Lower Snake River Draft Programmatic Sediment Management Plan Environmental Impact Statement

Appendix J: 2013/2014 Navigation Maintenance Monitoring Plan

Prepared by USACE, 2012

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1 INTRODUCTION

The Walla Walla District of the U.S. Army Corps of Engineers (Corps) proposes to perform navigation channel maintenance dredging at four locations in the lower Snake River and lower Clearwater River in Washington and Idaho. The dredging would occur during the winter in-water work window, which is currently identified as December 15 through March 1,in the first window available following completion of the Lower Snake River Programmatic Sediment Management Plan/Environmental Impact Statement (PSMP/EIS). The purpose of the channel maintenance activities is to provide a 14-foot depth as measured at minimum operating pool (MOP) throughout the designated Federal navigation channel in the project area and to restore access to selected port berthing areas. Dredging would occur in the Federal navigation channel at the confluence of the Snake and Clearwater Rivers, at the downstream approach to the Ice Harbor Dam navigation lock, and at Port of Clarkston and Port of Lewiston berthing facilities in Lower Granite reservoir. Disposal would be in-water on a mid-depth underwater bench immediately upstream of Knoxway Canyon at RM 116 in Lower Granite reservoir. The material would be used to create shallow-water rearing habitat for juvenile salmonids.

The monitoring plan for the maintenance dredging evaluates several issues associated with the proposed dredging and disposal. These issues include water quality, biological impacts, and structural stability of the disposed material. The Corps has consulted with National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS) in recent years to assess potential impacts of dredging and disposal on fish use [Endangered Species Act (ESA)-listed salmonids and bull trout in particular] in the lower Snake and Clearwater Rivers, and this plan addresses those issues as well. This plan includes water quality monitoring that has been historically required for maintenance dredging projects in the lower Snake River as well as addressing concerns raised in previous ESA consultations. These concerns include viability of fish habitat and stability of the disposal embankment. Additional monitoring requirements may be identified in the Section 401 Water Quality Certification the Corps is requesting from Washington Department of Ecology, the short term activity exemption the Corps is requesting from Idaho Department of Environmental Quality, and the ESA consultation the Corps is currently performing with NMFS and USFWS. These more specific requirements would be incorporated into any future work plans of contracts associated with the dredging and disposal project.

This monitoring plan describes monitoring activities conducted during three different time periods: pre-dredging, during dredging and disposal, and post-dredging and disposal. Some of the monitoring has already occurred and was used to plan the proposed dredging and disposal activities. Some monitoring would extend up to 10 years following final shaping of the disposal site. The Corps intends to issue one or more reports presenting the results of the monitoring. All the Corps' monitoring activities described in this plan may be conducted either by the Corps or its contractors, based on the availability of funds.

2 PURPOSE

The purpose of the monitoring of the dredging and disposal is to:

- Address concerns related to ESA consultation with NMFS and USFWS and their respective Biological Opinions for the immediate need maintenance dredging action.
- Comply with the terms and conditions of the Clean Water Act, Section 401 Water Quality Certification that the Corps is requesting from Washington Department of Ecology, as well as the short term activity exemption the Corps is requesting from Idaho Department of Environmental Quality.
- Gather information for adaptive management in planning future dredging and disposal activities, and for mainstem habitat-related activities.

3 MONITORING

3.1 Pre-dredging

The Corps identified a need to perform biological monitoring prior to the start of any dredging or disposal activities. Some of this monitoring has already occurred and was used in designing the proposed dredging and disposal activities. Some of the monitoring would not occur until shortly before dredging begins. Descriptions of these monitoring efforts are below.

3.1.1 Redd Surveys

The Corps would perform redd surveys within the total boundary of the proposed dredging template for Ice Harbor navigation lock approach in the fall (November through mid-December) just prior to dredging to determine if any fall Chinook spawning has occurred in the navigation lock approach. Threatened Snake River fall Chinook salmon are known to spawn in the mainstem river using the type of cobble and large gravel substrate routinely found in dam tailwaters when other appropriate conditions are available. Following a thorough literature review and decades of experience surveying redds in the productive Hanford Reach of the Columbia River, Dauble et al. (1994) defined preferred ocean-type (sub-yearling) or fall Chinook salmon spawning criteria as:

- 0-25 feet depth,
- 0-20 degrees slope,
- unconsolidated large gravel, cobble, or boulder substrate,
- 2-6 feet per second water velocities.

