bulk bags due to prohibitive depths and velocities, as will occur during work on the island's south side (see Phase 1 Work Area Isolation). However, a floating silt curtain will be used on the north and east sides of Bayha Island to isolate areas of immediate fill placement (Figure 3, Note 8), and in conjunction with other best management practices (BMPs) described in the proposed action, is expected to maintain turbidity concentrations within state water quality standards during Phase 2. Material will be placed from the island along the north and east sides of Bayha Island using a long-arm excavator and progress water-ward to minimize in-water activity as the island area below the ordinary high water mark is expanded to the north and east.

Construction Schedule, Sequencing, and Equipment

The proposed construction sequence includes:

1. Mobilize equipment
2. Establish staging areas and construct site access improvements
3. Implement conservation measures
4. Deliver and stage materials
5. Construct river access improvements
6. Implement work area isolation and erosion control plans
7. Complete channel and floodplain earthwork
8. Construct floodplain roughness treatments
9. Plant riparian and floodplain surfaces
10. Reclaim project site and seed disturbed areas
11. Demobilize equipment and materials

The construction contractor will select equipment suited to efficiently accomplish each work element. Heavy equipment expected to be used is listed by major work element in Table 1.

Table 1. Heavy equipment expected to be used to construct the Bayha Island Research Project.

Access Improvements	Work Area Isolation and Erosion Control	Construction
Dozer	Excavator	Dozer
Excavator	Front End Loader	Long-arm Excavator
Grader	Bobcat	Front End Loader
Front End Loader	Dump Truck	Skidder
Compactor	Trackhoe	Bobcat
Dump Truck	Crane	Dump Truck
Water Truck		

Construction Materials

Sediment core samples were taken from within the proposed excavation zone to test river bed materials for construction suitability as well as for contamination. Results indicate sulfides in the fine-grained material in the top 18 inches of the existing river bed between Bayha Island and the south bank of the river are at concentrations considered toxic to benthic organisms, based on proposed updated (2015) guidance for freshwater screening limits from the Sediment Evaluation Framework (SEF) for the Pacific Northwest (USACE et al. 2009, 2015; also see Section 2.4.2 this Opinion). (Testing results also indicated that other chemicals or constituents of concern tested for in the sediment samples according to the SEF guidance occurred in concentrations below the freshwater screening limits, indicating that the material proposed for excavation in remaining project areas is suitable for use as fill for island enhancement.)

The channel area between Bayha Island and the south bank will be isolated from moving water during construction using floating silt curtains (Figure 3), and material excavated from areas with sulfide concentrations exceeding freshwater screening limits will be excavated and placed as bulk fill in the bottom of fill areas where it will be covered and not allowed to erode or be transported downstream (see Appendix, drawings 4.1 and 4.3, for sulfide fill placement). It is not possible for excavation to remove 100 percent of sulfide-containing fine-grained material; the act of scooping the material will suspend a small portion of these fine particulates which will re-deposit within the isolated work area. Re-deposited sulfide-containing material will, however, be at much lower concentrations than the existing 18 inch layer. Continued excavation into the channel to target depths will further redistribute fine-grained material, further reducing concentrations of any sulfide-containing material.

Approximately 51,200 cubic yards of river bed sediment will be excavated from the river, and between approximately 46,080 and 47,800 cubic yards of this material will be used to enlarge the islands below the ordinary high water mark: some of the total excavated material, as much as about 10 percent, is expected to be unsuitable for project enhancement, and will be removed from the project and disposed of at an approved site. Approximately 34,860 cubic yards of additional material will be required and imported to the project site to complete the proposed enlargements and to be used in the construction process. Of this amount, approximately 28,400 cubic yards of sediment and alluvium (including about 6,300 cubic yards of topsoil) will be acquired from the adjacent landowner from areas that have been designated for the project and are on terraces (i.e., uplands) that are outside of the river floodplain and never see active river flow. The sands and gravels in the landowner’s areas are appropriate for placing in the river as fill as they are natural sediment deposits derived from the catastrophic Bonneville Flood. The remaining additional amount of fill needed, about 6,460 cubic yards, will be imported sands, gravels, and cobbles, and will be used to construct temporary access stream crossings/coffer dams. After bulk fill and topsoil are in place, floodplain roughness treatments will be constructed using wood brush and vegetation plantings. Stream crossing/coffer dams will be removed prior to the end of construction.

Revegetation

Planting design was informed by reference data collected from nearby islands with similar hydraulic characteristics illustrating conditions such as native plant species composition and density. Based on these data, plantings will be installed on the newly created floodplain surfaces to initiate a riparian forest dominated by black cottonwood (*Populus trichocarpa*) and peachleaf willow (*Salix amygdaloides*), with an understory of native willows and other shrub species and native grasses such as slender wheatgrass (*Elymus trachycaulus*) and Canada wildrye (*Elymus canadensis*). Planting will occur during island construction, and will consist of material that is weed free and amenable to species requirements by planting zone. Post-planting maintenance will also be conducted to ensure planting success. Site preparation will consist of noxious weed treatments on existing island surfaces to manage/remove tamarisk (*Tamarix sp*.), perennial pepperweed (*Lepidium latifolium*), Canada thistle (*Cirsium arvense*) and other noxious species before restoration planting. Tamarisk will be cut and stumps chemically treated by hand sprayers. Tamarisk and herbaceous weeds will be treated using herbicides selected from those that have been evaluated for field station level (i.e., Refuge-level) approval through the Service's Pesticide Use Proposal System (PUPS), and for which a pesticide use proposal for this project has been approved through the PUPS. Herbicides will be applied by Company licensed pesticide applicators or their contractors licensed for pesticide application. Applicators will follow BMPs required for PUPs approved at the field level (USFWS 2013, p. 4-5). BMPs include but are not limited to: maintain a minimum 25 foot buffer from all surface water sources; do not apply when wind speed exceeds 7 miles per hour; only use approved surfactants that are practically non-toxic or have slight acute toxicity (LC_{50} > 10 mg parts per million) to aquatic organisms when applying within 25 feet of surface waters.

Monitoring and Evaluation

A long-term monitoring program will be implemented to document post-construction effectiveness at achieving three primary objectives: 1) increase habitat area for target species (including Snake River physa); 2) improve altered thermal regime; and 3) enhance riparian vegetation. Data on river morphology such as width, depth and velocity; substrate composition; macrophyte status; detailed water temperature monitoring; and riparian vegetation plots, etc., will be collected over the long term to quantify project effectiveness. Detailed monitoring approaches and methods are currently under development by The Freshwater Trust, IPC, and River Design in coordination with the Service and other stakeholders.

2.1.2.2 Proposed Conservation Measures

Conservation measures presented below are components of the proposed action and will be required of the contractors implementing the proposed action. The following measures are intended to minimize potential construction impacts to listed species and aquatic habitat.

Preconstruction Activities

Before work commences, the following actions will be completed:

- Staging areas and clearing/disturbance limits will be visibly marked in the field with orange plastic fencing or similar methods prior to earthwork.

- The contractor will ensure that the following materials for emergency erosion control are on site: 1) a supply of sediment control materials (e.g., silt fence, straw bales), and 2) oil absorbing floating booms and spill containment kits at each work site.
- Temporary erosion controls identified on project drawings must be placed and remain in place until completion of construction activities and site restoration.

Construction BMPs

Site specific BMPs have been identified as a component of preliminary design. Specific notes in design drawings addressing both construction and isolation BMPs are consistent with the descriptions provided in the subsections below. The BMPs follow the Idaho Department of Environmental Quality's Catalog of Stormwater Best Management Practices for Idaho Cities and Counties (IDEQ 2005). Construction specifications will include these BMPs for contractors. Additionally, The Freshwater Trust and other Company contractors will implement any permit conditions, such as Section 401 of the Clean Water Act (Water Quality Certification) issued by the Idaho Department of Environmental Quality. Construction specifications will refine conservation measures for the following work components:

- Mobilization and Demobilization
- Pollution Control
- Clearing and Grubbing
- Stripping
- Revegetation of Construction Sites
- Fencing of Construction Sites
- Drainage Filters
- Erosion Control Blankets
- Construction Fabrics

Staging Areas

- Staging areas will be the minimum size necessary to practically conduct the work.
- Staging area limits will be clearly marked on the ground with orange plastic fencing or similar methods prior to construction.
- Staging areas will be chosen to minimize disturbance to perennial vegetation (based on logistical constraints).

Pollution Control Measures

Prior to initiating each of the restoration projects, a project-specific Pollution Control Plan for construction activities will be prepared and implemented by the contractor to prevent construction-related pollution from reaching flowing waters or contaminating upland areas. This plan will include the following:

- Practices will be identified to prevent pollution from equipment and material storage sites, fueling operations, and staging areas.
- Sanitary facilities such as chemical toilets will be located at least 150 feet from water bodies to prevent contamination of surface or subsurface water.
- A spill containment and control plan will be prepared that includes agency notification procedures, chain of command, incident response procedures, specific clean-up and

disposal instructions, quick response containment and clean up materials that will be available on the site, proposed methods for disposal of spilled materials, and employee training for spill containment following all applicable local, state, and Federal regulations.

- If a spill of chemical pollutants such as fuel or hydraulic fluid should occur, the plan will require that the contractor attempt to contain the spilled material. The following procedures will be followed:
  - Notify the project inspector immediately.
  - For spillage on land construct earthen berms or use other suitable barricade material of sufficient size to contain the spill and keep it from spreading.
  - For spillage on water, attempt to isolate and contain the spilled material. Commercial booms or other suitable materials shall be kept on site during construction to contain fuel and oil spills on water.

Equipment Maintenance and Refueling

- Prior to entering the project site, all equipment will be washed to minimize the introduction of foreign materials and fluids. All equipment will be free of oil, hydraulic fluid, diesel fuel leaks, and invasive species.
- Prior to being transported to the work site, all equipment to be used within the Snake River ordinary high water mark will be inspected and decontaminated for invasive species before and after use.
- Vehicle staging, maintenance, refueling, and fuel storage must take place in a designated area at least 150 feet from any stream or wetland.
- When equipment is initially cleaned prior to being used on the project, washing or cleaning will conducted at least 500 feet from the shoreline. This is to prevent invasive species (terrestrial or aquatic) from being deposited on shore or washed into the river.
- All vehicles operated within 150 feet of any stream or wetland must be inspected daily for fluid leaks before leaving the vehicle staging area. Any leaks detected must be repaired in the vehicle staging area before the vehicle resumes operation. Inspections must be documented in a record that is available for review on request.
- All equipment operated instream must be cleaned before beginning operations below the bank full elevation to remove all external oil, grease, and dirt.
- All other power equipment within 150 feet of the water will be inspected daily for fluid leaks and repaired. The contractor must prepare daily inspection reports.
- If a fluid leak does occur, the project inspector shall be notified immediately, and all work ceased at that specific location until the leak has been rectified. At all times during construction, fluid spill containment equipment will be present on-site and ready for deployment should an accidental spill occur. The project inspector reserves the right to refuse equipment that does not meet criteria.
- Stationary power equipment (e.g., generators) operated within 150 feet of any stream, water body, or wetland must be diapered to prevent leaks.
- All fuel and lubricants will be stored in containers and areas that conform to applicable local, state, and Federal regulations.

- If a spill of fuel or hydraulic fluid occurs, the contractor will immediately attempt to contain the spilled material and notify the appropriate regulatory agency following the spill response plan and all applicable local, state, and Federal regulations.
- Petroleum contaminated soils resulting from contractor fueling, greasing, and cleaning, or due to fluid leaks will be removed and disposed of following all applicable local state, and Federal regulations.

Erosion Control and Construction Stormwater Management

An Erosion Control Plan and a Stormwater Pollution Prevention Plan will be prepared for the project. These plans will identify BMPs to minimize erosion and sedimentation associated with access roads, water crossings, construction sites, equipment and material storage sites, and staging areas. Typical measures will include:

- Contractor will submit an erosion control and stormwater pollution prevention plan to project engineer for approval prior to commencing construction.
- Stormwater and erosion control will be managed using existing drainage patterns and on-site storage areas. Existing drainage patterns will be maintained and runoff will be routed into natural depressions in the existing topography.
- Excavated areas and excavated material shall be protected from erosion as described on the plans and required by permits.
- Contractor will provide measures to prevent construction vehicles from tracking sediment off-site or onto roadways where it is subject to washing into storm drains, waterways, or wetlands, including gravel access pads, wheel wash stations, or other equally effective methods.
- Dust control: all heavy use areas are to be maintained in a condition that minimizes dust on the project site, and the contractor will have access to a water truck for dust management. The project inspector will notify the contractor to mobilize dust control activities (including watering) if conditions require.
- To prevent sediment from entering stream and wetland habitats, erosion control measures will be implemented such as filter bags, sediment traps or catch basins, vegetative strips, berms, jersey barriers, fiber blankets, bonded fiber matrices, geotextiles, mulches or compost, wattles and silt fences, and covering exposed soils with plastic sheeting.
- Disturbance to riparian vegetation will be the minimum necessary to achieve construction objectives so as to minimize habitat alteration and the effects of erosion and sedimentation.
- During construction, all erosion controls will be examined daily by the project inspector to ensure they are working adequately.
- If inspection shows that the erosion controls are ineffective, work crews will be mobilized immediately to make repairs, install replacements, or install additional controls as necessary.

In-Water Work

- Where feasible, the work areas will be isolated using cofferdams and floating silt curtains.
- The contractor shall install a "Layfield FSC 13" floating silt curtain, or an approved equal. The silt curtain will retain fine silts and sediments on-site. The curtain will be installed starting at the waterline along the stream bank and worked outward (similar to a seining net) and along the bottom.
- As work areas are isolated, fish will be removed by seining and/or electrofishing. Fish will be transported safely out of the work zone and released as soon as possible after collection. A summary report of any fish salvage effort will be prepared that, at a minimum, includes a summary of methods, enumeration by species of fish encountered, and description of their ultimate disposition.
- The silt curtains and cofferdams will remain in place for the duration of work. After work in a specific area is complete, these measures will be removed to introduce free flowing water into the area in a controlled manner. Introduced flow rates shall be managed to maintain low velocities (approximately 3 feet/second). Water velocity and duration of flow introduction (hours to days) will be adjusted to maintain downstream turbidity at or below the 50 NTUs required by the Idaho Department of Environmental Quality as the work areas are returned to a free-flowing state. Maintenance of downstream turbidity at or below 50 NTUs will further reduce concentrations of any remaining sulfide-containing fine-grained materials exiting a work area.

