# Periodic Review
# Spokane River Shoreline Metals Sites

## Spokane River, Spokane County

## Facility Site ID: 615198

## Cleanup Site IDs: 11576 (Island Complex), 11577 (Starr Road), 11578 (Murray Road), 11585 (Harvard Road), 11586 (Flora Road), 11587 (Barker Road North), 11588 (Barker Road South), 11589 (Myrtle Point), and 11590 (Islands Lagoon)

**Toxics Cleanup Program, Eastern Region**

Washington State Department of Ecology
Spokane, Washington

September 2022

# Document Information

This document is available on the Department of Ecology's cleanup site pages (linked under Related Information below).

### Related Information

- Cleanup site IDs: 11576 (Island Complex),[1] 11577 (Starr Road),[2] 11578 (Murray Road),[3] 11585 (Harvard Road),[4] 11586 (Flora Road),[5] 11587 (Barker Road North),[6] 11588 (Barker Road South),[7] 11589 (Myrtle Point),[8] and 11590 (Islands Lagoon)[9]
- Facility site ID: 615198

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[1] https://apps.ecology.wa.gov/cleanupsearch/site/11576
[2] https://apps.ecology.wa.gov/cleanupsearch/site/11577
[3] https://apps.ecology.wa.gov/cleanupsearch/site/11578
[4] https://apps.ecology.wa.gov/cleanupsearch/site/11585
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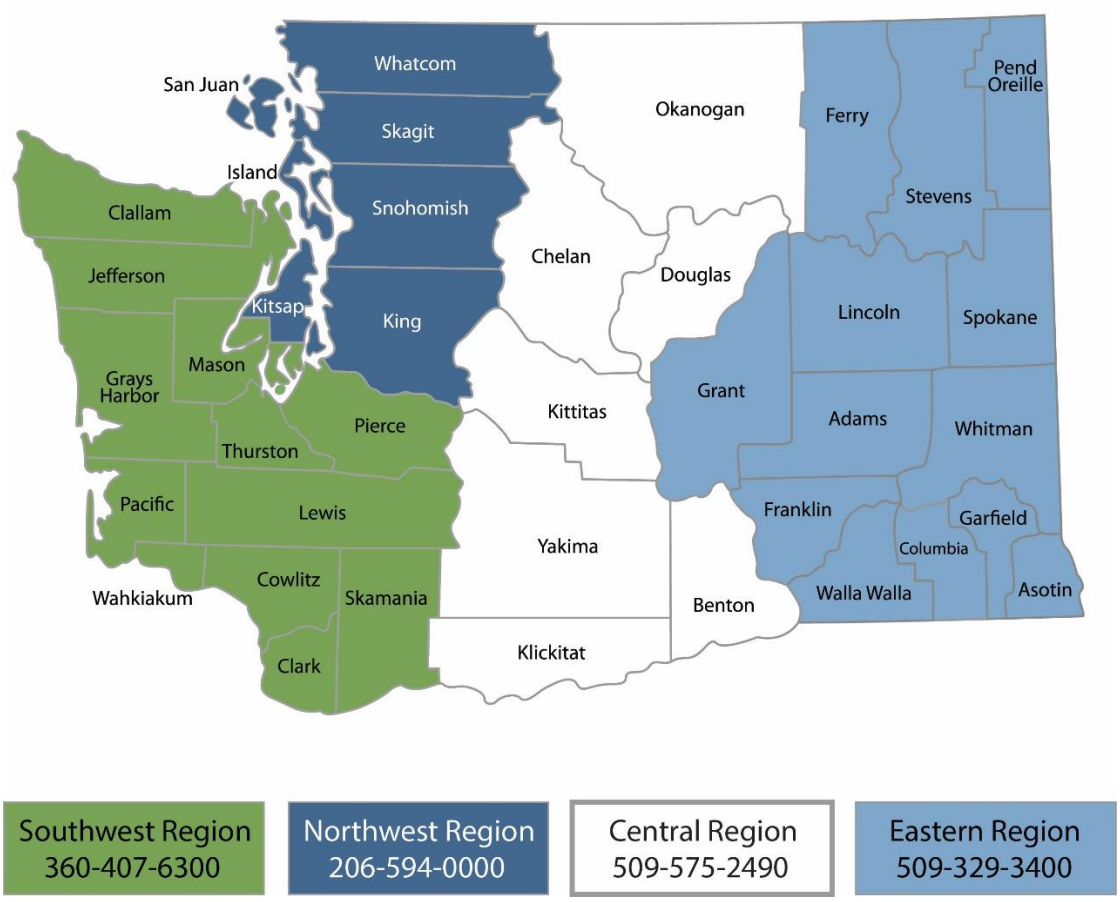
# Department of Ecology's Regional Offices

## Map of Counties Served

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# Introduction

This document is a review by the Washington State Department of Ecology (Ecology) of post-cleanup site conditions and monitoring data at the Spokane River Shoreline Metals sites (Site) (Figure 1). Cleanup at this Site was implemented under the Model Toxics Control Act (MTCA) regulations, Chapter 173-340 Washington Administrative Code (WAC). The purpose of this periodic review is to determine whether the cleanup remedy at the Site continues to be protective of human health and the environment.