Upon further study of refining preferred salmon spawning habitat criteria for use in predictive habitat models used for larger mainstem river reaches, Dauble et al. (2003) included hyporheic upwelling flow as an important correlative criteria required for successful redd production and increasing the probability of researchers locating redd aggregations. Fall Chinook usually spawn in the Snake River in late-November and early December. Redd surveys have occurred in several years since 1993 in the tailwaters of lower Snake River dams proposed for dredging.

In 1993, the first year in which comprehensive surveys were conducted, a total of 18 redds were found, accounting for approximately 7.5% of all redds found in the Snake River basin. Additional surveys were conducted at Lower Granite and Lower Monumental dams in association with in-river dredging in 2002, 2004, and 2005 (Mueller 2003, 2006; Mueller and Duberstein 2005). These surveys were limited to only likely spawning regions (e.g., near the fish return outfall pipes) and resulted in the finding of a single redd downstream of the fish return outfall pipe at Lower Granite Dam in 2004 (Mueller and Duberstein 2005).

Dauble et al. (1994, 1995) found that while suitable spawning habitat criteria does not occur downriver of the navigation locks at Lower Granite and Lower Monumental dams, such criteria does occur downriver of the navigation locks at Little Goose and Ice Harbor dams. Mueller and Coleman (2007, 2008) and Mueller 2009 found potentially suitable spawning substrate within the immediate vicinity of proposed template at Ice Harbor Dam. However, based on the multiple years of surveys, no redds have ever been found within the navigation lock approaches of any of the lower Snake River projects since surveys began in 1993.

Starting in 2006, USACE Walla Walla District conducted a three year study to determine if fall Chinook salmon (*Oncorhynchus tshawytscha*) spawn within the immediate tailrace regions of Lower Granite, Little Goose, Lower Monumental, and Ice Harbor dams as part of developing a Programmatic Sediment Management Plan for the lower Snake River. As part of this comprehensive evaluation, zones were established downstream of all four lower Snake River dams in which habitat criteria met the requirements for fall Chinook salmon spawning (Mueller and Coleman 2007, 2008; Mueller 2009). In 2006, Mueller and Coleman (2007) confirmed one redd in the tailwaters below Lower Granite Dam and two redds in the tailwaters below Little Goose Dam during comprehensive deepwater video surveys. In 2007, six redds were found in the tailrace regions of two of the four dams—four at Lower Granite Dam and two at Ice Harbor Dam (Mueller and Coleman 2008). In 2008, surveys showed a total of 15 redds in the tailrace regions of two of the four dams – eight redds downstream of Lower Granite Dam; seven redds in the tailrace region of Lower Monumental Dam (Mueller 2009).

Since potential spawning habitat exists within the footprint of the proposed dredging area of the Ice Harbor Dam tailrace, the proposed action may have the potential to disturb and/or harm eggs and alevins in redds if found to be present immediately prior to or during the proposed dredging activities. In an effort to avoid disturbing or harming fall Chinook redds, the Corps would conduct underwater surveys of the proposed dredging site at the Ice Harbor navigation lock in November and the first 2 weeks of December prior to commencing dredging. Techniques similar to those used by Battelle from 1993 to 2008 (Dauble et al. 1994-1998; Mueller 2005, 2009; Mueller and Coleman 2007, 2008) would be employed. This technique has used a combination of a boat mounted underwater video camera tracking system to look at the bottom of the river to identify redds. On at least 2 separate sampling periods (one in November when spawning activity is active and one in December when spawning activity is complete or near-complete), a one-pass search pattern would be conducted throughout a consistent transecting grid of the navigation lock approach template using a systematic tracking method employing a Global Positioning System (GPS) to determine both location of the redds on the river bottom and the position of the boat as it navigated through its search pattern. Results of the surveys would be transferred to the Corps within 2 days of the survey dates in order for compilation prior to December 15, at which time the Corps can communicate results to NMFS for appropriate action. If no redds are located, then the Corps would proceed with proposed dredging within the boundaries of the surveyed template. If one or more redds are located within the proposed dredging template and such redds are verified with video, then the Corps would coordinate with NMFS under Section 7 of the ESA consultation to determine what the appropriate avoidance and protection actions would be prior to dredging the affected location.