2.1.2.3 Restoration of Temporary Construction Impacts

Streambanks, soils and vegetation will be restored at each project site as previously described for the overall habitat restoration plan. Temporary construction impacts outside the treatment areas will be restored as follows:

- All damaged or disturbed streambanks are to be restored to a natural slope pattern and profile suitable for establishment of permanent woody vegetation.
- All disturbed vegetation is to be replaced using a variety of species native to the project area to replant and reseed each area requiring revegetation before the end of the first planting season following construction.
- No pesticides, including herbicides, will be allowed within 25 feet of waters of the state. Mechanical, hand, or other methods may be used to control weeds and unwanted vegetation. Fertilizer application within 50 feet of the river will not be authorized.
- Stockpile all woody material, native vegetation, topsoil, and native channel material displaced by construction, and use as appropriate for site enhancement activities. The site should show the following features, as appropriate, at the end of the monitoring period:
    - Bare soil spaces shall approximate the size and dispersal pattern of pre-existing condition; soil movement, such as active rills or gullies and soil deposition around plants or in small basins, should be absent or slight and local.
    - Plant material, e.g., leaves, branches, etc., should be well distributed and effective in protecting the soil with few or no litter dams present.

  - Native woody and herbaceous vegetation, as appropriate for the site conditions, should be present and well distributed across the site.
  - Vegetation structure should result in rooting throughout the available soil profile. Plants should have normal, vigorous growth form, and a high probability of remaining vigorous, healthy and dominant over undesired competing vegetation.
  - Streambanks shall have less than 5 percent exposed soil with margins anchored by deeply rooted vegetation or coarse-grained alluvial material.
- Temporary access roads and other areas disturbed during construction will be rehabilitated to similar or better than pre-work conditions.
- Contractors will remove and dispose of all erosion control measures at a legal disposal location.
- Areas accessed by construction traffic will be scarified at least 6 inches deep. At a minimum, site reclamation activities will result in plant distribution and density that match pre-project conditions.
- Short-term stabilization measures (will include but not be limited to such measures as mulching, ground cover seeding [native grasses], and pre-vegetated coir logs) will be implemented until permanent erosion control measures (plant restoration) are effective.
- Reclamation planting shall be completed before the end of the first planting season following construction.
- All disturbed areas will be broadcast seeded with an "erosion control" seed mix and covered with sterile straw. The seed mix will contain the following native seeds by weight: 1 part crimson clover, 1 part white sweet clover, and 2 parts cereal rye (*Secale cereale*) or approved equal based on seed availability. The contractor will provide seed mix constituents to the project engineer for approval. The minimum application rate will be the greater of the manufacturers or 30 pounds per acre. Seeding will be accomplished with a hand/broadcast seeding method and will be raked one-quarter inch into the soil and compacted with a 5,000 pound or less tracked vehicle and then covered with sterile straw.

2.2 Analytical Framework for the Jeopardy and Adverse Modification Determinations

2.2.1 Jeopardy Determination

In accordance with policy and regulation, the jeopardy analysis in this Opinion relies on four components:

1. The *Status of the Species*, which evaluates the Snake River physa rangewide condition, the factors responsible for that condition, and its survival and recovery needs.
2. The *Environmental Baseline*, which evaluates the condition of the Snake River physa in the action area, the factors responsible for that condition, and the relationship of the action area to the survival and recovery of the Snake River physa.

3. The *Effects of the Action*, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the Snake River physa.
4. *Cumulative Effects*, which evaluates the effects of future, non-Federal activities in the action area on the Snake River physa.

In accordance with policy and regulation, the jeopardy determination is made by evaluating the effects of the proposed Federal action in the context of the species' current status, taking into account any cumulative effects, to determine if implementation of the proposed action is likely to cause an appreciable reduction in the likelihood of both the survival and recovery of the Snake River physa in the wild.

The jeopardy analysis in this Opinion places an emphasis on consideration of the rangewide survival and recovery needs of the Snake River physa and the role of the action area in the survival and recovery of the Snake River physa as the context for evaluating the significance of the effects of the proposed Federal action, taken together with cumulative effects, for purposes of making the jeopardy determination.

2.3 Status of the Species

This section presents information about the regulatory, biological and ecological status of the Snake River physa that provides context for evaluating the significance of probable effects caused by the proposed action.

2.3.1 Listing Status

The Service listed the Snake River physa as threatened effective January 13, 1993 (57 FR 59244). No critical habitat has been designated for this species. A recovery plan for the Snake River physa was published by the Service as part of the Snake River Aquatic Species Recovery Plan (USFWS 1995). The target recovery area for this species is from River Mile (RM) 553 to RM 675 (USFWS 1995, pg. 30). The proposed action is located outside of the recovery area.

2.3.2 Species Description

The Snake River physa was formally described by Taylor (Taylor 1988, pg. 67-74; Taylor 2003, 147-148), from which the following characteristics are taken. The shells of adult Snake River physa may reach 7 mm in length with 3 to 3.5 whorls, and are amber to brown in color and ovoid in overall shape. The aperture whorl is inflated compared to other Physidae in the Snake River, the aperture whorl being ≥ 1/2 of the entire shell width. The growth rings are oblique to the axis of coil at about 40° and relatively course, appearing as raised threads. The soft tissues have been described from limited specimens and greater variation in these characteristics may be present upon detailed inspection of more specimens. The body is nearly colorless, but tentacles have a dense black core of melanin in the distal half. Penal complex lacks pigmentation although the penal sheath may be opaque. Tip of the penis is simple (not ornamented). The preputial gland is nearly as long as the penal sheath.

The Snake River physa is a pulmonate species, in the family Physidae, order Basommatophora (Taylor 1988, 2003). The rarity of Snake River physa collections, combined with difficulties associated with distinguishing this species from other physids, has resulted in some uncertainties over its status as a separate species. Taylor (2003, pg. 135-137) presented a systematic and taxonomic review of the family, with Snake River physa being recognized as a distinct species (*Haitia* (*Physa*) *natricina*) based on morphological characters he originally used to differentiate the species in 1988. Later authors concluded that the characters described by Taylor (1988) were within the range of variability observed in the widely distributed *Physa acuta,* and placed Snake River physa as a junior synonym of *P. acuta* (Rogers and Wethington 2007, entire document). Genetic material from early Snake River physa collections was not available when Rogers and Wethington published and their work included no analysis or discussion on the species' genetics.

More recent collections of specimens resembling Taylor's (1988, 2003) descriptions of Snake River physa have been used to assess morphological, anatomical, and molecular uniqueness. Live snails resembling Snake River physa collected in the Snake River by the Bureau of Reclamation (Reclamation) below Minidoka Dam as part of monitoring recommended in the Service's 2005 Opinion (USFWS 2005, pg. 162-163) began to be recovered in numbers sufficient to provide specimens for morphological review and genetic analysis. Burch (*in litt*. 2008) and Gates and Kerans (2010, pg. 41-61) identified snails collected by Reclamation as Snake River physa using Taylor's (1988, 2003) shell and soft tissue characters. Genetic analysis conducted by Gates et al. (2013, entire) also found these specimens to be a species distinct from *P. acuta*.

Gates and Kerans (2011, entire) also performed genetic analyses on 15 of 51 live-when-collected specimens recently identified by Keebaugh (2009) as Snake River physa (based on shell morphology) and collected by the Company between 1998 and 2003 in the Snake River from Bliss Dam (RM 560) downstream to near Ontario, Oregon (RM 368). Gates and Kerans (2011, entire) found that these specimens were not genetically distinct from Snake River physa collected below Minidoka Dam (but were genetically distinct from *P. acuta*), and provided additional support that Taylor's (1988) shell description of Snake River physa is diagnostic.

2.3.3 Life History

Freshwater pulmonate snail species such as Snake River physa do not have gills, but absorb oxygen across the inner surface of the mantle via a "lung" or pulmonary cavity (Pennak 1953, pg. 675-676). Some freshwater pulmonates may carry an air bubble within the mantle as a source of oxygen, which may be replenished via occasional trips to the surface, though this is not a required mode of respiration and many diffuse oxygen directly from the water into their tissues across the surface of the mantle (Pennak 1953). The latter method is assumed to be the likely respiratory mode for the Snake River physa: since they live in moderately swift current, individuals that release from substrates to replenish air at the surface would mean they would likely be transported some distance downstream away from their cohort and habitat of choice, and thus away from potential mates and known food sources. The lung-like mantle cavity may also permit at least some physa species to survive for short periods out of water. *Physa virgata*, a junior synonym of *P. acuta* (Dillon *et al*. 2005, pg. 415), have been observed to move and remain out of the water for up to 2 hours in reaction to chemical cues given off by crayfish foraging on nearby conspecifics (Alexander and Covich 1991, pg. 435). Whether or not Snake River physa can survive under such conditions of desiccation is not known.

As far as is known, all freshwater pulmonates, which include Snake River physa, are able to reproduce successfully by self-fertilization (Dillon 2000, pg. 83). While self-fertilization (selfing) in pulmonates can be forced under laboratory conditions by isolating individual snails, there is considerable variation within and among pulmonate genera and species in the degree of selfing that occurs in natural populations. Of the many *Physa* species in North America and world-wide, studies of self-fertilization effects on population genetics seem to have been conducted only on *P. acuta*. Selfing and its implications for genetic variation and species fitness are unknown for Snake River physa.

Snake River physa have yet to be reared and studied in the laboratory, and the species' reproductive biology has not been studied under natural conditions. Dillon *et al*. (2004, pg. 65) reported mean fecundity of 39.1 hatchlings per pair per week for *P. acuta*, but whether the Snake River physa exhibits similar reproductive output is not known. Dillon (2000, p. 119-121 and 156-170) discusses the number of generations pulmonate species may show per year, and indicates that the period of egg-laying is somewhat dependent on snail size and water temperature. McMahon (1975) discussed the range of critical water temperatures in which the onset of egg-laying begins in a number of *Physa* spp., and also stated that breeding frequently ceases when water temperature drops below some critical level. Table 2 provides a summary of McMahon's information.

Table 2. Temperature ranges for onset of egg-laying of some Physa species in the United States and Europe (McMahon 1975).

Location	**Temperature Range**	***Physa* species**
Texas	> 13 ^{0}C	*P. acuta*
Michigan	10-12 ^{0}C	*P. gyrina*
Southern England	7-11 ^{0}C	*P. fontinalis*
Netherlands	7-8 ^{0}C	*P. fontinalis*

P. gyrina and *P. acuta* have both been identified based on shell and internal morphology as having been recovered from the Snake River, with the latter's presence recently confirmed via genetic analysis (Company, unpublished results). The Service considers it likely that the temperature range for reproduction among three *Physa* species across a range of latitude on two continents may also include the temperature at which Snake River physa may breed in the Snake River, and we regard 10 ^{o}C as a median water temperature at which *Physa* reproduction might begin. Evaluation of Company and USGS water temperature data from near Marsing, Idaho and Swan Falls Dam (not shown) suggests that Snake River physa might reproduce between late

March through early November, depending on the year, with a possibility for more than one generation.

Habitat Characteristics

Water is the primary habitat requirement of Snake River physa. Analysis of Snake River physa substrate preferences (Winslow *et al. in litt.* 2011) indicates the species selects for gravel to pebble, possibly gravel to cobble, substrates where water velocity is sufficient to keep the substrate free of fine sediments and macrophyte plant growth. The earliest descriptions of the species state that it was predominantly found in deep, fast flowing habitats such as rapids, and on boulder to bedrock substrates (Taylor *in litt*. 1982). While habitats such as rapids over boulder to bedrock substrates may be utilized by the Snake River physa, the large amounts of collection data currently available have allowed for a more rigorous analysis of occupied habitat within the Snake River. Gates and Kerans (2010, pg. 33-36) found the species in the Minidoka Reach (between Minidoka Dam and Milner Reservoir) to be most associated with pebble to gravel sized substrate, but note that these substrate types made up 67 percent of the river sampled, and the Minidoka Reach is predominantly made up of run-glide habitats, with rapids making up a small proportion of habitats present (substrate size categories, i.e., gravel, pebble, follow Cummins 1962). In a more recent analysis of the downstream data collected by the Company, Winslow *et al.* (*in litt*. 2011 pg. 6) found that Snake River physa occurred on substrates containing gravel (gravel/pebble and gravel/cobble categories) more than expected by chance alone ($X^2 \geq 55.504$, $P \leq 0.00032$). These findings of Snake River physa habitat selection support those of Gates and Kerans (2010, p. 33-36). In addition, such gravel substrates are more prevalent where typical river velocities are great enough to transport finer sediments, but not so high as to readily transport pebble/gravel sized sediments, representing water velocities typically encountered in the Snake River in runs and glides. The species has also been found on occasionally on sand and silt, but does not seem to select for these substrates.

Gates and Kerans' (2010, pg. 8-36) detailed study sampled cross sections of the river profile, and characterized Snake River physa habitat as occurring in runs, glides, or pools, with moderate mean water velocity of 0.57 meters/second (m/s). Mean depth of samples containing Snake River physa was 1.74 m, with live specimens most frequently recovered from depths of 1.4 to 2.5 m (4.6 to 8.2 feet) (p. 23). Depths in which all specimens were recovered ranged from less than 0.5 m (1.6 feet) to over 3.0 m (9.8 feet), and abundances of three or more Snake River physa per sample were found at depths > 1.4 m (4.6 feet) (p. 23). This evidence is suggestive of habitat requirements related primarily to velocity and depth as they influence substrate deposition. The U.S. Geological Survey (USGS) currently conducts water velocity measurements in conjunction with random sampling for Snake River physa conducted by Reclamation in the Jackson Bridge area of the Minidoka Reach. The combined velocity and species sampling data consistently shows recovery of Snake River physa from gravel/pebble/cobble in areas with water velocity between 0.18-0.83 m/s, with mean velocities of 0.52 m/s in 2013 (USBR 2014a, p. 16, Table) and 0.25 m/s (mean depth of 1.62 m) in 2014 (USBR 2015, p. 8).

In a regulated river, whether fine sediments are present and suspended in the water column or are deposited on the river bed may be a function of water velocity, or of dams that act as sediment traps. Chambers *et al*. (1991) demonstrated how the interaction between sediment and water velocity affected the establishment of macrophyte beds. Low current velocities resulted in sediment deposition and macrophyte establishment in deposited sediment, with macrophyte biomass significantly and inversely correlated with velocity within the macrophyte bed over the range of 0.01-1.0 m/s. Once established, the nutrient concentrations (primarily phosphorous and nitrogen) in the sediments determined macrophyte abundance and density. At velocities greater than 1 m/s, macrophytes were either absent or present in negligible quantities. American Falls Dam and Minidoka Dam both act as highly effective sediment traps, with the result that water in the Minidoka Reach is relatively free of fine sediment (USBR 2014b, p. 79). Although the mean water velocity of 0.57 m/s in Snake River physa occupied habitat in the Minidoka Reach is roughly half of the velocity (1.0 m/s) for which Chambers *et al*. (1991) reported that macrophytes are absent or present in negligible quantities, macrophytes are nearly absent in the permanently watered river sections of the Minidoka Reach; minimal fine sediments passing Minidoka Dam are a plausible cause. Company biologists surveying for Snake River physa downstream in the Walters Ferry reach of the Snake River (~ RM 424), which typically carries a high sediment load, reported few or no macrophytes and gravel to pebble-sized substrates when water velocities approached 1 m/s. This suggests that the presence of Snake River physa in the Minidoka Reach may be, at least in part, a function of sediment trapped behind Minidoka and American Falls dams; and, that under some river conditions water velocities greater than the mean of 0.57 m/s may be required to maintain Snake River physa potential habitat in suitable condition where sediment loads are higher.