Cleanup actions at this Site were conducted in accordance with the selected remedies outlined in the United States Environmental Protection Agency's (USEPA) Bunker Hill Mining & Metallurgical Complex Record of Decision (ROD). The selected remedies involved containing hazardous materials by capping the contaminated sediments in place; therefore, heavy metals remain in sediments at concentrations exceeding the selected cleanup levels for the Site.

# Summary of Site Conditions

## Site history

Mining operations in the Coeur d'Alene Basin of northern Idaho have operated since the late 1800s, yielding large quantities of silver, zinc, and lead. During the course of the mining, mine waste was directly discharged into the South Fork of the Coeur d'Alene River and its tributaries until approximately 1968 (USEPA 2002). An estimated 62 million tons of tailings containing heavy metals such as arsenic, cadmium, lead, and zinc were discharged into streams prior to 1968. Over time, the tailings and the heavy metals were carried downstream into Lake Coeur d'Alene and eventually into the Spokane River. In the Spokane River, the contaminants have settled in low velocity depositional areas upstream of downtown Spokane.

The Spokane River (river) is a major river system that drains more than 4,900 square miles in Washington and Idaho. The river watershed includes areas in the northern Rocky Mountain and Columbia River ecoregions. The river begins as the Lake Coeur d'Alene outflow and flows through an urbanized and industrialized basin past the City of Spokane (Spokane) before eventually flowing into Lake Roosevelt, the reservoir section of the Columbia River formed by Grand Coulee Dam.

The USEPA began the Remedial Investigation/Feasibility Study (RI/FS) in 1998 with the RI/FS report produced in 2001. The RI/FS found that sediments in depositional areas of the river upstream of Upriver Dam to the Idaho-Washington Border contained heavy metals above risk-based concentrations (RBCs). Following the RI/FS report, the USEPA issued a ROD in 2002 that outlined the remedial actions to be taken as a part of the Bunker Hill Mining & Metallurgical Complex, which includes the Washington State portion of the Spokane River. At that time, Ecology elected to take the lead on the remedial actions at the shoreline beach sites of Island Complex, Murray Road, Harvard Road, Barker Road North, Flora Road, Myrtle Point, and Islands Lagoon. USEPA took the lead on the remedial action at the Starr Road site in coordination with Ecology.

Remedies at the shoreline beach sites (see Appendix A: Site Map) were taken in the following years:

- 2006 – Starr Road
- 2007 – Island Complex and Murray Road
- 2008 – Harvard Road
- 2012 – Barker Road North, Flora Road, Myrtle Point, and Island Lagoon

## Site physical characteristics

Sediment and sediment-bound contaminants within the river are transported downstream and deposited in slow-moving reaches that are often exposed during low flows. The sediment sources to the upper river include remobilized channel bed material, bank erosion, and tributary inputs. Although Lake Coeur d'Alene provides a low energy environment where much of the sediment derived from the upstream watershed and former mining sources is deposited, some silts and clay remain suspended through the lake and enter the river. Fine-grain, suspended sediments travel downstream, bound with heavy metals, originating from both upstream sources, and settle in downstream depositional areas.

From the Washington-Idaho border to the upstream end of the Upriver Dam impoundment near Plante's Ferry Park, higher velocity stream flow limits the deposition of sands and finer-grained materials to localized slack water areas. These low-flow areas are typically exposed during summer low-flow conditions, but are submerged during the spring runoff. During this high-flow period, upstream sediments bound with heavy metals are mobilized and eventually deposited in the upstream slack water deposits.

Below is a brief summary of the physical characteristics of each of the shoreline beach sites.

### Starr Road

The Starr Road Site is adjacent to River Road just downstream of the Idaho state line. During the spring runoff, the area of concern is underwater but is exposed during the summer-fall low-flow period. A small area of trees and brush border the Site to the north on the steep slope directly above the Site. During remediation activities, the access trail was enhanced to provide entrance to the Site from River Road. The river bar area bordering the fine-grained depositional area to the south acts as a barrier to the main flow of the river. The bar area contains fish-spawning-sized gravel intermixed with fine-grained sediment.

### Murray Road

The Murray Road Site is adjacent to River Road. During the spring runoff, the area of concern is underwater, but is exposed during the summer-fall low-flow period. The small area of trees surrounded by brush on a steep slope is directly adjacent to the Site to the north. In the upriver direction of the Site is a recreational trail area sparsely covered by trees and small brush that the river flows through during times of high flow. The river bar area bordering the fine-grained depositional area to the south is heavily armored with river cobble.

## Island Complex

Access to the Island Complex Site is from a parking lot adjacent to the river near Exit 299 on Interstate 90 via a gravel trail that was enhanced during cleanup activities. Portions of the Site are in Riverside State Park, and the Site is a popular recreation area. The Site contains a backwater area that serves as a depositional zone for fine-grained contaminated sediments. The river flows by the Site to the north year-round, and during the spring runoff, it also flows in a side-channel to the south and west of the Site. The main river channel area to the north and the seasonal side-channel to the west contain fish-spawning-sized gravel intermixed with fine-grained sediment. During cleanup work, a multi-layered soil cover was placed over the contaminated sediments, and native trees and shrubs were planted to help stabilize the bank in the backwater area. In addition, gravels were placed below the ordinary high water mark (OHWM) to act as a part of the sediment cover and limit erosion.