3.1.2 Rearing Habitat and Site Use Surveys

The Corps has conducted multiple years of biological surveys within the lower Snake River including at the proposed RM 116 disposal site to determine current usage by juvenile salmonids, potential usage as rearing habitat by fall Chinook, and the efficacy of in-water disposal of dredged material for creating juvenile fall Chinook resting and rearing habitat in the lower Snake River reservoirs. These surveys have been conducted by Corps and their contractors as part of follow-up surveys associated with previous dredging actions and for planning purposes associated with potential future dredging and disposal actions. The results of this research have shown that the use of dredged material to create shallow-water habitat has not adversely impacted salmonid species and after stabilization provides suitable salmonid rearing and shallow habitat functions (Artzen et al, 2012; Gottfried et el, 2011, Tiffan and Conner 2012). These newly built shallow water areas were found to be at least as productive for invertebrates as compared to reference sites, provide beneficial shallow water habitat for natural subyearlings during the spring and summer (i.e., rearing fall Chinook), minimized the presence of predators at that site, and in general made the reservoir environment more hospitable for the Chinook salmon using it (Artzen et al, 2012; Gottfried et el, 2011; Tiffan and Conner, 2012).

The proposed action at Knoxway Canyon (RM 116) is to create a shallow water (<6 feet deep) ribbon composed of sand/silt substrate for resting/rearing habitat area for juvenile fall Chinook salmon on the current mid-depth bench located immediately downstream of where dredged materials were deposited at the Knoxway Bench Lower as part of the 2005/06 dredging action. This location is approximately 0.25 to 0.5 mile upriver of the Knoxway Canyon reference site and immediately downstream of Knoxway Bench Upper reference sites (see Artzen et al, 2012; Tiffan and Conner 2012 for reference). Previous monitoring of this bench, prior to placement of dredged material in 2005/06, indicated zero to low salmonid use, moderate predator use, and low macroinvertebrate species composition and abundance (Bennett et al. 1992-1997; Curet 1993). Recent monitoring indicates use of the Knoxway Bench Lower area by natural subyearling Chinook in higher densities, with longer residency times at the as compared to the Knoxway Bench Upper site (Tiffan and Conner, 2012). The Knoxway Bench Upper site (i.e., the upper half of the Knoxway Bench complex) has a steep lateral bed slope that is not preferred by subyearlings (Tiffan et al.

2006) whereas the shoreline of Knoxway Bench Lower site (i.e., location of the 2005/06 dredged materials) has a suitable lateral bed slope. This difference in lateral bed slopes likely explains the density of subyearlings being nearly twice as high in the area of dredged material deposition as compared to the upper half of the site (Tiffan and Conner, 2012). Based on recent habitat modeling efforts in the Lower Granite pool (Tiffan and Hatten, 2012 in-press), construction of additional salmonid rearing habitat in this area and in near proximity to a moderately suitable reference backwater site that has been shown to be used by rearing Snake River fall Chinook salmon (Artzen et al, 2012), should result in increased benefits to Snake River fall Chinook salmon production and survival at the cohort and population levels attributable to both sites.

Due to concerns regarding potential impacts to juvenile Pacific lamprey as part of the proposed dredging action, a minimally obtrusive electroschocking sled with an optical camera was developed to survey for presence/absence of juvenile Pacific lamprey. In order to assess presence/absence of juvenile Pacific lamprey in the lower Snake River that may be impacted by potential dredging actions Artzen et al. (2012) conducted surveys at 24 sample sites within the lower Snake River to determine presence of juvenile Pacific lamprey including at potential dredge locations (Clarkston Upper and Lower, RM 138), past dredged material disposal sites, and reference sites. No lamprey were observed at any of the 24 sample sites during either of the two sample periods in late July and September 2011. It is plausible that juvenile lamprey were present but not observed with this electroshocking sled as it was recently developed for this specific objective and had a limited testing period prior to deployment. However, while juvenile lamprey are often found in silt/sand substrate (Artzen et al 2012), it is unlikely that juveniles are present in moderate or high numbers in the proposed templates. Juvenile lamprey typically have a patchy distribution related to other environmental variables such as water depth and velocity, light level, organic content, chlorophyll concentration, proximity to spawning area and riparian canopy (Moser et al. 2007).