Water temperature requirements and tolerances of Snake River physa have not been specifically researched. Gates and Kerans (2010, pg. 21) reported a mean water temperature of 22.6° C for sites occupied by the species at the time of sampling (in August and October), but it is not known if this represents an optimal range or if it happens to be the temperature range in which the species has been able to persist following anthropogenic changes to the Snake River system. Winter water temperatures in the Snake River have historically reached freezing, though records are patchy (USGS 2003). Water temperatures for samples collected by the Company in the Bruneau Arm of C.J. Strike Reservoir and in the Snake River between RM 559 and RM 367 in late July to mid-August between 1998 and 2002 that contained live-when-collected Snake River physa averaged 23.4° C. The maximum temperature for cold water biota established in the Clean Water Act is 22° C. Based on available information, the range of water temperatures encountered by Snake River physa in its occupied range and habitat do not appear to be limiting.

Diet

Diet preferences of Snake River physa are not known. Species within the family Physidae live in a wide variety of habitats and exhibit a variety of dietary preferences to match this. Physidae from numerous studies consumed materials as diverse as macrophytes; and benthic diatoms (diatom films that primarily grow on rock surfaces), bacterial films, and detritus (collectively termed periphyton) (Dillon 2000, pg. 66-70). *P. gyrina* consumes dead and decaying vegetation, algae, water molds, and detritus (DeWitt 1955, pg. 43; Dillon 2000, p. 67).

2.3.4 Status and Distribution

At the time of its listing in 1992, the Snake River physa was presumed to occur in two disjunct populations, one in the Lower Salmon Falls and Bliss Reaches (approximately RM 553-572), and the Minidoka Reach (approximately RM 669-675). Its historic range was believed to extend as far downstream as Grandview, Idaho (RM 487) (USFWS 1995, pg. 8-9). Fossil evidence indicates this species existed in the Pleistocene-Holocene lakes and rivers of northern Utah and southeastern Idaho, and as such, is a relict species from Lake Bonneville, Lake Thatcher, the Bear River, and other lakes and watersheds prehistorically connected to these water bodies (Frest *et al*. *in litt.* 1991, pg. 8; Link *et al.* 1999). The species' cryptic morphology (resembling more common species within the genus), the difficulty of sampling a large river, and the species' rarity, all made determining its distribution and abundance challenging and ambiguous.

Much of the resolution on the species' distribution has come from recent advances in the use of genetic tools, which have provided a greater degree of certainty in identification, and hence confirmation of the species' abundance and distribution (see Section 2.3.2). Subsequent work conducted by a number of agencies, private entities, and academics has greatly increased our understanding of the species' distribution and preferred habitat, though numerous questions on the factors limiting its distribution and abundance remain. Surveys conducted by the Company between 1995 and 2003 (Keebaugh 2009) and Reclamation from 2006 through 2008 (Gates and Kerans 2010), confirmed with genetic identification, place the species' current distribution from RM 368 near Ontario, Oregon (some 128 miles downstream from its previously recognized downstream range), upstream to Minidoka Dam (RM 675). Gates and Kerans (2011, pg. 10) confirmed that shell morphology, diagnostic of Snake River physa, from one of the specimens collected in the Bruneau River arm of C.J. Strike Reservoir matches that of specimens with similar morphology also confirmed as Snake River physa by DNA analysis.

As discussed above, while the full extent of the species' range is considerably greater than originally thought, the snail is not uniformly distributed throughout that range and there remain extensive portions of the Snake River that have not received adequate survey. The Snake River physa is known to reach it highest densities and abundance in the upstream-most population which is roughly delineated as occurring from immediately below Minidoka Dam (RM 675), downstream to Milner Reservoir (RM 663). Snake River physa have been sporadically recovered from the snail pool located about 250 meters downstream of the Minidoka Dam spillway (the area below the spillway was originally dry ground before the dam was built; it is not part of the original Snake River channel). Although low numbers of individuals have been recovered in the pool, one sample held the highest number (15) of Snake River physa ever recorded in a single sample (Kerans and Gates *in litt.* 2008).

From their transects located in the Snake River, Gates and Kerans (2010, pg. 23) report Snake River physa from 19.7 percent of their samples with high density samples ranging from 30 to 64 individuals per m^2 (Gates and Kerans 2010, Figure 1.6, pg. 23), though typically samples contain lower densities. In addition, Kerans and Gates (*in litt*. 2008, p. 8) also reported finding 7,540 empty Snake River physa shells during their 2006 sampling effort in the Minidoka Reach, by far the largest number of Snake River physa shells reported from any surveys. The frequency of occurrence and densities both decline in this reach downstream toward Milner Reservoir where the river transitions from a lotic to more lentic and sediment-laden environment (Gates and Kerans 2010, Table 1.2, pg. 21, 39).

In contrast to the Minidoka Reach, the Snake River physa is considerably less commonly encountered in its downstream range (below Bliss Dam). Only 49 live-when-collected specimens have been recovered in the Snake River between Bliss Dam and Brownlee Reservoir (2 additional specimens were identified from the Bruneau River Arm of C.J. Strike Reservoir). These specimens were identified in only 4.3 percent of 787 inspected samples containing live animals; the density of live animals typically did not exceed 4 individuals per m^2 in these river reaches (Keebaugh 2009, entire document). The numbers of live-when-collected Snake River physa in these reaches are too few to estimate the species' density or abundance with acceptable confidence. Other portions of the Snake River (*e.g.*, Thousand Springs (RM 584) to Milner Reservoir) have received little to no survey effort. Table 3 displays all Snake River physa live recoveries in the Snake River from Bliss Dam (RM 560.3) downstream to near Ontario, Oregon (RM 367.9), and in the Bruneau River, all collected by the Company. There is no information on the continued presence of Snake River physa in the Bruneau River beyond the collection of the 2 live specimens from the Bruneau River Arm of C.J. Strike Reservoir.

Early reports of the collection of two live Snake River physa above American Falls Dam (Pentec Environmental 1991, pg. 8, 16) have never been confirmed. Recent survey efforts by Reclamation failed to locate Snake River physa upstream of Lake Walcott, the reservoir behind Minidoka Dam (Newman, pers. comm. 9 Jan. 2012). In addition, a recent review (Keebaugh *in litt*. 2014) of a large gastropod collection conducted in 2004 in the Snake River and tributaries upstream of American Falls Reservoir did not identify any live-when-collected Snake River physa specimens or shells, providing further strong, although not conclusive, evidence that the species may not occur upstream of Lake Walcott.

Table 3. Snake River physa collected by Idaho Power Company between 1998 and 2002. (Bean and Stephenson 2011).

Date	River Mile	Number Collected
7/24/2002	Bruneau River 3.8	1
7/24/2002	Bruneau River 3.9	1
8/29/2001	367.9	2
7/13/1998	400.1	1
8/7/2001	400.3	1
7/13/1998	401.9	1
8/6/2001	403.6	2
7/13/1998	407.5	2
7/14/1998	417.0	1
7/14/1998	417.0	1
8/2/2001	420.5	7
8/2/2001	421.0	1
7/15/1998	424.3	3
7/15/1998	424.3	2
7/15/1998	424.3	1
8/1/2001	425.8	1
8/1/2001	426.3	1
8/1/2001	428.3	1
7/20/1998	433.1*	1
7/20/1998	433.1*	1
7/22/1998	442.0*	1
7/24/2001	443.6	2
7/24/2001	445.2	2
7/28/1998	445.8	1
5/17/2001	467.7	1
5/3/2001	471.6	1
5/3/2001	471.6	4
5/2/2001	478.5	1
5/2/2001	478.5	1
5/1/2001	480.2	2
7/30/2002	489.5	1
7/31/2002	489.5	1
7/17/2002	559.3	1
Total		**51**

* The action area is located between RM 433 and 442.

2.3.5 Conservation Needs

Survival and recovery of the Snake River physa is considered contingent on "conserving and restoring essential mainstem Snake River and cold-water spring tributary habitats (USFWS 1995, pg. 27)." The primary conservation actions outlined for this species are to "Ensure State water quality standards for cold-water biota…" (USFWS 1995, pg. 31).

Priority 1 tasks consist of:

- Securing, restoring, and maintaining free-flowing mainstem habitats between the C.J. Strike Reservoir and American Falls Dam; and securing, restoring, and maintaining existing cold-water spring habitats.
- Rehabilitating, restoring, and maintaining watershed conditions (specifically: cold, unpolluted, well-oxygenated flowing water with low turbidity (USFWS 1995, pg. 1)).
- Monitoring populations and habitat to further define life history, population dynamics, and habitat requirements (USFWS 1995, pg. 27-28).

Priority 2 tasks consist of:

- Updating and revising recovery plan criteria and objectives as more information becomes available, recovery tasks are completed, or as environmental conditions change (USFWS 1995, pg. 28).

The conservation needs of listed species are based on the species' habitat requirements. Habitat requirements of the Snake River physa are based on habitat where the species has been found, which may inject substantial uncertainty for a rare species. Recorded habitat may not necessarily represent optimum habitat, but until more definitive data on optimal habitat can be obtained, we must accept habitat where the species has been found as representing what we know of its habitat requirements. Information and conclusions here are based on the most recent information on the species' distribution in the wild.

As described in Section 2.3.3, the Service has concluded that Snake River physa select for substrates in the gravel to pebble range, and possibly in the gravel to cobble range, in water velocity sufficient to keep these substrates free of fines and macrophytes, and that these conditions represent the species' preferred habitat in conditions extant in the Snake River.

2.4 Environmental Baseline of the Action Area

This section assesses the effects of past and ongoing human and natural factors that have led to the current status of the species, its habitat and ecosystem in the action area. Also included in the environmental baseline are the anticipated impacts of all proposed Federal projects in the action area that have already undergone section 7 consultations, and the impacts of state and private actions which are contemporaneous with this consultation.

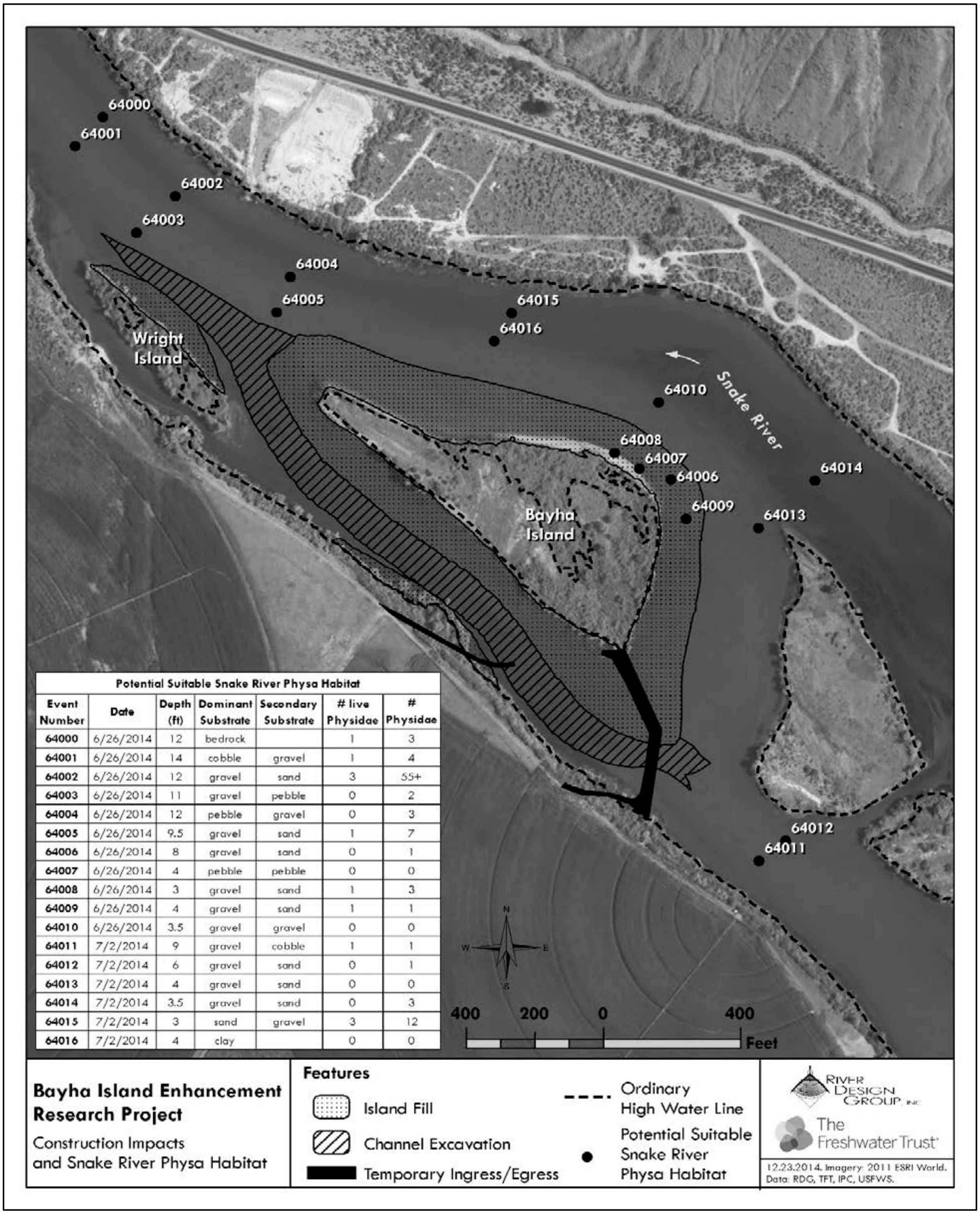
2.4.1 Status of the Species in the Action Area

Prior to development of this project, the most recent sampling data for snails and substrates in the vicinity of the action area was conducted by the Company in 1998. The Company recorded gravel and sand near the downstream end of Brooks Island at RM 440.8, the sample site nearest the action area. The locations of live Snake River physa recovered by the Company in 1998 nearest to the action area were 2 specimens downstream at RM 433.1, and 1 specimen upstream at RM 442 (Table 3).