## Harvard Road

The Harvard Road Site, located on the north side of the river, is just downstream of the Harvard Road Bridge. The Site is accessed through an unimproved dirt road. The Site acts as a recreational area for river users and rainbow trout spawning. A graveled boat launch, the portion of the Site closest to the bridge, is separated from the rest of the Site by large boulders. The boulders were placed during cleanup activities to prevent vehicular traffic from accessing the remaining parts of the Site. During cleanup activities, fish-spawning-sized gravel was placed as part of the cap to promote rainbow trout spawning. The area downstream of the Site is sparsely covered in vegetation during low flows and is heavily armored in cobble-sized rock.

## Flora Road

The Flora Road Site is accessed via a short footpath that leads from the Centennial Trail. During spring, runoff portions of the recreational shoreline area are underwater, but are exposed during the summer-fall low-flow period. The resulting exposed areas of concern provide zones of fine-grained sediment while the area adjacent to the east is underlain predominantly with gravel and sand. The area adjacent to the west is occupied by cobble- boulder-sized rock.

## Barker Road North

The Barker Road North Site is upstream of the Barker Road Bridge along the north bank of the river. During spring, runoff parts of the shoreline area of concern can be flooded, but are exposed and dry during the summer-fall low-flow period. The Site is surrounded by residential land to the north and east. The ease of access to the Site from Barker Road and the relatively level topography provide an area used for recreational activity, primarily as a canoe and kayak launch site. The area is underlain with fine-grained sediment.

## Myrtle Point

The Myrtle Point Site is easily accessed from the adjacent Centennial Trail along the southern riverbank and upstream of the Centennial Trail Footbridge. The Site is accessed via a footpath leading from the Centennial Trail. The Site is upstream of a bend in the river that creates a slow

current used for recreational activity. During spring runoff, the recreational shoreline area of concern is submerged, but becomes dry and exposed during the summer-fall low-flow period. Adjacent to the Centennial Trail and bordering the Site to the east and west are areas covered with small trees and brush.

### Islands Lagoon

The Islands Lagoon Site is upstream of the Centennial Trail Footbridge. The Site is bounded by large basalt monoliths and gravel bars within the main channel of the river. The setting provides a calm water area that is used as a recreational area. During the spring runoff, portions of the recreational shoreline are underwater, but become exposed during the summer-fall low-flow period. Adjacent to the Centennial Trail and bordering the Site to the south are gently sloped areas covered with trees and brush. The area adjacent to the Site to the west is sparsely covered with brush and is underlain predominantly with gravel and sand.

## Remedial investigation

The USEPA began the RI of the Spokane River Beach Sites in 1998 with the final RI published in 2001. During the course of the RI, surface water and sediment samples were collected from the river starting from the Idaho-Washington border downstream to Upriver Dam. In general, it was found that surface water and sediments in the river were impacted by metals contamination associated with the Bunker Hill Metallurgical Complex.

The RI did not evaluate fish consumption along the river; however, the United States Geological Survey sampled fish for Ecology in the area and analyzed them for several metals, including lead. The lead data from whole fish was evaluated in the RI for the subsistence scenarios, and some lead concentrations in the whole fish data were found to be a potential concern (contributing to blood lead levels above the target health goal) for children and pregnant women if they ingested large amounts of fish.

In response to metals contamination, the Washington State Department of Health and Spokane Regional Health District have issued two health advisories for the upper reaches of the river. The first advisory alerts visitors to the presence of elevated lead in shoreline and beach sediments frequented by river and park users. The second alerts visitors to elevated lead concentrations in fish. Recommended fish consumption limits for children and adults have been established, with particular emphasis on children and pregnant women or women considering pregnancy. A brief overview of the surface water and sediment sampling results is below.

### Surface water

To evaluate surface water impacts from mining contamination, total metals analysis was conducted on surface water samples collected from seven stations in the river between Long Lake and Post Falls. The surface water samples collected were compared to human health water quality criteria, and 21 percent contained cadmium exceeding a screening level of 0.9 micrograms per liter (µg/L), 48 percent contained lead exceeding a screening level of 0.66 µg/L, and 68 percent contained zinc exceeding a screening level of 30 µg/L. These concentrations, however, did not exceed safe drinking water standards. Surface water impacts

of cadmium, copper, lead, and zinc to ecological receptors was further evaluated as a part of the RI. While the ROD noted that ecological receptors may be impacted from surface water contamination in the river, the selected remedies focused solely on contaminated sediments as upstream remedies were required to address surface water contamination. As a result, the remedial actions this Periodic Review covers only focus on nearshore contaminated sediments.