Biological and physical parameters measured for pre-dredging monitoring associated with rearing habitat and habitat site use have mimicked those measured under Bennett (2003) and Bennett and Seybold (2005). This is so consistency can be maintained for correlation analyses used to estimate effectiveness of the action for benefit to salmonid production and reservoir survival. A wide suite of parameters were measured at the Knoxway Bench (RM 116) disposal site (newly constructed habitat), the Knoxway Canyon reference site (backwater transect site of previous monitoring efforts), and as well as at several other sites in the Lower Granite Reservoir (Gottfried et el, 2011; Tiffan and Connor, 2012) and within the four lower Snake River reservoirs (Artzen et al. 2012) These were sampled at a frequency of up to biweekly during March through November and have generally included:

- Surface sediment/substrate composition and grain size of the habitat, including percent organic or organic content.
- Presence and abundance of macrophyte plants.
- Predator species composition and abundance [catch-per-unit-effort defined as 5 minutes of electrofishing and one seine haul (CPUE)].
- Juvenile salmonid abundance and habitat usage (CPUE).

- Macroinvertebrate species composition, species richness/diversity, periodicity or seasonality, and abundance on both soft and hard substrates, including crayfish.
- Water temperature.
- Bathymetry used to verify designed slope, depth, and acreage.
- Dissolved oxygen.
- Water velocity.
- Secchi depth and surface water elevation.
- Chlorophyll *a*.
- Photo record of shoreline substrate composition, landform, and riparian species composition.

3.2 During Dredging and Disposal Activities

The Corps proposes to perform monitoring during the dredging and disposal activities. This monitoring would be to ensure the Corps is meeting environmental compliance requirements.

3.2.1 Water Quality Monitoring

Water quality monitoring would be conducted during dredging and disposal activities to accomplish two goals:

- Ensure the Corps is meeting applicable water quality standards while performing these activities; and
- Address concerns raised during the ESA consultation process.

The Corps would monitor depth, turbidity, pH, temperature, dissolved oxygen, and conductivity. Water quality monitoring would be performed before, during, and after all in-river work at each active dredging site and at the disposal site.

The water quality monitoring equipment used would meet industry standard sensitivity and accuracy levels available at the time the dredging and disposal takes place. The equipment would have the capability to transmit the data via satellite or radio relay rather than having to be downloaded at each station in the field.

All of the equipment would be calibrated prior to use according to the manufacturer's specifications using recognized industry standards. Cleaning and recalibration would occur daily, and whenever there is any indication that the equipment is not performing properly.

Turbidity data measured by the sondes (i.e., multi-parameter probes) would be verified periodically in the field. This task would consist of collecting water samples when the sondes are calibrated daily, and when questionable values appear in the data set. Sample turbidity would be measured using a portable, calibrated turbidimeter.

Monitoring locations for all parameters will follow the specifications in the Washington Administrative Code (WAC) 173-201A, Idaho Administrative code (IDAPA) 58.01.02, the requirements in the 401 certification the Corps is requesting from the Washington Department of Ecology, and the requirements in the current ESA consultations with NMFS and USFWS. Monitoring would be performed at several points to evaluate water quality, but will generally include:

- Active dredging site (Figure 1)
  - A monitoring zone approximately 1,000-ft long and 600-ft wide would be created around the dredge area.
  - A background station would be placed 300-ft (± 30 ft) upstream of the monitoring zone.
  - Two compliance stations would be located 300-ft (± 30 ft) downstream of the monitoring zone and no less than 100-ft apart.
  - A remote monitoring station would be located 600-ft (± 30 ft) downstream of the monitoring zone.
  - When all dredging is completed inside the zone a new monitoring zone would be defined and the monitoring network repositioned.