On May 8, 2014, Company and Service biologists conducted an assessment of potential Snake River physa habitat suitability in the littoral areas near Bayha and Wright islands. Patches of moderately suitable substrates (i.e., gravel, pebble, and cobble) were found around Bayha Island, but these substrates were typically embedded with fines or occupied by macrophytes. Most of the littoral area adjacent to Wright Island contained an unsuitable anoxic silt substrate, especially in the channel adjacent to the southwest side of the island; a small portion of moderately suitable habitat was identified on the northeast side of the island. The surveyors concluded that suitable Snake River physa habitat was not present within the littoral areas accessible via wading. On May 28, 2014, IPC biologists revisited Bayha Island and collected additional substrate data from a boat at deep water sample sites. Potentially suitable substrates (cobble/gravel, pebble/gravel) with suitable depths/velocities were noted in the vicinity of event numbers 64006 through 64009 on the northeast side of Bayha Island (Figure 5), and also in the main channel on the north side of the island. Other adjacent areas with suitable water column velocities contained unsuitable amounts of fine substrates (sand or silt).

On June 26 and July 2, 2014, IPC and USFWS biologists collected additional benthic samples from 18 sites (Figure 5). Areas of proposed disturbance along the right bank of Wright Island and the channel on the south side of Bayha Island had been determined to contain no potential suitable Snake River physa habitat, and so were not sampled by dredge for the species. Sample sites on the north side of Bayha Island were located in the island fill area (Figure 5) in support of section 7 consultation for this project. Sample sites in the main channel on the north side of the island north of the island fill area and further upstream were located to support separate section 7 consultations for sediment coring needed to determine if substrates at depth were suitable for excavation, and for placement of temperature monitoring transects designed to gather pre-project baseline data (USFWS 2014, 2015a). Substrates encountered during sampling indicated the presence of habitat suitable for Snake River physa in many of the samples (Figure 5). All physa specimens (live-when-collected and shells) from the samples were examined by EcoAnalysts, Inc. (Hill *in litt*. 2014). No adult live physa specimens matched Snake River physa internal morphology. A subset of 4 of these live physa specimens were evaluated for similarity to Snake River physa using molecular genetic tools, but no Snake River physa were identified (Liu *in litt*. 2014). Hill (*in litt*. 2014) determined that two of the 96 empty physa shells collected matched Snake River physa shell morphology. Of these shells, one appeared to have been dead for an extended period of time based upon the level of observed shell abrasion and wear. The second specimen appeared to have less visible damage, indicating it was likely more recently dead. Both shells were recovered from the two downstream-most sampling sites (event numbers 64000 and 64001 in Figure 5).

Empty snail shells may be carried several miles under the right river conditions, but the presence of several thousand empty shells identified as Snake River physa recovered in the Minidoka Reach (Kerans and Gates *in litt.* 2008) also suggests that many empty shells may remain in and adjacent to occupied habitat. Hence, the presence of live Snake River physa in the action area cannot be ruled out.



Potential Suitable Snake River Physa Habitat

Event Number	Date	Depth (ft)	Dominant Substrate	Secondary Substrate	# live Physidae	# Physidae
64000	6/26/2014	12	bedrock		1	3
64001	6/26/2014	14	cobble	gravel	1	4
64002	6/26/2014	12	gravel	sand	3	55+
64003	6/26/2014	11	gravel	pebble	0	2
64004	6/26/2014	12	pebble	gravel	0	3
64005	6/26/2014	9.5	gravel	sand	1	7
64006	6/26/2014	8	gravel	sand	0	1
64007	6/26/2014	4	pebble	pebble	0	0
64008	6/26/2014	3	gravel	sand	1	3
64009	6/26/2014	4	gravel	sand	1	1
64010	6/26/2014	3.5	gravel	gravel	0	0
64011	7/2/2014	9	gravel	cobble	1	1
64012	7/2/2014	6	gravel	sand	0	1
64013	7/2/2014	4	gravel	sand	0	0
64014	7/2/2014	3.5	gravel	sand	0	3
64015	7/2/2014	3	sand	gravel	3	12
64016	7/2/2014	4	clay		0	0

Figure 5. Sampling locations and results of Idaho Power Company sampling for Snake River physa and substrates in the project area.

Habitat Estimates

Due to the difficulty of detecting low densities of Snake River physa in this area of the river, in the past the Service has used estimates of potential habitat as a surrogate for actual density estimates. Available evidence as described in Section 2.3.3 suggests that Snake River physa habitat can be described as:

- Gravel to cobble substrates free of fines and aquatic macrophytes (a function of sorting by current velocity);
- Mean current velocity of 0.57 meters/second (m/s); and
- Depths of 0.5 to 3 m, with most individuals collected from depths between 1.25 to 2.5 m.

Because there is substantial overlap between Snake River physa habitat characteristics and the habitat suitability criteria developed for mountain whitefish (*Prosopium williamsoni*) spawning (Anglin et al. 1992), the Service has used estimates developed by Anglin et al. (1992) of available mountain whitefish spawning habitat at varying flows as a surrogate for Snake River physa habitat between the Walter’s Ferry Bridge (RM 441.9) and the Snake River/Boise River confluence at RM 395.5 (USFWS 2012, 2015a,b), also called the Walter’s Ferry Reach (see page 34 of this Opinion for mountain whitefish spawning habitat parameters). The techniques used by Anglin et al. (1992) allowed for course-scale estimates of habitat for mountain whitefish and several other fish species using the best channel survey methods available at the time, and remain the only large scale habitat estimates for these species in this 46 mile area of the Snake River. In order to inform their design specifications for this project, River Design employed several more intense measurement techniques (single-beam sonar; topographic and shallow depth Light Detection and Ranging Radar [LiDAR]) to obtain river bathymetry descriptions more precise than those obtained by Anglin et al. (1992), justified by the relatively small scale of this project (River Design *in litt*. 2015a, p. 3). Feeding this and other information (historic flow data from the Murphy gage; sediment sampled from the project area [p. 4-9]) into hydraulic models, River Design modeled Snake River physa habitat estimates in the project area under existing and proposed conditions at four specified flows (Figure 6).

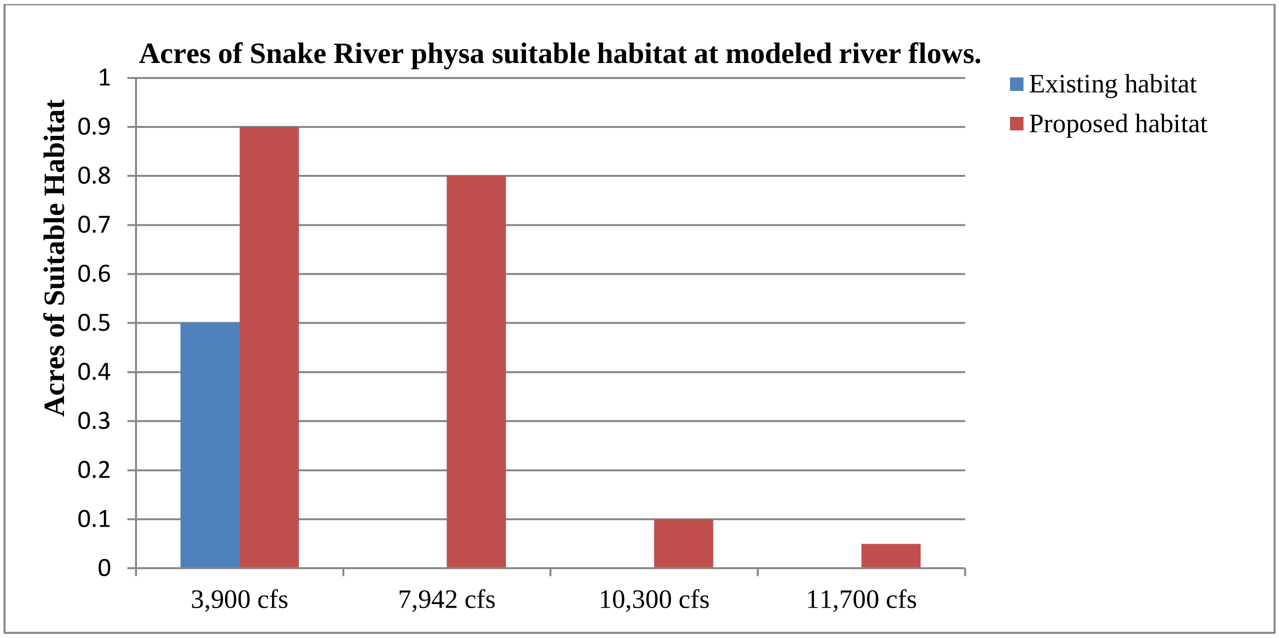


Figure 6. Estimated acres of Snake River physa habitat at four flows: 3,900 cfs is the minimum summer flow that the Company can release from Swan Falls Dam under their 2012 Swan Falls license, and also under the 1984 Swan Falls Settlement with the State of Idaho; 7,942 cfs is the flow that is exceeded 50 percent of the time based on flow records for the last 30 years; 10,300 cfs is the historic discharge during fall Chinook salmon and mountain whitefish spawning between October 15 – November 30; and 11,700 cfs is the historic mean discharge during the rearing period (March 15 – June 15) for fall Chinook (River Design in litt. 2015a, p. 11-12).

Modeling was conducted at four designated flows, which provides no habitat estimates associated with any flow other than those depicted in Figure 6. Under existing conditions, Snake River physa suitable habitat in the project area is estimated at 0.5 acres at 3,900 cfs, with zero suitable habitat estimated at the remaining three flows.

While recognizing that the relationship between habitat needs for Snake River physa and mountain whitefish spawning is likely not one-to-one, given the similarities, estimates of mountain whitefish spawning habitat represent the best estimates available for the amount of Snake River physa habitat in the Walter's Ferry Reach, which includes the action area. The habitat suitability index values for mountain whitefish spawning habitat ranges between 0.0 and 1.0, with 1.0 being most suitable. The index values (**bold**) for velocity, depth, and substrate for mountain whitefish spawning habitat are (Anglin et al. 1992):

- Mean water column velocity: **1.0** at approximately 0.55 m/s (the index is **0.0** at both 0.0 m/s and 1.0 m/s, with the shape of the velocity curve symmetrical)
- Depth: **0.0** from 0.0 to 0.1 m, **1.0** at 0.25 m up to 3.0 m
- Substrate size: **0.9** for cobble, **1.0** for gravel.

In the range of flow/habitat combinations modeled by Anglin et al. (1992) (USFWS 2012, p. 23), the Walters Ferry Reach provides between approximately 1789.5 to 2412 acres of potentially suitable Snake River physa habitat at flows between 3,900 and 8,000 cfs as measured at the

USGS gage #13172500 (Murphy gage), located about 4.3 miles downstream of Swan Falls Dam; above 8,000 cfs the amount of available mountain whitefish spawning habitat begins to decrease with increasing flow. The 0.5 acres of Snake River physa habitat modeled in the action area by River Design represents between 0.02 and 0.03 percent of the species' potential habitat in the Walter's Ferry Reach.

2.4.2 Factors Affecting the Species in the Action Area

Sediment Quality, Water Quality and Quantity

In part to comply with the Corps regulatory requirements for this project under the Clean Water Act, The Freshwater Trust contracted with River Design; Gravity Consulting, a dredge-sampling contractor; and ALS Laboratory, an analytical laboratory, to take and test sediment core samples from the action area for contaminants (heavy metals, pesticides, and other chemicals of concern) based on 2015 freshwater screening limits in the SEF (USACE et al. 2009, 2015) (River Design *in litt*. 2015b, entire). As described in Section 2.1.2.1 under Construction Materials, test results indicated high levels of sulfides (between 134 and 386 parts per million, or ppm) present in a portion of the channel to be excavated on the south side (river left) of Bayha Island, DMMU 1 (dredged material management unit 1) in Figure 7. Dredged material from DMMU 2 did not contain any contaminants at levels of concern (Joint Team *in litt*. 2016) and was deemed suitable for fill. The SEF freshwater screening limit for sulfides in material to be dredged is 39 ppm, due to sulfide toxicity to benthic organisms.

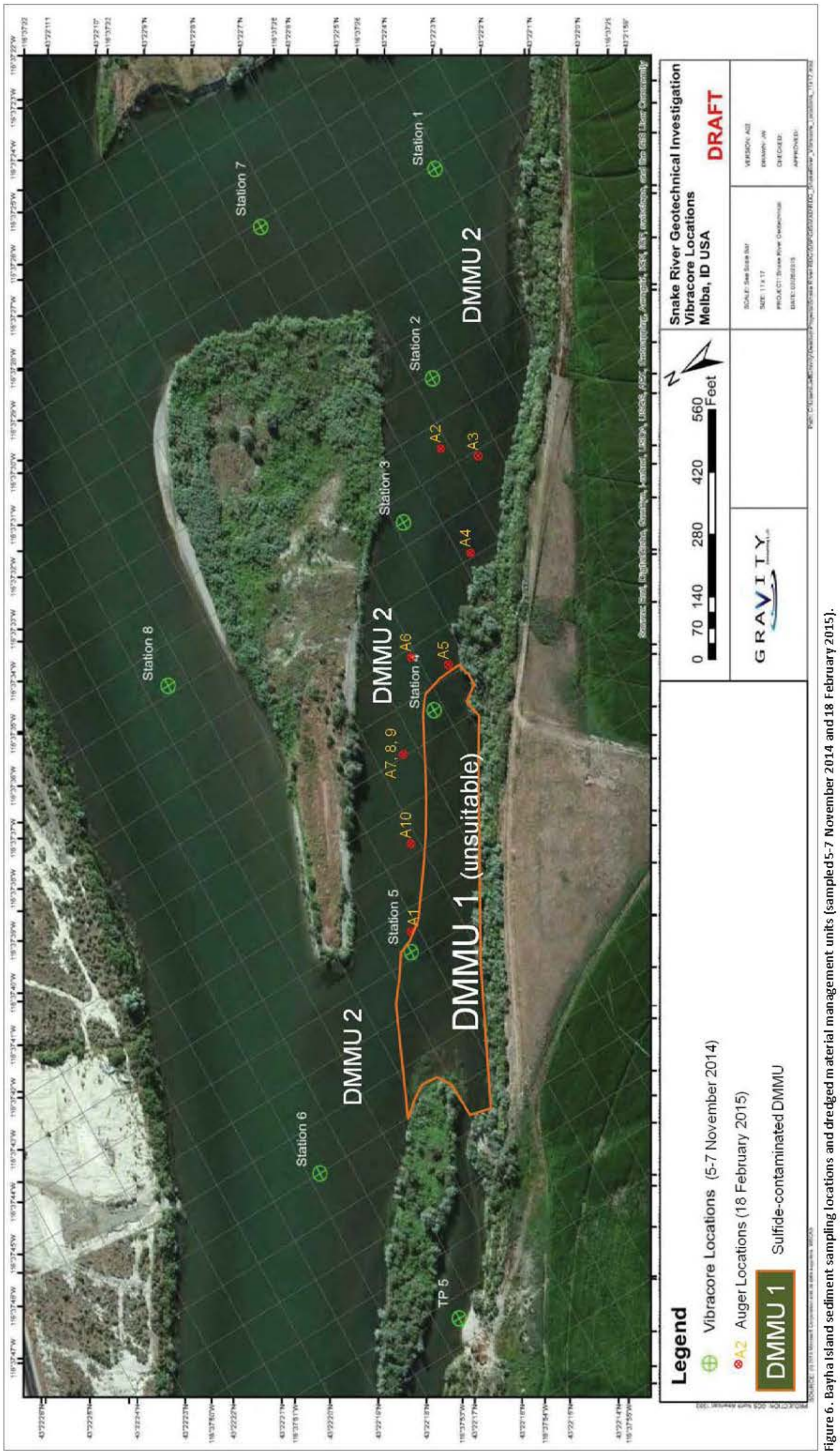


Figure 7. Final sediment sampling locations and dredged material management units (DMMU).