### Sediments

The River upstream of Upriver Dam was estimated to contain 260,000 cubic yards of contaminated sediment at the time the ROD was written (USEPA 2002). To evaluate the extent of contamination of sediment, depositional areas in the Washington portion of the river were sampled during several studies that occurred between 1998 and 2000 (Groisbois 1999, USEPA 2000, and USEPA 2001b). The most comprehensive of these studies was conducted in 2000 where 25 beaches were sampled between Upriver Dam and the Idaho-Washington border (USEPA 2001b). Average lead concentrations at each of the sampling locations ranged from 70 to 1,140 milligrams/kilogram (mg/kg) while average zinc concentrations ranged from 524 to 3,340 mg/kg. Arsenic concentrations from this study were below the instrument detection limit of approximately 60 mg/kg. From previous studies, arsenic sediment concentrations ranged from 6.9 mg/kg near Upriver Dam to 36.2 mg/kg at the Barker Road North shoreline site. As with arsenic, lead and zinc concentrations were observed to be highest at beach locations near the Idaho-Washington border and decrease downstream.

During the RI, sediment concentrations were compared to human health and ecological RBCs. Of the shoreline beaches sampled throughout the RI, three had arsenic concentrations over the arsenic RBC of 10 mg/kg (Harvard Road, Barker Road North, and Flora Road). Arsenic concentrations at these locations represent cancer risks in the $1x10^{-5}$ range, above Washington State's target risk goal of $1x10^{-6}$ for the general public. These three shoreline beaches were carried forward for further remedial action. After the initial screening, an additional screening was conducted in comparison to MTCA. During the course of that additional screening, an additional eight shoreline beach sites were included for remedial action for exceeding either background concentrations or human health criteria. The additional shoreline beach sites that were included are Island Complex, Starr Road, Murray Road, Barker Road South, Plante's Ferry Park Area (Myrtle Point), Donkey Island Bar, Centennial Bridge/Islands Shore (Islands Lagoon), and the Upriver Dam Site. Donkey Island and Upriver Dam Site were addressed during the cleanup of the Spokane River Upriver Dam and Donkey Island Site (Cleanup Site ID: 4213[12]) in 2006.

## Cleanup levels and points of compliance

The methodology and decision criteria implemented to select cleanup levels and points of compliance for the protection of sediments are described in the USEPA ROD and the Screening Level Human Health Risk Assessment for Nonresidential Receptors (HHRA) (URS Greiner, INC

[12] https://apps.ecology.wa.gov/cleanupsearch/site/4213

and CH2M Hill 2000). The following sections briefly summarize the cleanup levels and points of compliance for each media type found at the Sites.

### Sediment cleanup levels

Since each shoreline beach site exhibits a human health exposure, predominantly through recreation, the RBCs USEPA developed and presented in the ROD and HHRA were used as the cleanup levels. While, contaminated sediment exposure was of concern, and a driver for cleanup, at the time of the remedial actions Ecology did not have promulgated freshwater sediment standards. Freshwater sediment standards that are found in literature, probable effects concentrations (PECs) developed by MacDonald et al (2000), were used as additional guidelines to help determine remedial action for protection of benthic organisms and other aquatic biota. The values for the RBCs and PECs are depicted in Table 1 in Appendix B.

### Sediment point of compliance

At the time of the cleanup action, the Sediment Management Standards' default point of compliance for sediment and surface water cleanup levels was the 0-to-10 centimeter (cm) depth interval below the mudline. Radioisotope-dating evaluations conducted as a part of the Spokane River Upriver Dam and Donkey Island Site support that the biologically active zone in the contaminated sediments does not extend below the 10-cm interval, and in several cores is limited to the 0-to-4 cm interval. Use of a default 0-to-10 cm point of compliance in the sediment cleanup standard provides an additional level of protectiveness to address potential future improved conditions at the Site. For more information on the coring data, please refer to the Focused Remedial Investigation Report, Upriver Dam PCB Sediments Site[13] (Anchor Environmental LLC 2005).

## Selected remedial action

The remedial action for each beach site is detailed in the Capping Construction Completion Report[14] (GeoEngineers 2013). A brief summary of the cleanup action performed at each beach site is provided below.

### Cleanup action for Island Complex

A gravel cap of varying thickness ranging from 6 to 24 inches in depth and native vegetation plantings were used as the selected remedy for the Site. Capping activities occurred in four sections using different sized rock mixtures. The first area, approximately 3,300 square feet along the riverbank, contained a mixture of 4- to 6-inch quarry spalls and 1- to 3-inch-minus rounded river rock. The second section, approximately 6,400 square feet directly upslope of the first area, was capped using topsoil rolled in erosion-control coir fabric with native vegetation planted throughout the section. The third capped section was completed in a chevron-shaped area where the southern and backwater channel come together. Capping materials, composed

[13] https://apps.ecology.wa.gov/cleanupsearch/document/51492
[14] https://apps.ecology.wa.gov/cleanupsearch/document/24562

of 6- to 10-inch river cobbles, were placed over an area of approximately 1,200 square feet. The fourth section was 2,000 square feet of 3/8-inch minus crushed gravel for travel improvement. Total approximate cap area: 12,900 square feet.