- In-river disposal site (Figure 2)
  - A monitoring zone approximately 1,000-ft long and 400-ft wide (measured from the shoreline) would be created around the disposal area.
  - A background station would be located 300-ft (± 30 ft) upstream of the monitoring zone.
  - Two compliance stations would be located 300-ft (± 30 ft) downstream of the monitoring zone and no less than 100-ft apart. The stations would be located in the main direction of the river flow and, to the extent possible, in the direct path of the plume.
  - A lateral monitoring station would be located downstream at a distance of 300 ft outside the disposal area to evaluate whether disposed material moved down-slope towards the thalweg before it was entrained in the river current.
  - When disposal is completed inside the zone, a new monitoring zone would be defined and the monitoring network repositioned.

Measurements would be taken at various depths in the water column. Each floating platform would include two multi-parameter probes. One probe would be located 3 feet below the surface and the second one would be situated approximately 3 feet above the sediment.

The timing of sampling will be as follows:

Floating Stations

- Pre-activity levels would be measured for 1-hour prior to work each new day at a given dredging location and at the disposal site if the work day is 10 hours or less. If work proceeds for 20 hours, or more, during a given day then the work would be considered continuous and pre-activity monitoring would only be required prior to the first day of operation. Instrument readings for each parameter would be taken every 5 minutes and reported near-real time.
- During all dredging and in-river disposal activities, near real-time water quality monitoring would be performed. Equipment would be deployed to allow the results to be monitored by the Corps and regulatory/ cooperating agencies. Readings would be taken every 5 minutes.
- Post-activity levels would be measured for 1 hour following completion of the work at each dredging site and the disposal site. Readings would be taken every 5 minutes and also reported near real time.

Figure 1. Conceptual Plan of Monitoring Station Locations for Dredging Activities Relative to the Dredging Monitoring Zone

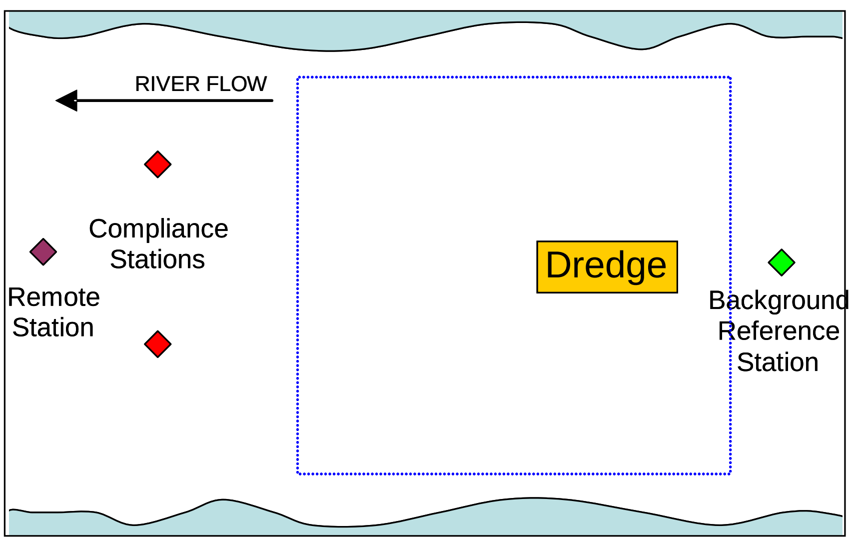
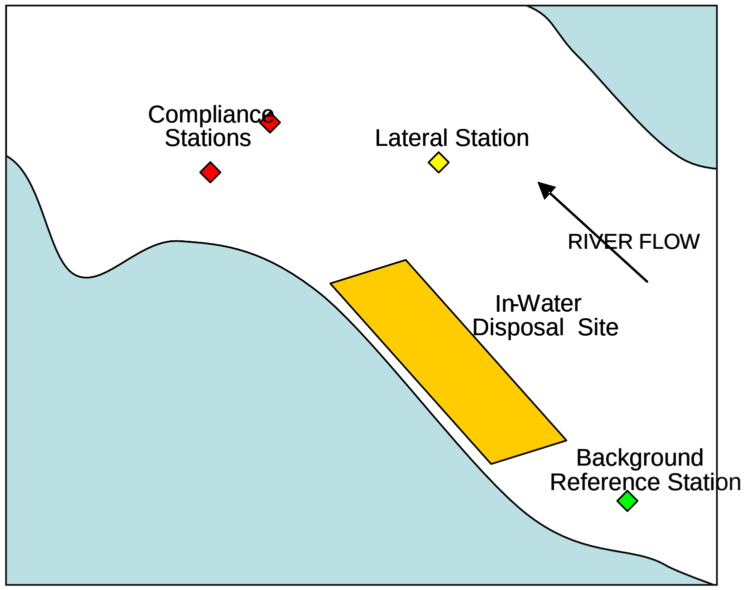