The south channel is not considered Snake River physa habitat due to any suitable substrates present being covered by fines of varying depths, and so sulfide-containing substrate *in-situ* here would not impact the species. In addition, anecdotal evidence indicates that at times the south channel around Bayha Island can be dry during low water when macrophytes growing in shallow areas at the upstream end of the channel essentially dam the channel. However, during periods of high flow portions or all of the fine-grained sulfide-containing material in the south channel may be flushed out and carried downstream outside of the action area.

Water quality in the Snake River has been cumulatively affected by decades of agricultural, municipal, and industrial activities within the watershed, and by the regulation of flows. The most recent five year review of the Mid-Snake River/Succor Creek TMDL (includes the Snake River from Swan Falls Dam to the Oregon state line) reported that downstream of Swan Falls Dam phosphorous concentrations still exceed the TMDL of 70 ug/L from May through September, and that this reach of the river is still temperature impaired (IDEQ 2011, p 30). Unpublished Company data collected in 1995, 2007, and 2013 indicates a *daily* loading of total suspended solids, heavily tied to irrigation, of approximately 79,000 pounds (36,000 kilograms) carried by the river in the vicinity of Bayha Island (The Freshwater Trust *in litt*. 2014, p. 16). High nutrient loading comes from tributaries and agricultural drains and is correlated with sediment loads (IDEQ 2011, p. 30). The primary factors limiting water quality and native fish assemblages in the river between Walters Ferry and Marsing (including the action area) are excess fine sediment, temperature, and nutrients (primarily phosphorus). Particularly relevant to the goals and objectives of the proposed action, average daily water temperature can exceed 25°C at the USGS gage at Murphy (Figure 3), which is about 14 miles upstream of the proposed action site. Instantaneous daily maximum temperatures can be well above 25°C during summer (USGS data, Murphy gage).

Water quality issues in the Snake River are typically exacerbated under low water conditions (FERC 2010, p. 33). Chambers et al. (1991, entire) established the links between water velocity, nutrients, and establishment and density of macrophytes in rivers. They found that macrophyte biomass was significantly and inversely correlated with current velocity within the macrophyte bed over the range of 0.01-1.0 m/s (p. 254). Macrophyte biomass was weakly correlated with discharge rate (or flow), and they suggested that for large rivers, macrophytes are responding to localized changes in velocity and not necessarily changes in river-wide flow (p. 255-256), and therefore it can be difficult to set flow criteria that would prevent macrophyte accumulation. *In situ* experiments of macrophytes growing in varying sediment textures (sand, and sand/silt mixtures) conducted by Chambers et al. demonstrated that increase of velocity over a range of 0.2–0.7 m/s resulted in a decrease in plant biomass irrespective of sediment texture (p. 256). They also noted that nutrient uptake by macrophytes was negatively affected by increased velocity (see also Biggs 1996, p. 137-138 for description of the relationship between velocity and nutrient uptake). Their results indicated that low current velocities result in macrophyte establishment and growth, and once established the nutrient concentrations in the sediments determine macrophyte abundance and density. In addition, once established, macrophytes further reduce velocity within the macrophyte bed (p. 254), which may lead to additional sediment deposition over the macrophyte bed with the potential to maintain or increase nutrient concentrations. At velocities greater than 1 m/s macrophytes were either absent or present in negligible quantities (p. 253). At velocities less than 1 m/s, even small velocity increases resulted in a decrease in biomass (p. 256).

Summer flows passing Swan Falls Dam during the irrigation season (considered to be between April 1 and October 1) are lower than during winter months. Summer flows are further reduced during low water years, with subsequent effects on water quality due to decreased water velocity, sediment and nutrient deposition, and macrophyte establishment. Mean monthly flow data from the Murphy gage (located about 4.3 miles downstream of Swan Falls Dam) from 1950 to the present indicates a general downward trend in low summer flows. The discharge from Swan Falls Dam is now typically reduced during summer when water for irrigation is in high demand. The 1984 Swan Falls Settlement between the Company and the state guaranteed the Company an unsubordinated water right of 3,900 cfs average daily flow passing Swan Falls Dam from April 1 to October 1. To allow the Company to come into compliance with the agreement, the Federal Energy Regulatory Commission (FERC 2012, p. 5-7) approved a decrease in minimum summer flow from 5,000 to 3,900 in their 2012 renewal of the Swan Falls license. Discharge data from the Murphy gage indicates that discharge from Swan Falls Dam has never dropped to 3,900 cfs, but has approached that flow once—between 3,990 and 3950 cfs for about 1.5 hours in July of 2003. If inflow to Swan Falls Reservoir is 3,900 cfs or less, then the license requires that discharge from Swan Falls Dam equal inflow to Swan Falls Reservoir. The Company advised of the possibility of flows dropping to 3,900 cfs during the 2015 summer, but the lowest flow recorded was 4,660 cfs on August 22, 2015 (IPC *in litt*. 2015).

The Swan Falls Hydroelectric Project, located about 17.75 miles upstream of the action area, is a re-regulating reservoir, with limited storage capacity available to provide minimal peaking operations. The Swan Falls reservoir is not used to store water on a seasonal basis. Rather, the 3 feet of limited available reservoir storage is used on a daily basis to re-regulate flows from the upstream C.J. Strike Hydroelectric Project. Operations at Swan Falls Dam are conducted to safely accommodate inflow (over which the Swan Falls Project has no control) that exceeds specified minimums: hydroelectric power can be produced as a byproduct, and the limited storage can also be used to meet short-term, unexpected peak load requirements. Ramping rate restrictions on discharge from Swan Falls Dam imposed by the FERC license are no more than 1 foot per hour and 3 feet per day, as measured at the downstream Murphy gage. Ramping rates would not be employed if inflow/outflow at the Swan Falls Project is 3,900 cfs or less.

Stage height changes accompanying the ramping rates at Swan Falls Dam have some potential to affect Snake River physa, depending on depths of occupied habitat. Gates and Kerans (2010, p. 23) reported that most Snake River physa (3 or more per sample) at Minidoka were recovered between the depths of 1.4 and 2.5 meters. A depth of 1.4 meters is approximately 4.6 feet. The stage height at the Murphy gage associated with the minimum discharge of 3,900 cfs from Swan Falls Dam is 2.43 feet. If Snake River physa rarely occur above a depth of 4.6 feet, then this depth can be subtracted from the stage heights associated with higher flows to determine if a decrease in flow to 3,900 cfs is likely to expose Snake River physa to stranding. Maximum Snake River physa habitat (using mountain whitefish spawning habitat as a surrogate) in the Walter's Ferry Reach occurs at about 8,000 cfs, corresponding to a stage height of between 3.85 and 4.03 feet at the Murphy gage. Subtracting 4.6 feet from either figure yields a stage height of considerably less than the 2.43 feet associated with 3,900 cfs, meaning that Snake River physa are unlikely to be exposed to stranding if flows are decreased from 8,000 cfs to 3,900 cfs. In fact, Snake River physa occurring at typically occupied habitat depths are unlikely to be exposed to stranding if flows decreased from the maximum flow (15,000 cfs) modeled by Anglin et al.

(1992) to 3,900 cfs: maximum stage height at 15,000 cfs is 6.24 feet, less 4.6 feet, yields a stage height of 1.6 feet, also less than the stage height at 3,900 cfs.

Snake River physa have been recovered downstream of C.J. Strike Dam at depths as shallow as 1 foot, however, including near Marsing, Idaho, where 7 Snake River physa were recorded in one sample in 2001. Hence, there is some possibility that the maximum depth changes downstream of Swan Falls Dam could affect Snake River physa if they are present at shallow depths in the action area.

Climate Change

Climate change analyses for the Pacific Northwest drawn from several sources have produced projections for the Columbia River Basin that include or are specific to the Snake River Subbasin through about 2040, as follows:

- Mean annual air temperature is projected to increase by 1 to 3 ^{o}F (0.5 to less than 2 ^{o}C) (USBR et al. 2011, Part IV, p.vi).
- Projected changes in mean annual precipitation range from a 5 percent decrease to > 10 percent increase for the Snake River Subbasin (USBR 2011, Part II, p. 185). However, such projections may be a geographic artifact of the mix of models selected by the group (in this case, the River Management Joint Operating Committee [RMJOC] Climate Change Study) studying the Columbia River Basin as a whole. The RMJOC study indicated that a concensus view of precipitation changes from a larger collection of projections suggests the Snake River Subbasin may experience only a 1 to 2 percent increase in annual precipitation through 2039 compared to historical conditions (similar to projections for the Columbia River Basin as a whole), and possibly slightly less than historical (USBR et al. 2010, Part I, p. 89).
- At least 20 more days in the frost-free period are predicted in the Northwest, lengthening the growing season; concomitantly, an increase in irrigation demand of 2.2 percent is projected across the Columbia River Basin by 2030 (Raymondi et al. 2013, p. 47).
- The number of days of extremes of heat will increase, and extremes of cold will decrease (Mote et al. 2013, p. 37).
- Warming projections indicate increased winter rainfall, reduced snowpacks, and increased rate of snowmelt (USBR 2011 et al., Part IV, p. vi).
- Overall annual inflow to reservoirs on the Snake River upstream of Brownlee Reservoir will increase, with most of the increase between October and May (USBR 2011, Part II, p. 134). However, the projected magnitude of reservoir inflow during a portion of the irrigation season—June through September—will be *less* compared to historical conditions (USBR 2011, Part II, p. 136). The projection of reduced reservoir inflow from June through September is a function of change in timing of runoff (earlier) and existing finite reservoir storage space.

A review of discharge data from the Murphy gage from 1950 to the present indicates a trend of decreasing annual flow passing Swan Falls Dam, although not all of the decrease may be attributed to decreased precipitation resulting from climate change. Summer flow at Swan Falls is derived from a combination of discharge from the Eastern Snake River Plain Aquifer (aquifer) between Pillar Falls and King Hill, plus flow salmon flow augmentation and any additional excess flow that is discharged from Milner Dam during the irrigation season. Decreasing discharge from the aquifer is influenced by changes in irrigation practices which have decreased groundwater recharge since 1950, plus increased withdrawal of groundwater for irrigation since that time. However, Luce et al. (2013, entire) hypothesized that decreases in lower tropospheric winter westerlies across the Pacific Northwest since 1950 have been reducing orographic precipitation. That is, high elevation snowpacks may have been shrinking annually not just because of more precipitation falling in winter as rain instead of snow, but also because precipitation at high elevation has actually decreased due to a weakened orographic effect. If correct, the areas influenced by this effect include major drainage areas of the Snake River in the northwestern Wyoming mountains and in Idaho's central mountains (Luce et al. 2013, Figures 2 and 4). Climate projections indicate continued weakened lower tropospheric flow across the Pacific Northwest under enhanced greenhouse forcing (Luce et al. 2013, abstract), suggesting a continued reduction in overall high elevation precipitation. Combined with earlier runoff, less precipitation would further decrease inflow to Snake River reservoirs, possibly leading to a higher frequency of water years in which the summer minimum discharge from Swan Falls Dam may approach or reach 3,900 cfs.

The Service's Swan Falls Opinion (USFWS 2012) for the relicensing of the Swan Falls Hydroelectric Project concluded that degradation of Snake River physa habitat downstream of Swan Falls Dam due to conditions stemming from low flows was part of the environmental baseline (i.e., degradation was already occurring prior to relicensing). Our indirect effects analysis from that Opinion assumed that nutrient input to the Snake River from agricultural and municipal sources will remain relatively constant for at least the near future. Chambers *et al.* (1991, entire) implied that even small decreases in water velocity will increase macrophyte growth (section 2.4.2), in part by increasing nutrient uptake. We concluded that the decrease in the Company's minimum summer flows from 5,000 to 3,900 cfs would indirectly affect Snake River physa by further contributing to macrophyte growth due to decreased current velocity in the Swan Falls action area during the part of the year when macrophytes would typically exhibit the highest rate of primary production under warm water temperatures and high insolation. Reduction to flow of less than 3,900 cfs would have the same effects. We also stated that we considered the impacts of low summer flows, nutrient load, and sediment deposition in the Swan Falls action area, particularly in the Walter's Ferry Reach (RM 441.9-395.5), to be the most significant threat to the persistence of Snake River physa downstream of Swan Falls Dam. Projected effects of climate change cited in this Opinion are expected to exacerbate the degree of this threat.

2.5 Effects of the Proposed Action

Effects of the action considers the direct and indirect effects of an action on the listed species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action. These effects are considered along with the environmental baseline and the predicted cumulative effects to determine the overall effects to the species. Direct effects are defined as those that result from the proposed action and directly or immediately impact the species or its habitat. Indirect effects are those that are caused by, or will result from, the proposed action and are later in time, but still reasonably certain to occur. An interrelated activity is an activity that is part of the proposed action and depends on the proposed action for its justification. An interdependent activity is an activity that has no independent utility apart from the action under consultation.

The following analysis builds on the analytical framework used to assess effects on Snake River physa associated with the substrate coring surveys and placement of the temperature monitors at the proposed action site (USFWS 2014 and 2015a).

2.5.1 Direct and Indirect Effects of the Proposed Action

The Service has concluded that implementation of proposed construction actions in Section 2.1.2.1 and of the BMPs and other measures described in Section 2.1.2.2 (Proposed Conservation Measures) will avoid or minimize impacts to Snake River physa in the action area to the extent that impacts would be insignificant or discountable except for those aspects of the proposed action described here as resulting in direct and indirect effects. Insignificant and discountable effects include those involving sulfide-containing materials (see Sections 2.1.2.1, Construction Materials; and 2.1.2.2, In-Water Work). Contractor use of floating silt curtains and coffer dams to isolate mobilized sediment, and post-construction introduction of free-flowing water into the isolated areas in a manner controlled to minimize turbidity in the action area, are expected to minimize or contain any mobilized sulfide-containing material within the action area and away from potential Snake River physa habitat in the north channel. Placement of bulk sulfide-containing material at the bottom of the fill areas with a cap of approved fill will isolate sulfide bulk material from post-construction contact with river water, preventing impacts to benthic organisms including Snake River physa.