## Cleanup action for Starr Road

The cleanup action for the Starr Road site was conducted by USEPA and the Army Corp of Engineers in coordination with Ecology. A gravel cap of varying thickness ranging up to 12 inches in depth combined with grass seeding were used as the selected remedy. Capping activities used four different types of fill material: Gravel Bar Fill Type A (Type A), Gravel Bar Fill Type B (Type B), Upland Fill, and soil. Type A consisted of a gravel mix that was 3 inches or less in diameter, while Type B consisted of a gravel mix that was 6 inches or less in diameter. Type B was used in high velocity flow areas to limit erosion during high runoff. Contaminated sediments on the gravel bar that protrudes into the Spokane River were excavated and backfilled with Type A or Type B fill, depending on the location. The fill on the gravel bar was placed to return the area to the original elevation. Contaminated areas outside of the gravel bar were capped with the Upland Fill. Sediments below the OHWM received a 12-inch Upland Fill cap, while soils above the OHWM received an 8-inch Upland Fill cap followed by a 4-inch soil layer. The soil layer was seeded and mulched. In addition to the gravel caps, a crushed gravel trail was placed from the newly paved parking area to the Site. Total approximate cap area: 130,000 square feet.

## Cleanup action for Murray Road

A gravel cap of varying thickness ranging from 12 to 18 inches in depth and native vegetation plantings were used as the selected remedy. Capping activities occurred at four locations. Cap A consisted of a spawning gravel mix, 3 inches or less in diameter, and was placed in the area that exhibits lower velocity conditions during high flows, but remains submerged during low-flow conditions the longest. Cap A covered an area approximately 26,000 square feet in size. Cap B was placed directly adjacent to Cap A and consisted of a gravel mix that was 3 inches or less in size and did not contain spawning gravel. A small portion of the Cap B mix was placed along the river adjacent to Cap D. Cap C contained the same gravel mix as Cap B; however, Cap C had an additional soil layer placed on top that was hydroseeded. Caps B and C covered approximate areas of 43,100 and 50,000 square feet, respectively. Cap D was located several hundred feet upstream of caps A, B, and C. Cap D consisted of a sand and gravel mix with the material less than 8 inches in diameter with 85 percent of the material greater than 2 inches in diameter. Cap D covered an approximate area of 4,200 square feet. In addition to the gravel caps, a gravel trail (consisting of gravel less than 3/8-inch diameter was placed from the parking area to the Site. Total approximate cap area: 123,300 square feet.

## Cleanup action for Harvard Road

The Harvard Road Site has been identified as a spawning location for Redband trout. In an effort to maintain a consistent water depth throughout the Site during spawning and fry hatching season, native material was excavated and backfilled with a gravel cap. Approximately 12 inches or 916 tons of material was excavated and disposed of at a solid waste landfill. After

excavation, capping material was placed at the Site. The first area cap was composed of a 12-inch layer of rounded gravel-spawning mix consisting of 3 inch or less diameter material with a majority in the larger gradations. The spawning mix was applied to approximately 23,000 square feet. The second cap area was located in the upslope parking area and was capped with approximately 6 inches of 5/8-inch crushed gravel over 16,600 square feet. The third capped area was the boat launch area. Approximately 2 inches of 5/8-inch crushed gravel was placed over a 500-square-foot area along with 1,400 square feet of spawning mix placed adjacent to the spawning mix in the first cap area. Total approximate cap area: 41,000 square feet.

## Cleanup action for Barker Road North

The remedy used a combination of native material excavation and backfilling with a gravel cap and native vegetation plantings. Since the proposed remediation would occur within a Special Flood Hazard Area, excavation was required so not to increase the base flood elevation prior to capping. Approximately 13 inches of material was excavated to accommodate the gravel cap. The 20-inch cap was composed of 4 inches of 1.5-inch minus filter material laid and compacted, after which an additional 16 inches of 12-inch minus rock was laid on top. Once the gravel cap was laid and compacted, native riparian vegetation was planted on top of the cap to assist with erosion control. The excavated material was tested prior to being disposed of as solid waste. Total approximate cap area: 8,855 square feet.

## Cleanup action for Barker Road South

Upon review of USEPA- and Ecology-collected sediment data combined with the limited site access, a remedial action to further limit Site access was selected and implemented. Site access is through a steep, heavily vegetated gulley, which discourages most recreational users. To further discourage Site access and help prevent hillside erosion, a chain-link fence with signage was installed.

## Cleanup action for Flora Road

A combination of native material excavation with a gravel cap backfill was used as the remedy. Since the remedy would occur within a Special Flood Hazard Area, excavation was required so not to increase the base flood elevation prior to capping. Approximately 15 inches of material was excavated and tested prior to being disposed of as solid waste. A 4-inch-thick filter material composed of 1.5-inch minus was laid and compacted, after which a 16-inch depth of material composed of 12-inch minus rock was laid on top. Total approximate cap area: 10,497 square feet.