Figure 2. Conceptual Plan for Monitoring Station Locations at Disposal Site



3.2.2 Biological Monitoring

Fish Monitoring

During dredging and disposal activities, the Corps would monitor for sick, injured, or dead fish. The Corps would continuously visually monitor the waters surrounding the dredging and disposal activities as well as observing the content of each clamshell bucket as it discharges in the barges. If a sick, injured, or dead specimen is encountered, it would be placed in a container of cold river water until it could be determined if it was a species listed under the ESA. If it is a listed species, the Corps would then contact the Vancouver Field Office of NOAA Fisheries Law Enforcement as soon as possible for further instructions. If a healthy fish has been entrained by the dredging operations, the Corps would make every reasonable attempt to return the specimen safely back to the river.

3.3 Post-dredging and Disposal

Monitoring performed at the disposal area following completion of disposal activities would consist of hydrographic surveys and biological surveys. The hydrographic surveys would be performed each year for at least 2-3 years to determine if the embankment has sloughed, settled, or moved, and to verify that the desired physical structure determining rearing habitat suitability have been achieved and maintained. The Corps would use the information from these efforts to assess the stability of the embankment in the short-term and long-term to determine if changes need to be made in grain size composition of construction methods for any future in-water disposal of dredged material. Biological surveys would be performed twice over 10 years, if funding is available, to assess the use of the disposal area by target fish species and to document changes in several parameters such as use by juvenile salmonids, sediment grain size, food organisms, and water temperature.

3.3.1 Hydrographic Surveys

The Corps would perform a series of hydrographic surveys of the disposal site. The Corps would perform hydrographic surveys for both the pre and post condition surveys of the disposal area. The Corps would provide survey control to be utilized, a horizontal alignment with stationing, and a drawing representing the required area to be surveyed. The cross sections would be required to be surveyed at specific 25-foot interval spacing for both the pre and post condition surveys performed. The Corps would perform follow up surveys after the first spring runoff (July-September time frame) following disposal utilizing the same control, alignment, and interval requirements. The Corps proposes to replicate the surveys one year later if funding is available.

The results obtained would provide the following data:

1. Dredged material disposal site bathymetry before material placement.
2. Bathymetry of the disposal site after embankment construction (accepted configuration).
3. Embankment bathymetry after first runoff season is complete. Comparing (2) and (3) would identify any erosion and/or settlement that have occurred.
4. Bathymetry of the embankment after second runoff season is complete (if funding is available). Comparing (2) and (4) would identify the overall settlement of the embankment, and any additional erosion that may have occurred. Comparing
   (2), (3) and (4) would also provide curves that could be used for predicting settlement rate and erosion rate for future in-water disposal sites.

This information would provide a good picture of the embankment performance regarding its shape and final geometry.

3.3.2 Biological Monitoring

To evaluate use of the newly created habitat area by juvenile salmonids and food organisms, the Corps would repeat all monitoring tasks under protocols and study designs of tasks outlined above in Section 3.1.2 Fish Habitat and Habitat Site Use Surveys for at least post-construction years 2 and 10, subject to the availability of funding. However, the Corps has modified the sampling timing so the sites would be sampled at a frequency of biweekly during April through July and December and January, and at least monthly during August through November and February through March during biological study years. The Corps would compile draft reports detailing multi-year comparison of research results and would make these available to regulatory agencies and all interested parties for their review and comment prior to the production of a final biological monitoring report.