Direct and indirect effects to Snake River physa in the action area may result from the following aspects of the proposed action:

- River bed excavation and placement of excavated materials below the ordinary high water mark in order to enlarge Bayha and Wright Islands;
- Placement of materials excavated from uplands below the ordinary high water mark in order to enlarge Bayha and Wright Islands;
- Installation of bulk bags (or other approved method) in the river to create a cofferdam at the upstream end of the side channel between Bayha Island and the south Snake River bank;
- Removal of the bulk bags;
- Installation of floating silt curtains in the north and east channels and at the downstream extent of the disturbance area in the south channel; and,
- Removal of the silt curtains.

Direct Effects

Direct effects may include:

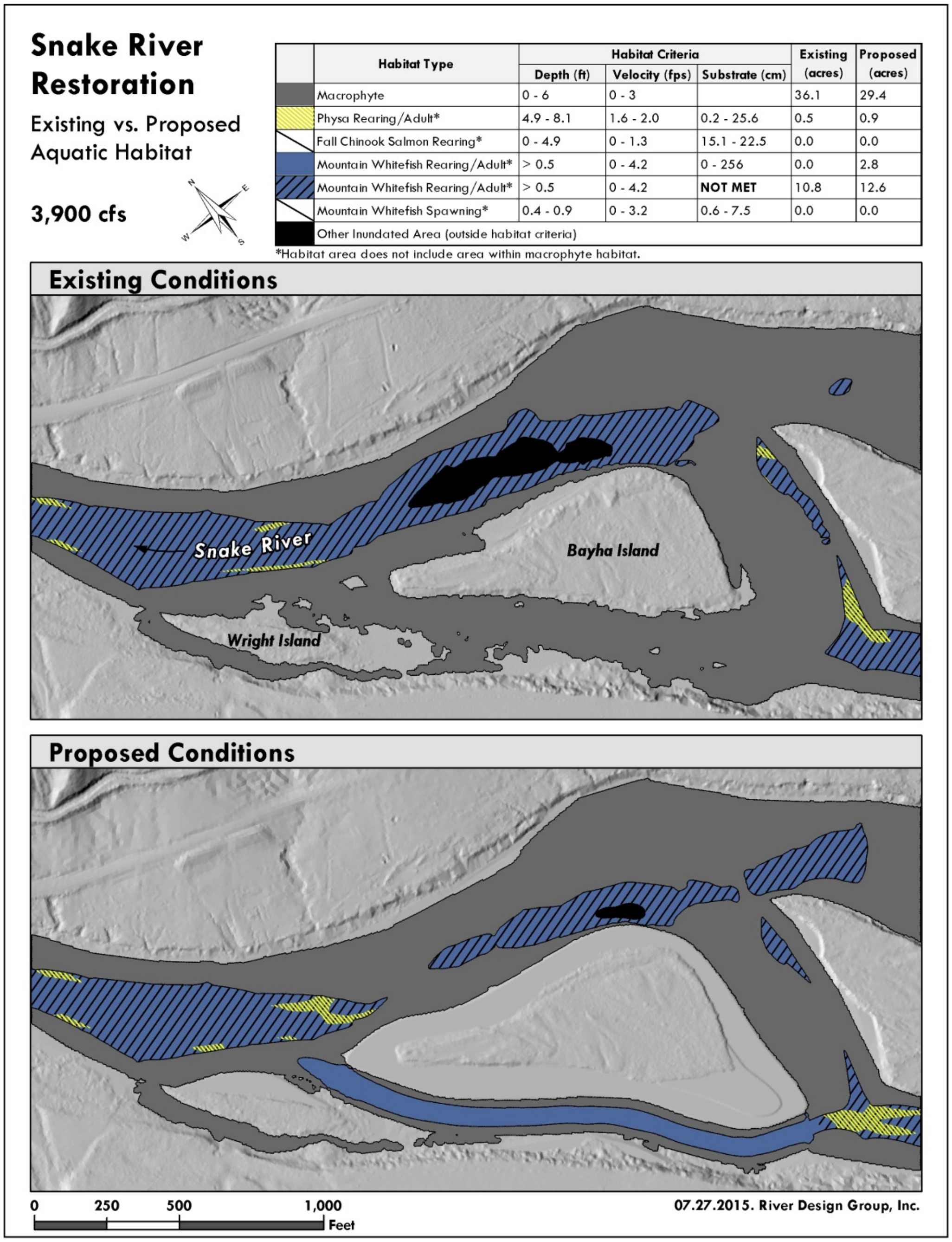
- Entrapment, crushing, and smothering of individuals and eggs, leading to their injury or mortality, as bottom substrates are excavated and placed to enlarge the islands; and during placement and removal of silt curtains and cofferdams. Entrapment, crushing, and smothering of individuals or eggs, leading to their injury or death, as land-sourced fill material is placed in water to enlarge the islands. Crushing may result from weight of fill material or of silt curtains and cofferdams. Smothering (oxygen deprivation) may occur as fill material or silt curtains or cofferdams restrict oxygen over individuals or eggs.

- Smothering of individuals or eggs, leading to mortality, from increased turbidity as bottom sediments are mobilized during excavation and fill and as land-sourced fill material is placed to enlarge islands, and during placement and removal of silt curtains and cofferdams. Mobilized sediment, particularly resulting from work in the main channel between Bayha Island and Argy Island and between Bayha Island and the right (north) bank of the river, may re-deposit over potential or occupied habitat in the action area and smother individuals or eggs. This is considered a short-term effect: mobilized and deposited sediment is expected to be flushed out of the action area during runoff in the year following completion of construction. The relatively small amount of such sediment flushed from the action area during runoff would not be expected to be meaningfully measured or distinguished from sediment normally carried by the river at this time, and so any potential effects to Snake River physa during runoff are considered discountable.

Indirect Effects

Disturbance/dislocation: Individual Snake River physa may release from substrates to drift in the water column in response to physical disturbance from channel excavation or fill placement, or from physical disturbance transmitted as pressure or sound waves through the water or substrate. Individuals that release in response to disturbance may be carried some distance downstream, resulting in stress. If they drop out of the water column onto preferred substrates providing suitable forage and reproductive activities, stress may be temporary; if they settle onto unsuitable substrates inhibiting or preventing feeding or reproduction, eventual death or reduced reproductive fitness may occur, an indirect effect.

Indirect effects other than those that result from disturbance or dislocation are anticipated to be beneficial and include increased depth and velocity in the channels on all sides of the island. Figure 6 indicates the expected increases in modeled Snake River physa habitat at four flows under proposed conditions compared to existing conditions. Figures 8-11 (River Design *in litt.* 2015 b) display how Snake River physa habitat may vary in location and area post-construction under the four flow conditions. Of particular interest is Figure 9, which suggests 0.8 acres of Snake River physa habitat at 7,942 cfs may be concentrated in the south channel—an area currently consisting in part of toxic sulfide substrates—and that the habitat patches may be nearly contiguous. Results of Gates and Kerans (2010, p. 7-40) studies of Snake River physa in the Minidoka Reach suggest that relatively large, relatively contiguous areas of preferred substrates may be one factor resulting in the comparatively high densities and abundance of Snake River physa in that area. If a similar (albeit smaller), relatively contiguous habitat area can be created in the action area, this may create the potential for Snake River physa to establish and persist, assuming the species can colonize the action area.



	Habitat Type	Habitat Criteria			Existing (acres)	Proposed (acres)
		Depth (ft)	Velocity (fps)	Substrate (cm)		
	Macrophyte	0 - 6	0 - 3		36.1	29.4
	Physa Rearing/Adult*	4.9 - 8.1	1.6 - 2.0	0.2 - 25.6	0.5	0.9
	Fall Chinook Salmon Rearing*	0 - 4.9	0 - 1.3	15.1 - 22.5	0.0	0.0
	Mountain Whitefish Rearing/Adult*	> 0.5	0 - 4.2	0 - 256	0.0	2.8
	Mountain Whitefish Rearing/Adult*	> 0.5	0 - 4.2	**NOT MET**	10.8	12.6
	Mountain Whitefish Spawning*	0.4 - 0.9	0 - 3.2	0.6 - 7.5	0.0	0.0
	Other Inundated Area (outside habitat criteria)					

*Habitat area does not include area within macrophyte habitat.

Figure 8. Snake River physa habitat at 3,900 cfs, existing and proposed conditions.

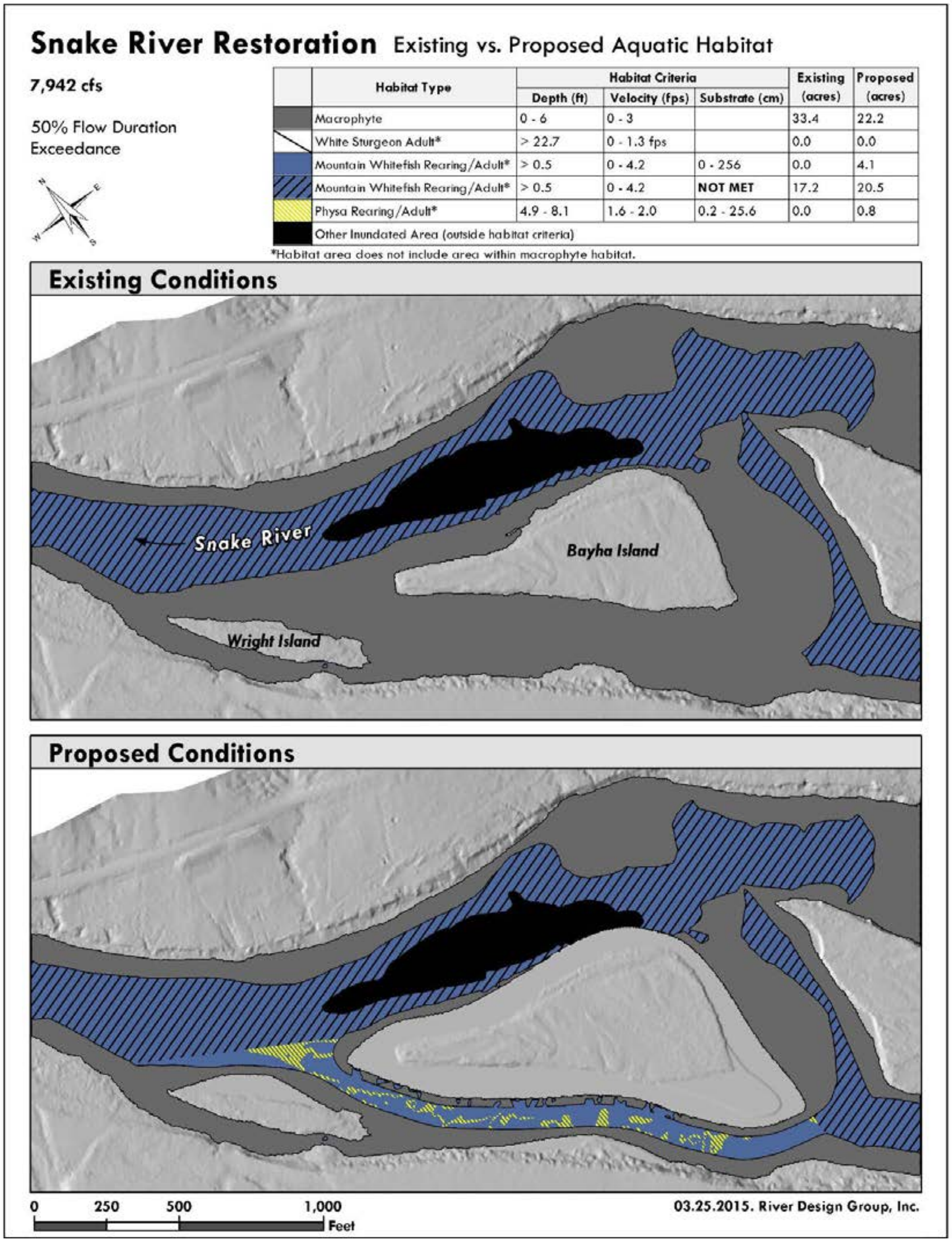
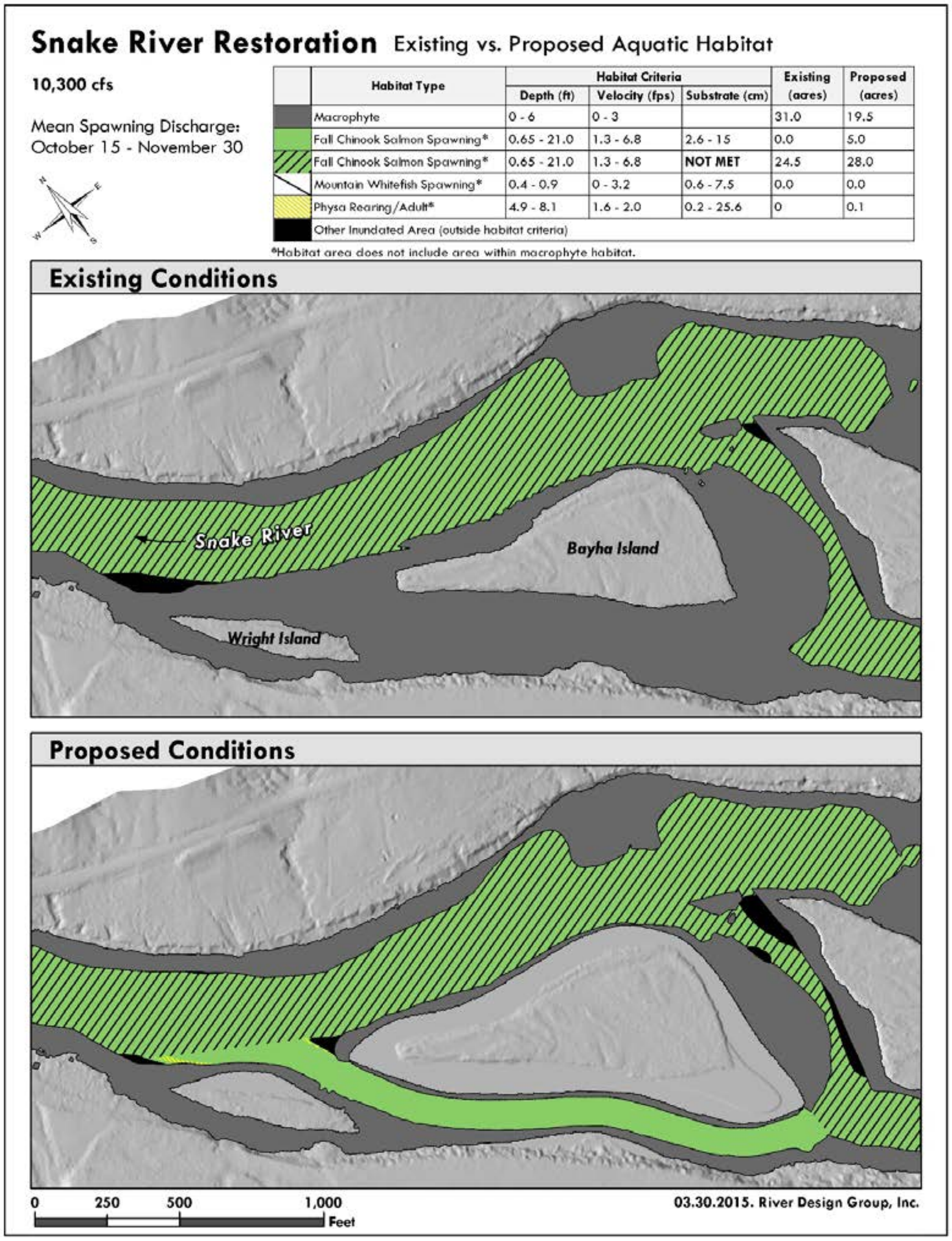


Figure 9. Snake River physa habitat at 7,942 cfs under existing and proposed conditions.