## Cleanup action for Myrtle Point

A combination of native material excavation backfilled with a gravel cap and native vegetation plantings was used as the remedy. Since the proposed remediation would occur within a Special Flood Hazard Area, excavation was required so not to increase the base flood elevation prior to capping. Approximately 7 inches of material was excavated to accommodate the gravel cap and was tested prior to being disposed of as solid waste. A 4-inch-thick filter material

composed of 0.75- to 1.5-inch minus was laid and compacted, after which 11 inches of 1.5- to 8-inch minus rock was overlaid. Following gravel cap placement, native riparian vegetation was planted on top of the cap to assist with erosion control. Total approximate cap area: 3,290 square feet.

### Cleanup action for Islands Lagoon

A sand and gravel cap was used as the remedy to limit potential human health exposure to the sediments contaminated with heavy metals. A 4-inch filter rock layer was placed first with compaction lifts done at 2- and 4-inch depths. On top of the filter rock, an 8-inch-thick gravel cap consisting of a mix ranging between 1.5- and 6-inch minus. A final 4-inch cap of sand was placed on top of the rock fill and compacted. In the erosional beach area, boulders between 2.5 to 3.5 feet in diameter were placed in a vertical formation to limit erosion. Total approximate cap area: 9,743 square feet.

## Long-term compliance monitoring

Ecology (2013) developed a post-remediation inspection and monitoring plan described in the Monitoring, Sampling, and Analysis Plan[15] (MSAP). As a part of the MSAP, Site visits are scheduled to occur every year for visual observation while surface sediment sampling would occur every 5 years or when a flow event exceeding 40,000 cubic feet per second occurs in the Spokane River. The visual observation schedule was later amended to follow the same schedule as the sampling schedule. During the Site visits, visual observations are recorded noting changes from the previous site visit, including sediment deposition or erosion, deposition of debris, and whether the gravel caps are intact. Monitoring events were conducted in 2013[16] and 2018.[17]

Surface sediment sampling focused on collecting material from the 0-to-10 cm biologically active layer of the cap. Material that was placed as a part of the gravel cap was not collected. The sample number and location at each beach Site are determined in the field based on previous sampling results, surface geology, and sediment depositional patterns. Surface sediment samples were initially collected, prepped, and sent for laboratory analysis as a part of the 2013 monitoring event. This procedure was changed to use an x-ray fluorescence (XRF) device that is able to analyze for the same contaminants of interest (arsenic, cadmium, lead, and zinc). The XRF is field-portable and can be used where sediment volume is insufficient to be analyzed by a laboratory, which was the case during the 2013 monitoring event.

The data collected during the monitoring events were evaluated to determine whether remedial actions at the Sites have provided sufficient protection to human health and the environment and to determine whether the monitoring strategy should be revised. An evaluation of sediment compliance monitoring data is in the Sediment Analysis section.

[15] https://apps.ecology.wa.gov/cleanupsearch/document/116270
[16] https://apps.ecology.wa.gov/cleanupsearch/document/116271
[17] https://apps.ecology.wa.gov/cleanupsearch/document/83854

# Periodic Review

## Regulation

WAC 173-340-420(2) requires Ecology to conduct a periodic review of a site every five years under the following conditions:

(a) Whenever Ecology conducts a cleanup action;
(b) Whenever Ecology approves a cleanup action under an order, agreed order, or consent decree;
(c) Or, as resources permit, whenever Ecology issues a no further action opinion;
(d) And, one of the following conditions exists:
    (1) Institutional controls or financial assurance are required as part of the cleanup.
    (2) Where the cleanup level is based on a practical quantitation limit.
    (3) Where, in the department's judgment, modifications to the default equations or assumptions using site-specific information would significantly increase the concentration of hazardous substances remaining at the site after cleanup, or the uncertainty in the ecological evaluation or the reliability of the cleanup action is such that additional review is necessary to assure long-term protection of human health and the environment.

When evaluating whether human health and the environment are being protected, the factors Ecology shall consider include [WAC 173-340-420(4)]:

(a) The effectiveness of ongoing or completed cleanup actions, including the effectiveness of engineered controls and institutional controls in limiting exposure to hazardous substances remaining at the site;
(b) New scientific information for individual hazardous substances or mixtures present at the site;
(c) New applicable state and federal laws for hazardous substances present at the site;
(d) Current and projected site and resource uses;
(e) The availability and practicability of more permanent remedies; and
(f) The availability of improved analytical techniques to evaluate compliance with cleanup levels.

Ecology shall publish a notice of all periodic reviews in the *Site Register* and provide an opportunity for public comment.

## Effectiveness of ongoing or completed cleanup actions

Evaluating the cleanup action effectiveness involves visiting the site and assessing contaminant levels and trends to determine if the cleanup actions are performing as expected.

### Cleanup action for Islands Lagoon

Based upon the Site visit Ecology conducted October 1 and 3, 2018, the Site remains owned by Washington State and is used for recreational purposes. A photo log is in Appendix C.

During the 2013 monitoring, Ecology observed:

- New sediment deposition on top of the gravel caps on the furthest upstream sites: Island Complex, Starr Road, Murray Road, and Harvard Road. New sediment deposition could be sampled only at these locations.
- Recreational use had occurred at each of the shoreline beach Sites. Little to no impact was noted from such use.