4 MONITORING CRITERIA AND SUBSEQUENT ACTIONS

4.1 Biological

4.1.1 Redd Surveys

The Corps would discuss the results of the pre-dredging research with NMFS personnel prior to initiating dredging. If a redd is found in the proposed dredging footprint, the Corps would coordinate with NMFS under Section 7 of the ESA consultation to determine what the appropriate avoidance and protection actions would be prior to dredging the affected location. This potentially would include modifying the dredging footprint to avoid the redd and/or postponing dredging in that footprint to a later date after emergence of young fish from the redd in the spring.

4.1.2 Fish Habitat

The Corps, in conjunction with USGS, has conducted a comprehensive modeling effort of juvenile rearing habitat in the Lower Granite Reservoir, where creation of new shallow water habitat appears to be most beneficial (Tiffan and Hatten 2012, in-press). As part of this modeling effort, USGS has estimated the amount of current rearing habitat available in Lower Granite Reservoir at five different flows using a statistical rearing model and a spatially explicit analysis that incorporated river bathymetry and outputs (i.e., depth and velocity) from a hydrodynamic model. Results indicate that Lower Granite Reservoir contains about 255 ha of rearing habitat at a flow of 143 kcfs, which equates to about 7% of the reservoir area when a 20-ft shallow water depth criterion is used. Most available rearing habitat is located in the upper half (i.e., upstream of Centennial Island) of the reservoir and little exists in the lower half due to steep lateral bed slopes and unsuitable substrate along the shorelines. The largest habitat areas were associated with known shallow-water locations such as at Silcott Island (~85 ha) and the area near Steptoe Canyon (~32 ha). Reducing the criterion to define shallow water from <20 ft (the COE's current definition) to <6 ft (based on recent habitat use data) resulted in a significant reduction in available habitat but spatial trends remained consistent. The number of habitat patches did not vary much with flow when the 20-ft depth criterion for shallow-water habitat was used; however, the number of habitat patches was reduced by about 20% when the 6-ft depth criterion was used. Mean habitat patch area was also higher when the 20-ft depth criterion was used, and showed declines with increasing flow, but the distance between rearing patches was greater for the 6-ft compared to the 20-ft depth criterion. Because of the shoreline orientation of subyearling fall Chinook salmon and their transient rearing strategy, creating new habitat in the lower portion of Lower Granite Reservoir in ribbons along the shoreline appears as though it may provide the greatest potential benefit from creation of additional shallow water habitat.

As a result of this modeling effort, recent biological monitoring and evaluation of previous and potential future disposal areas, and other engineering considerations, the proposed disposal area at RM 116 was selected for disposal of dredged material as part of the proposed action. In addition, as a result of recent habitat sampling efforts showing rearing/resting juvenile fall Chinook appear to utilize shallow water habitat <2 meters in depth in higher frequency (Tiffan and Conner 2012) and a general paucity of available shallow water habitat in the lower portion of the Lower Granite Pool (Tiffan and Hatten 2012, in-press) as described above, the Corps will attempt to create shallow water habitat that is primarily less then 6 feet in depth instead of six meters in depth as traditionally done in the past.

Habitat surveys conducted after final shaping of the proposed disposal site would be used to evaluate future use of in-water disposal to create resting/rearing habitat for juvenile salmonids with particular emphasis on evaluating whether the creation of shallow water habitat in a <6 and <20 foot deep ribbon along the shoreline results in increased habitat utilization as expected. These surveys would be used to document several parameters such as trends in usage by juvenile salmonids, changes in food organism composition, and changes in substrate over time as described in previous sections. If the surveys indicated a need to take corrective action at the disposal area, such as possible modifying the contours to reduce predation on juvenile salmonids, the Corps would consider taking this action pending availability of funds.