Habitat Type	Habitat Criteria			Existing (acres)	Proposed (acres)
	Depth (ft)	Velocity (fps)	Substrate (cm)		
Macrophyte	0 - 6	0 - 3		31.0	19.5
Fall Chinook Salmon Spawning*	0.65 - 21.0	1.3 - 6.8	2.6 - 15	0.0	5.0
Fall Chinook Salmon Spawning*	0.65 - 21.0	1.3 - 6.8	NOT MET	24.5	28.0
Mountain Whitefish Spawning*	0.4 - 0.9	0 - 3.2	0.6 - 7.5	0.0	0.0
Physa Rearing/Adult*	4.9 - 8.1	1.6 - 2.0	0.2 - 25.6	0	0.1
Other Inundated Area (outside habitat criteria)					

*Habitat area does not include area within macrophyte habitat.

Figure 10. Snake River physa habitat at 10,300 cfs under existing and proposed conditions.

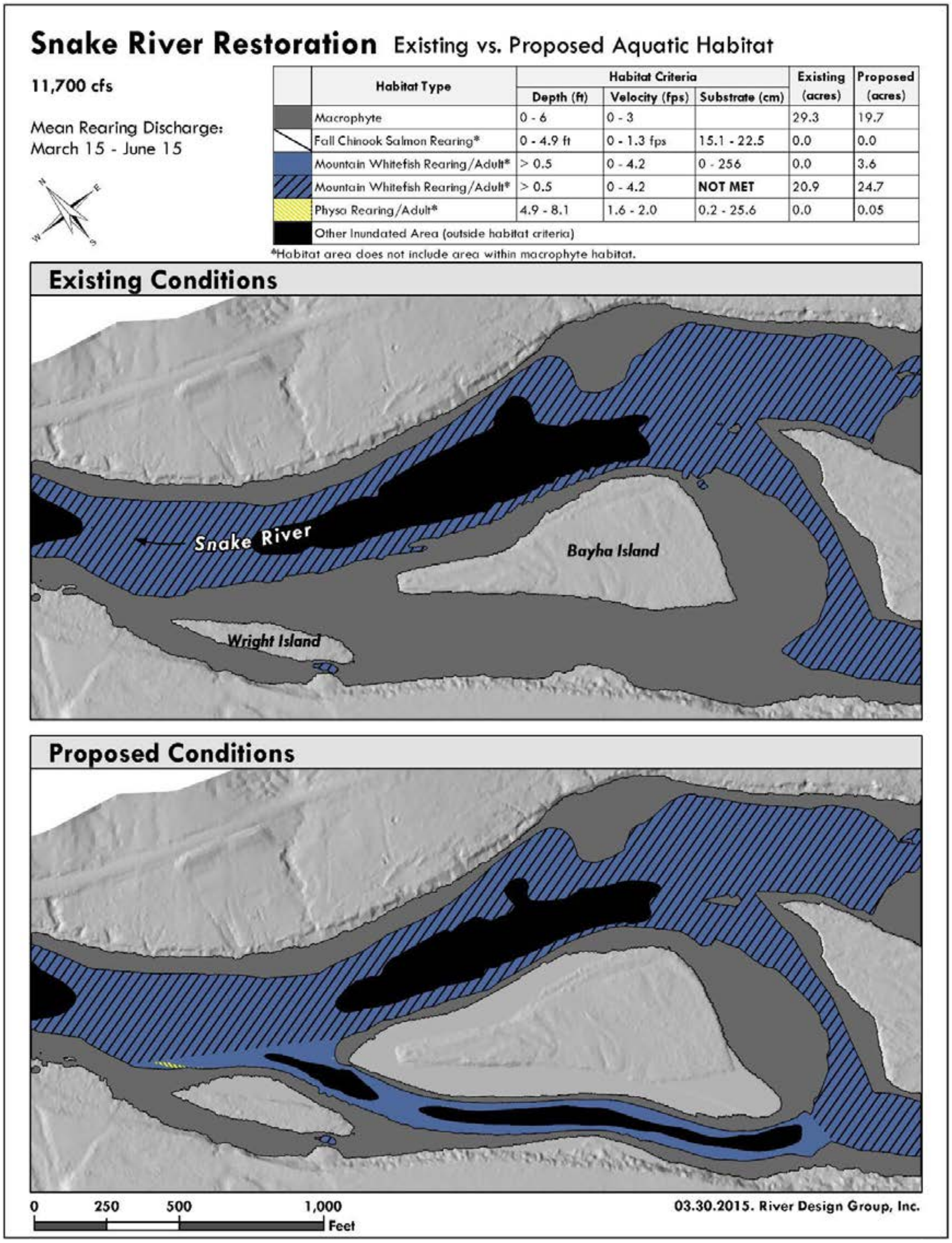


Figure 11. Snake River physa habitat at 11,700 cfs under existing and proposed conditions.

2.5.2 Effects of Interrelated or Interdependent Actions

There were no interrelated or interdependent actions identified as associated with the proposed action.

2.6 Cumulative Effects

The implementing regulations for section 7 define cumulative effects to include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this Opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

There are no known specific future State, tribal, local, or private actions that may occur in the action area. Relatively minor cumulative effects may include impacts from recreation; pollutants from boats (e.g., oil and fuel, battery acid) and sediment mobilization and crushing of individuals and eggs by swimmers and fishermen in the action area may degrade Snake River physa habitat and/or kill, harm, or harass individuals and eggs. Such impacts are anticipated to be localized. They contribute to negative conditions for the species and could exacerbate impacts resulting from the proposed action, but in general are considered to have relatively minor and insignificant impacts to the Snake River physa population in the action area.

2.7 Conclusion

The process of jeopardy determination involves the assessment of the effects of the proposed action in combination with any cumulative effects to determine if the proposed action will appreciably reduce the likelihood of both the survival and recovery of the species. Survival is the condition in which a species continues to exist into the future while retaining the potential for recovery (USFWS and NMFS 1998, p. 4-35).

The Service has reviewed the current status of the Snake River physa, the environmental baseline in the action area, including future climate and hydrologic conditions, effects of the proposed action, and cumulative effects. Based on the following rationales it is our conclusion that the proposed action is not likely to jeopardize the species continued existence, and that impacts of the project are unlikely to appreciably reduce Snake River physa numbers in the action area or rise to the level of population effects:

- The highest known abundance and density of Snake River physa occurs in the Minidoka Reach, approximately 230 river miles upstream of the action area. Based on prevailing conditions in the Minidoka Reach, the Service considers the Minidoka population of Snake River physa to be relatively stable (USFWS 2012, p. 16; 2015b, p. 73; and Sections 2.3.3 and 2.3.4 this Opinion), including under future hydrologic conditions in so far as those can be predicted at this time. In our 2012 Swan Falls Opinion we stated that the species is expected to persist and retain the potential for recovery for the foreseeable future—even if the Swan Falls proposed action significantly contributed to adverse effects to the species in the Swan Falls action area—due to the stability of the Minidoka colonies with their high abundance and densities. (In that Opinion we gave the length of the new Swan Falls license—30 years—as an example of "foreseeable future"). This reasoning holds true for the effects of the proposed action analyzed in this Opinion: based on known information the survival and recovery of Snake River physa will continue to be dependent on the stability of the Minidoka population, and the species' survival and recovery are not expected to be affected by the proposed action analyzed in this Opinion.

- The very small percentage of the total estimated Snake River physa habitat in the Walters Ferry Reach that will be impacted in the project area (p. 35 of this Opinion), in conjunction with the species' exhibiting diffuse distribution in occupied habitat, suggests that if Snake River physa are present they will occur in very low numbers.

2.8 Incidental Take Statement

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without specific exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm in the definition of take in the Act means an act which actually kills or injures wildlife. Such act may include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as an intentional or negligent act or omission which creates the likelihood of injury to listed species by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering.

Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The Corps has a continuing duty to regulate the activity covered by this incidental take statement. If the Corps fails to assume and implement the terms and conditions the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Corps must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 CFR §402.14(i)(3)]. As indicated in Section 2.8.1 below, incidental take is described in terms of the number of Snake River physa that may occur in the species' habitat in the action area. Therefore, the Corps may report on project impacts to Snake River physa habitat within or outside the action area as a surrogate for reporting on project impacts to the species.

2.8.1 Form and Amount or Extent of Take Anticipated

Based on past and recent surveys in the Walters Ferry Reach, Snake River physa are presumed to be present in the action area and the project footprint. The proposed action may result in incidental take of Snake River physa.

It is difficult to quantify the exact number of Snake River physa that would be taken as a result of project implementation because numbers of animals currently known from samples are low for this reach of river, and density data are not available for Snake River physa in the action area. Given the current state of knowledge regarding Snake River physa distribution and abundance, the Service does not have the ability to accurately exempt take solely on the basis of numbers of individuals affected by the proposed action. Therefore, the amount or extent of take incidental to the project will be described in terms of the amount of Snake River physa habitat affected by the project.

Incidental take will occur in the form of harm and harassment resulting in injury or death. The total estimated area of Snake River physa habitat in the river portion of the action area in which incidental take may occur is 0.5 acres, representing between 0.02 and 0.03 percent of the estimated habitat in the Walters Ferry Reach (Section 2.4.1, p. 31-32). The amount of take exempted as incidental is all Snake River physa individuals or eggs that may occur within the 0.5 acres of Snake River physa habitat of the river portion of the action area for the duration of the project.

Harm and harassment are expected to result from:

- Entrapment, crushing, and smothering of Snake River physa individuals and eggs from activities associated with excavation of bottom sediments (excluding impacts from excavating sulfide-containing materials) and fill of these sediments on the margins of Bayha and Wright Islands, and fill of land-sourced materials on the margins of Bayha and Wright Islands; and from activities associated with placement and removal of silt curtains and cofferdams;
- Smothering from increased turbidity due to mobilization and settling of sediments over occupied Snake River physa habitat during excavation and fill of river bed materials, and from sediment released from fill of land-sourced materials; and,
- Disturbance and dislocation of Snake River physa associated with channel excavation and fill placement.

2.8.2 Effect of the Take

In the accompanying Opinion, the Service determined that this level of anticipated take is not likely to jeopardize the continued existence of the Snake River physa across its range, due to the stability of the Minidoka colonies with their high abundance and densities. The percentage of the estimated Snake River physa habitat in the Walters Ferry Reach expected to be impacted by the project represents an insignificant portion of the estimated available habitat. Given that no live Snake River physa and only two Snake River physa shells were recovered during surveys in the action area, and that the species' exhibits diffuse distribution in occupied habitat, we expect actual numbers of Snake River physa that may be harmed or harassed in 0.5 acres to be quite low, and do not expect that incidental take will rise to population level effects.

2.8.3 Reasonable and Prudent Measures

The Service concludes that the following reasonable and prudent measures are necessary and appropriate to minimize the take of Snake River physa caused by the proposed action.

1) Minimize the potential for construction related erosion and sediment mobilization that may affect Snake River physa in the action area by implementing the BMPs and all other protective construction and other protective measures described in Sections 2.1.2.1, 2.1.2.2, and 2.1.2.3.
2) Minimize the potential for contact of hazardous materials and invasive species with the river by implementing the BMPs and all other protective measures described in Sections 2.1.2.1, 2.1.2.2, and 2.1.2.3.

2.8.4 Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, the Corps must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

1) The Corps and the Company shall ensure that silt curtains and cofferdams are deployed (where feasible) in a manner to ensure maximum containment of sediment, and are removed in a manner that will maintain turbidity within state standards. Turbidity monitors approved by the IDEQ shall be deployed in in-water construction areas consistent with IDEQ monitoring protocols. If turbidity exceeds state standards, in-water work associated with the exceedance shall cease until turbidity returns to state standards.

2) The Corps and the Company shall insure that construction contractor(s) implement the BMPs and all other protective measures described in Sections 2.1.2.1, 2.1.2.2, and 2.1.2.3 to meet their explicit and implied intent. As a component of this term and condition, the Corps and the Company shall allow Service site inspections, after first coordinating such visits with the landowner on the south side of the action area. If any BMP or other protective measure is found not to work, or does not accomplish its intent as far as minimizing or avoiding potential take of Snake River physa, work involving that BMP or other protective measure shall stop. The Company and the contractor shall modify the existing BMP and/or devise or implement additional BMPs that will accomplish the intent of the failed BMP or protective measure. The Company and the contractor shall advise the Corps and the Service as soon as possible regarding the incident and the BMP revision, and to discuss if reinitiation of consultation is needed (see section 2.10).

2.8.5 Reporting and Monitoring Requirement

In order to monitor the impacts of incidental take, the Corps or the Company must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [(50 CFR 402.14 (i)(3)]. As indicated in Section 2.8.1 above, incidental take is described in terms of the amount of Snake River physa habitat that may occur in the action area. Therefore, the Corps or the Company may report on project impacts to Snake River physa habitat within or outside the action area as a surrogate for reporting on project impacts to the species.

2.9 Conservation Recommendations

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery programs, or to develop new information on listed species.

The Service recommends that the Company monitor the enhanced areas (additional island area) below the ordinary high water mark post-construction on a regular basis for degradation resulting from human use or from natural flow events. After the project is completed, the enhanced areas may serve as an attractant to people curious to see the changes, resulting in higher than normal visitation. Increased visitation could create the potential for digging, building, or other actions that might affect the stability of soil, gravel, and other fill used to enlarge the islands; or affect the stability of rocks, boulders, and/or large woody debris used to stabilize the fill and floodplains.

Natural flow events that might lead to degradation would include high flows approaching or exceeding the high end of the range of flows for which the enhanced areas were designed to tolerate, and which may change the profile of the enlargements; and also debris such as large trees that may be carried by high flows and which, if they impact the islands, may dislodge portions of the enhanced areas, or may lodge on the enhanced areas.