During the 2018 monitoring, Ecology made the following visual observations:

- With the exception of the Islands Lagoon Site, all of the Sites exhibited sediment deposition with the most upstream Site, Island Complex, exhibiting the greatest accumulation.
- Each Site showed signs of recreational use. Minor damage, mostly limited to gravel pathways developed during the remedial actions, was observed at the Island Complex, Starr Road, and Barker Road North Sites.
- Island Complex is showing signs of erosion as a result from high-flow events with damage noted to the coir fabric and with less than 50 percent of the planted vegetation surviving.

As a whole, the gravel caps at the Sites appear to be intact, providing a barrier to eliminate direct exposure pathways to contaminated sediments.

## Sediment analysis

As a part of the 2013 monitoring event, 18 samples were analyzed, while 45 sediment samples were analyzed during the 2018 event. The analytical results from the monitoring events are discussed below.

During the 2013 monitoring event, new depositional sediment was observed and sampled at the upstream locations of Island Complex, Starr Road, Murray Road, and Harvard Road. The downstream locations of Flora Road, Barker Road North, Myrtle Beach, and Islands Lagoon did not exhibit any new depositional sediment and thus were not sampled. Four samples were collected from Island Complex, five from Starr Road, five from Murray Road, and four from Harvard Road. See Appendix B for detailed results. Contaminant concentrations varied across each site as well as between the four sites. Arsenic, cadmium, and lead showed a decreasing trend moving downstream between Island Complex and Murray Road. However, contaminant concentrations increased at Harvard Road in comparison to Murray Road, the closest Site upstream. Ecology also observed that the highest concentrations found at Harvard Road for all four contaminants were from samples collected further up the shore, potentially indicating that the Harvard Road Site acts as a depositional area during high flows and, as the flows decline, the material from the lower parts of the Site are removed leaving relatively uncontaminated material behind.

Results were compared to samples collected prior to remediation (Table 4). At each Site, contaminant concentrations were generally less after the remedial actions. At the Island Complex Site, the pre-remediation and post-remediation sampling results were similar. This is

most likely due to the significant amount of new material deposited since the remedial action that Ecology observed at the Site.

During the 2018 monitoring event, sediment deposited on top of the gravel caps was observed and sampled at each Site except for Flora Road. The Sites furthest upstream were observed to have the most sediment deposition, which corresponds to the concentrations, observed in samples that were analyzed. Contaminant concentrations between the Sites and within each Site were varied. Arsenic and zinc concentrations showed a decreasing trend moving downstream, with a significant decrease starting at Barker Road North and continuing downstream. Lead concentrations, however, stayed relatively consistent until reaching the furthest downstream Site (Islands Lagoon). Islands Lagoon had the lowest concentrations for arsenic, lead, and zinc. See Appendix B for detailed results.

### Arsenic

Of the beaches sampled, the RBC for arsenic (~10 mg/kg) was exceeded by at least one sample at each Site except Barker Road North. The average arsenic concentration at Island Complex, Starr Road, Murray Road, Harvard Road, and Myrtle Point exceeded the RBC. The PEC for arsenic (33 mg/kg) was exceeded in at least one sample at Island Complex, Murray Road, and Harvard Road. Murray Road was the only Site where the average arsenic concentration exceeded the PEC. The highest arsenic concentration (114 mg/kg) was observed at Murray Road.

### Lead

The RBC for lead (700 mg/kg) was exceeded by at least one sample at Island Complex and Murray Road. The PEC for lead (128 mg/kg) was exceeded in at least one sample at all of the Sites sampled in 2018. In addition, average concentrations for lead exceeded the PEC at all of the Sites except Barker Road North and Islands Lagoon. The highest lead concentration (1,670 mg/kg) was observed at Murray Road.

### Zinc

The RBC for zinc was not exceeded at any Site. The PEC for zinc (459 mg/kg) was exceeded in at least one sample at each Site sampled in 2018. The highest concentration for zinc was observed at Murray Road (2,690 mg/kg) while both Island Complex and Harvard Road had zinc concentrations over 2,000 mg/kg (2,290 and 2,260 mg/kg respectively). All three sites also averaged zinc concentrations over 1,000 mg/kg.

The results were compared to samples collected prior to remediation efforts and previous monitoring events (Table 4). At each Site, contaminant concentrations were generally less after the remedial actions, except for arsenic at Murray Road and Harvard Road, and lead and zinc at Island Complex. While concentrations are still less than pre-remedial action concentrations, there has been an observed increase in concentrations for all contaminants at Harvard Road and the other upstream Sites since post-remediation sampling. Sites downstream of Harvard Road do not have enough post-remediation sampling events to observe a temporal trend.

To ascertain if the downstream Sites have potential to be impacted from contaminated sediment deposition, Ecology reviewed the data collected during the Spokane River Upriver Dam and Donkey Island site (Upriver Dam Site) sampling event in 2020. Surficial sediments were collected from the top of the gravel cap at the Upriver Dam forebay put in place during cleanup in 2006 (DH Environmental 2020). Eight surface grab samples were collected and analyzed for polychlorinated biphenyls (PCBs) and heavy metals. Table 6 presents the analytical results. The sediment sample collected furthest upstream on the gravel cap contained the highest levels of heavy metals amongst all the samples taken. The concentrations were similar to the furthest upstream Sites' concentrations from the monitoring event in 2018. It should be noted that the deposited sediment collected during the 2020 Upriver Dam Site sampling event was not present during the sampling event in 2010. These results indicate that sediment contaminated with heavy metals has an ongoing potential to deposit and impact the river in this area.