In addition, the Corps would use numbers of ESA-listed salmonid species or stocks present during critical seasons and life stages compared to presence and extent of critical habitat parameters at that proposed site versus ESA-listed species presence and abundance compared to critical habitat parameters and juxtaposition at alternative reference sites to determine whether or not the proposed criteria for selecting disposal sites and disposal methods would still be acceptable for potential future actions. If the surveys indicated a minimal number of ESA-listed juvenile salmonids were currently using potential future disposal sites, but the habitat suitability index of the site could be substantially increased effectively, the Corps would use the proposed site(s) for disposal with the intent to design to an optimal habitat suitability. The Corps will continue to coordinate with NMFS to determine the continued suitability of the currently proposed site and other potential disposal areas are still acceptable as continued and/or future disposal site(s).

4.2 Water Quality

4.2.1 Turbidity

Turbidity created by in-river activities and measured in nephelometric turbidity units (NTU) would be maintained below the following standards at the locations described in 3.2.1.

- **Washington**
  - 5 NTUs above background when background levels are 50 NTUs or less.
  - Maximum 10 percent increase when the background is more than 50 NTUs.

- **Idaho**
  - Shall not exceed the background by more than 50 NTU instantaneously below the compliance boundary or by more than 25 NTU for more than 10 consecutive days.

Measured turbidity data would be evaluated for trends using one-hour intervals. Specific details regarding trend analysis at each station, as well as between stations, would be developed jointly prior to dredging activities by the Corps and regulatory/cooperating agencies. However, a hypothetical approach is to first flag potential outliers that could be due to signal noise, debris in the sensors, or other factors not related to dredging using commercially available software or spreadsheet calculations. If the 1-hour trend for a given instrument exceeds the standard, the Corps would note the incident in a daily quality control record. If the subsequent 1-hour trend continues to show elevated values above the background for the same instrument, the Corps would verify that the probe is functioning properly. If the condition persists for the third hour, the Corps would then alter the dredging operation (e.g., reducing the rate of dredging) and continue monitoring turbidity at the downstream location. If the NTU levels remain above the acceptable standard the Corps would halt operation and wait for the NTU levels to drop before resuming dredging.

4.2.2 Dissolved Oxygen

Evaluation of temporal trends in the 5-min dissolved oxygen data by the Corps would follow the protocol yet to be determined for turbidity. The Washington water quality standard states that oxygen concentrations must be greater than or equal to 8.0 mg/L, while the Idaho standard is 6.0 mg/L.

If any dissolved oxygen reading is less than 5 mg/L, the Corps would verify instrument calibration and immediately take a second measurement. If the second reading is still less than 5 mg/L, the Corps would stop dredging and continue monitoring. The Corps would then contact the appropriate regulatory agencies to determine a course of action.

4.2.3 pH

Measured pH data would be compared to the state standard by the Corps using the method described for turbidity and dissolved oxygen. The Washington water quality standard designates an acceptable pH range of 6.5 to 8.5 units. The Idaho standard ranges from 6.5 to 9.0 pH units.

If the 1-hour trend in the pH readings for a given instrument exhibits a consistent drift that exceeds the upper and lower boundaries of the standard, the incident would be noted in a daily quality control record. If the subsequent 1-hour trend continues to show consistently increasing or decreasing values relative to the background for the same instrument, the Corps would verify that the probe is functioning properly. If the condition persists for the third hour, the Corps would alter the dredging operation (e.g., reducing the rate of dredging) and continue monitoring pH at the downstream location. If the pH levels remain outside the acceptable range the Corps would halt operation and wait for the values to fall within the acceptable range before resuming dredging.

4.2.4 Temperature

The water quality standards for temperature (20 ^{o}C) would likely not be exceeded during the winter dredge window. The user cannot calibrate sonde temperature, but since the measured dissolved oxygen, pH, and conductivity data are all temperature dependent it is important to verify sonde temperature values using a National Institute of Standards and Technology traceable thermometer

4.3 Hydrographic Surveys

The results of the hydrographic surveys of the disposal site would be used to assess slope stability and long-term structural stability of the disposal area. Changes in elevations would indicate movement of material. The Corps would compare pre-dredging sediment sampling records to the locations of material movement to evaluate the composition of the dredged material (i.e., percent sand vs. percent silt) disposed at that location. Based on the results of the comparison, the Corps may modify its disposal plans for future dredging. Modifications could include altering the percent of silt in in-water disposal areas, or constructing a berm of sand or cobble at the toe of the disposal area slope.

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