Human use and/or high flows and large debris lodgment or impact that affect the stability of the fill and constructed floodplains could result in changing or diverting water energy, leading to scour or erosion of the enhanced areas. Scour or erosion would release fine sediment and may change the constructed channel profile, potentially altering water velocity and leading to sediment and substrate deposition in unwanted areas adjacent to the islands. Since the enhancements will change the channels and the existing profiles of Bayha and Wright Islands, which seem to have endured in their current shape for a couple of decades, instability might also lead to scour or erosion through the enhanced areas and into existing islands, potentially altering their shape or existing land area. In addition, such degradation could change the ability of the enhancements to reduce thermal gain and thus affect the Company's 401 compliance under the Clean Water Act.

If inspections of the islands suggest degradation is occurring, we recommend the Company take immediate steps to determine and repair the cause, and to restore stability to the enhanced areas. If unanticipated bank erosion issues are discovered, we suggest the Company give priority consideration to soft bank stabilization methods to enhance overall wildlife values. We ask that the Company consult with us as needed regarding such methods.

We also recommend that monitoring of vegetation seeding and plantings be conducted annually for a period of five years, or for a period that The Freshwater Trust, the Company, and the Service (including the Refuge) agree to. We recommend that contingencies for re-seeding and re-planting be established should seeding or planting success not meet parameters established by The Freshwater Trust, the Company, and the Service (including the Refuge).

2.10 Reinitiation Notice

This concludes formal consultation on the Snake River physa. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been maintained (or is authorized by law) and if:

1. The amount or extent of incidental take is exceeded.
2. New information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this Opinion.
3. The agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this Opinion.
4. A new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

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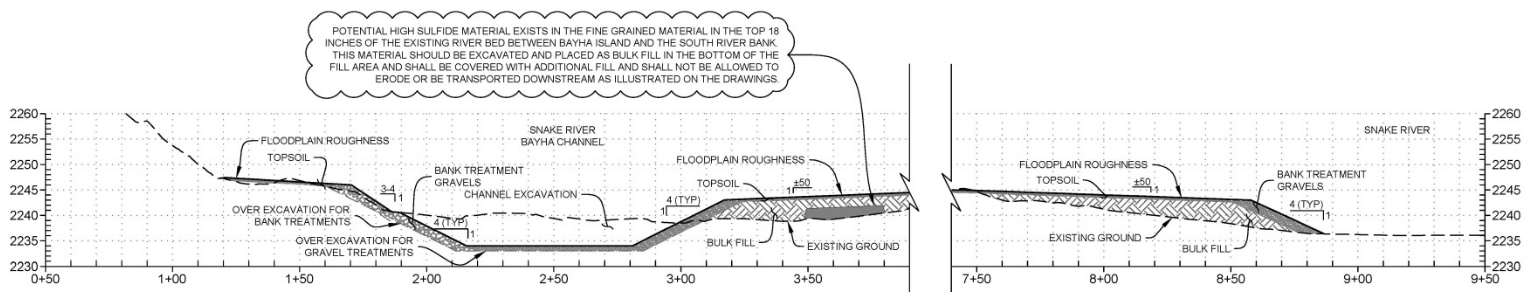
APPENDIX

River Design Group, Inc. Proposal Drawings 4.1, 4.2, 4.3. Bayha Island Enhancement Research Project.

River Design Group, Inc. Proposal Drawing 4.1. Bayha Island Enhancement Research Project.

PROJECT MATERIAL	MATERIAL SOURCE	GRADATION / COMPOSITION TECHNICAL SPECIFICATION 05001	PLACEMENT AND COMPACTION TECHNICAL SPECIFICATION 05001
BULK FILL ±47,800 CY (NEAT LINE)	PRODUCED THROUGH CHANNEL EXCAVATIONS ANTICIPATED THAT 90% OF ±51,200 CY CHANNEL EXCAVATION WILL BE USED AS BULK FILL ANTICIPATED THAT 10% OF EXCAVATED MATERIAL WILL BE REMOVED FROM PROJECT AND DISPOSED OF AT APPROVED SITE.	BULK FILL IS PRIMARILY NATURAL ROUND RIVER ROCK AND COBBLES, SAND, AND/OR CRUSHED ROCK, FREE FROM ORGANIC MATERIALS, WOOD, AND DELETERIOUS MATERIALS. BULK FILL COMPRISES A CATEGORY OF FILL THAT DOES NOT MEET SELECT GRADATIONS USED FOR BANK TREATMENTS AND IS DESIGNATED FOR USE IN AREAS WHERE THE MATERIAL COMPOSITION HAS LESS INFLUENCE ON PROJECT FUNCTION.	BULK FILL MIXTURE SHALL BE PLACED BY EQUIPMENT TO THE FILL COURSE THICKNESS IN LIFTS OF LESS THAN 12 INCHES PER TYPICAL SECTION THIS DRAWING AND DETAILED DESIGN SECTIONS DWGS 4.4-4.9.. PLACEMENT TO BEGIN AT EXISTING GROUND SURFACE AND EXTENDS VERTICALLY TO WITHIN 6 INCHES OF FLOODPLAIN FINISHED GROUND ELEVATION. INDIVIDUAL COURSES SHALL BE COMPACTED BY EQUIPMENT TRAVEL PRIOR TO PLACEMENT OF SUBSEQUENT COURSES. PLACEMENT SHALL OCCUR IN A MANNER THAT PREVENTS SORTING AND SEGREGATION OF MATERIALS. EACH LIFT SHALL BE THOROUGHLY TRACKED WITH EQUIPMENT WEIGHING AT LEAST 15 TONS AND TRACKS SHALL TRAVERSE THE ENTIRE SURFACE OF EACH LAYER. MATERIAL DEFORMATION OR RUTTING AFTER TRACKING SHALL BE LESS THAN 2 INCHES BEFORE PLACEMENT OF SUBSEQUENT LIFT.
BANK TREATMENT GRAVELS ±22,100 CY (NEAT LINE)	BANK TREATMENT ZONE 1: PRODUCED AT GRAVEL SOURCE SITE 3 BANK TREATMENT ZONE 2: PRODUCED AT GRAVEL SOURCE SITES 1-2 BANK TREATMENT ZONE 3: PRODUCED AT GRAVEL SOURCE SITES 1-2	BANK TREATMENT ZONE FILL IS A COBBLE AND GRAVEL MIXTURE WITH A MINIMUM OF FINES. THIS MATERIAL IS INTENDED TO BE AN ENVELOPE PLACED OVER EXPOSED BULK FILL SLOPED SURFACES AND ALONG THE EXCAVATED STREAMBED. GRADATION TO CONFORM TO BANK TREATMENT ZONE GRADATION TABLES PRESENTED ON BANK TREATMENT ZONES DRAWING 4.2.	BANK TREATMENT ZONE GRAVELS SHALL BE PLACED BY EQUIPMENT TO THE FULL COURSE THICKNESS IN LIFTS OF 12 INCHES OR LESS PER BANK TREATMENT ZONES DWG 4.2, 4.3 AND DETAILED DESIGN SECTIONS DWGS 4.4-4.9. WHEN PLACED, BANK TREATMENT ZONE GRAVELS SHALL BE "CLAST SUPPORTED" SUCH THAT GRAVEL AND COBBLE ELEMENTS OF THE FILL ARE IN CONTACT WITH GRAVEL AND COBBLE ELEMENTS AFTER PLACEMENT, THEY ARE NOT SEPARATED BY LAYERS OF FINE SOIL. CLAST SUPPORT MUST BE ASSURED EITHER BY MATERIAL COMPOSITION OR BY PLACEMENT METHOD, OR A COMBINATION THEREOF. EACH LIFT SHALL BE THOROUGHLY TRACKED WITH EQUIPMENT WEIGHING AT LEAST 15 TONS AND TRACKS SHALL TRAVERSE THE ENTIRE SURFACE OF EACH LAYER.
TOPSOIL ±6,300 CY (NEAT LINE)	IMPORTED TO SITE	TOPSOIL IS PRIMARILY A LOAM OR SANDY LOAM MATERIAL DESIGNATED FOR THE GROUND SURFACE ON THE TOP OF CONSTRUCTED FEATURES AND FLOODPLAINS SUITABLE FOR GROWING PLANTS. TOPSOIL SHALL NOT INCLUDE CLAY, SAND, ROCK OR DEBRIS. AS WELL MATERIAL MUST BE FREE OF WEEDS AND AMENDABLE TO SPECIES REQUIREMENTS BY PLANTING ZONE.	TOPSOIL SHALL BE PLACED BY EQUIPMENT TO THE FULL THICKNESS IN LIFTS OF 6 INCHES OR LESS TO FLOODPLAIN FINISHED GRADE PER TYPICAL SECTION THIS DRAWING AND DETAILED SECTIONS DWGS 4.4-4.9. INDIVIDUAL LIFTS SHALL BE CONSOLIDATED BY EQUIPMENT TRAVEL PRIOR TO PLACEMENT OF SUBSEQUENT LIFTS. FINAL TREATMENT THICKNESS TO BE ±6 INCHES.



1 TYPICAL SECTION DETAIL
*SECTION IS ORIENTED IN THE DOWNSTREAM DIRECTION
HORZ 1" = 40'
VERT 1" = 20'

PROPOSAL DRAWINGS
NOT FOR CONSTRUCTION

RIVER DESIGN GROUP, INC.
The Freshwater Trust® Changing the course of conservation.

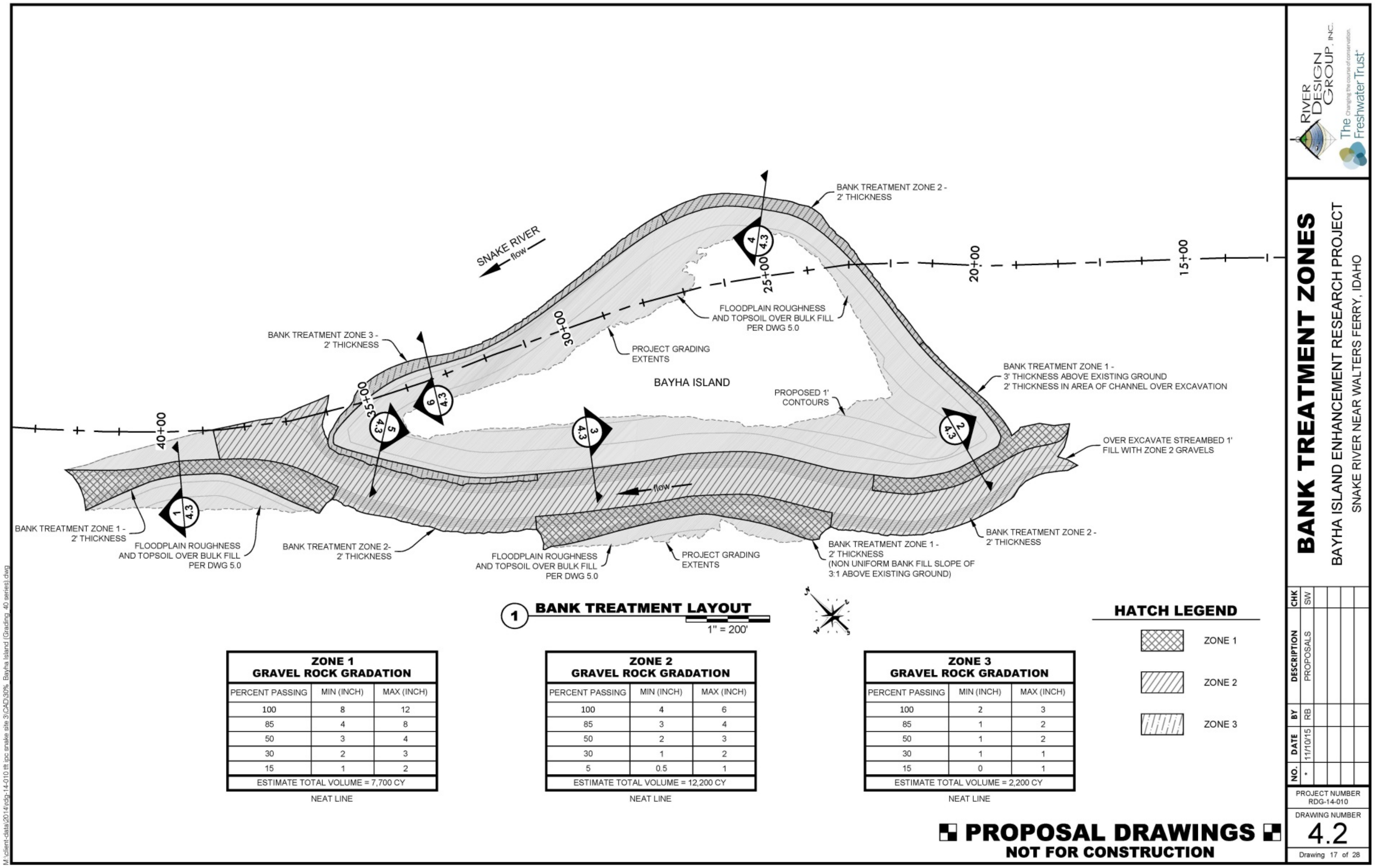
TYPICAL SECTION DETAIL
BAYHA ISLAND ENHANCEMENT RESEARCH PROJECT
SNAKE RIVER NEAR WALTERS FERRY, IDAHO

NO.	DATE	BY	DESCRIPTION	CHK
*	11/10/15	RB	PROPOSALS	SW

PROJECT NUMBER RDG-14-010
DRAWING NUMBER 4.1
Drawing 16 of 28

M:\client-data\2014\rdg-14-010 tft ipc snake site 3\CAD\30% Bayha Island (Grading 40 series).dwg

River Design Group, Inc. Proposal Drawing 4.2. Bayha Island Enhancement Research Project.



ZONE 1 GRAVEL ROCK GRADATION

PERCENT PASSING	MIN (INCH)	MAX (INCH)
100	8	12
85	4	8
50	3	4
30	2	3
15	1	2
ESTIMATE TOTAL VOLUME = 7,700 CY		

NEAT LINE

ZONE 2 GRAVEL ROCK GRADATION

PERCENT PASSING	MIN (INCH)	MAX (INCH)
100	4	6
85	3	4
50	2	3
30	1	2
5	0.5	1
ESTIMATE TOTAL VOLUME = 12,200 CY		

NEAT LINE

ZONE 3 GRAVEL ROCK GRADATION

PERCENT PASSING	MIN (INCH)	MAX (INCH)
100	2	3
85	1	2
50	1	2
30	1	1
15	0	1
ESTIMATE TOTAL VOLUME = 2,200 CY		

NEAT LINE

River Design Group, Inc. Proposal Drawing 4.3. Bayha Island Enhancement Research Project.