### Institutional controls

The only institutional control for the Sites is they are listed in Washington Department of Natural Resource's (DNR's) database of State-owned lands. Being identified in this database as State-owned land triggers additional review when construction or other projects that may affect the remedial action integrity are proposed.

## New scientific information for individual hazardous substances or mixtures present at the Site

There is no new relevant scientific information for the contaminants related to the Site.

## New applicable state and federal laws for hazardous substances present at the Site

Cleanup levels at the Site were based on the standards at the time of the remedial action for the protection of human health and the environment. Since the remedial action completion, the Sediment Management Standards (SMS, WAC 173-204) were updated in September 2013 with sediment quality values for the protection of benthic-dwelling invertebrates in freshwater systems. The recently updated freshwater SMS provides numerical criteria for the contaminants of concern. The numerical values are separated into two categories: Sediment Quality Standard (SQS) and the Cleanup Screening Level (CSL). The SQS represents the tier at which contaminant concentrations demonstrate no adverse effects and the goal sediment cleanups hope to achieve. The CSL represents the tier above which contaminants are expected to pose an adverse effect and is the minimum to which a sediment site must be cleaned. These standards, however, are not readily predictable of benthic toxicity at sites impacted by metals, such as these Sites.

In addition, the sediment point of compliance was updated to continue to be protective of aquatic life and human health. To protect aquatic life, the point of compliance was established as being within the biologically active zone. The biologically active zone was found not to occur beyond the 10-cm depth at the Sites and in most cases occurred much shallower.

The above-mentioned regulatory changes do not affect whether the remedies used at the Sites are protective of human health and the environment. The remedies implemented eliminate the exposure pathway for benthic organisms and other aquatic biota to contaminated sediments.

## Current and projected Site and resource uses

The Sites are under DNR jurisdiction. Recreational activities, including boating, may occur near the Sites; however, impact to the Sites is expected to be negligible.

## Availability and practicability of more permanent remedies

The remedy implemented included containment of hazardous substances, and it continues to be protective of human health and the environment. While more permanent remedies may be available, they are not practicable at this Site due to cost considerations and potential for recontamination from upstream sources.

## Availability of improved analytical techniques to evaluate compliance with cleanup levels

The analytical methods used at the time of the remedial actions were capable of detection below cleanup levels for contaminants of concern at the Site. The presence of improved analytical techniques does not affect decisions or recommendations made for the Site.

## Cleanup level evaluation

In addition to reviewing whether new applicable state and federal laws for hazardous substances apply to the Site, Ecology reviewed the methodologies for developing the cleanup levels implemented as a part of the remedial action. The cleanups used screening levels developed by USEPA for the Coeur d'Alene Basin. In discussions with USEPA, current Site conditions and remedial decision-making would be best evaluated using Washington State regulations and cleanup standards. Washington State cleanup levels that would be potentially applicable to the Site are the SMS (WAC 173-204), Method A Cleanup values (WAC 173-340-704), and the Terrestrial Ecological Evaluation (TEE) standards (WAC 173-304-7490).

Proceeding is a cleanup level development for the Site following MTCA regulations.

### Cleanup standards

The cleanup standard development process is used to determine which hazardous substances or indicator substances contribute to an overall threat to human health and the environment at a site. Once these indicator substances are identified, an evaluation is made to determine at what concentration these substances are considered protective of human health and the environment. A point of compliance is then established on the Site, which is a point or points where these cleanup levels must be attained (WAC 173-340-200). Cleanup standards include both cleanup levels and points of compliance for those cleanup levels.

MTCA provides three main methods for establishing cleanup levels at a site. These are Method A, B, and C. Method A provides cleanup levels for routine cleanup actions for sites with relatively few hazardous substances. Methods B and C cleanup concentrations are calculated from applicable or relevant and appropriate requirements and from using the formulas provided in WAC 173-340-720 through WAC 173-340-760. Method B is the universal method for establishing cleanup levels and is applicable to all sites. Method C is a conditional method for sites subject to limited uses.

Following establishment of cleanup levels, media having concentrations above cleanup levels must be addressed using one or more technologies selected as part of the remedy. Criteria for remedy selection are outlined in WAC 173-340-360.

Sediments and upland soils are the contaminated media at the Site. Elevated metals of arsenic, cadmium, lead, and zinc are the hazardous substances in these media. The metal contamination is a direct result of upstream sediment sources containing metal content that have migrated downstream to the Site.

Human health and terrestrial ecological conditions are evaluated to establish cleanup standards. Even though the Site is located in an area that allows for a mixture of uses, Ecology determined that the most reasonable exposure scenarios for human health and ecological receptors are ingestion and direct contact with the sediments and soils.

Method A cleanup standards will be used for establishing cleanup levels protective of human health, while the TEE will be used to develop cleanup levels protective of terrestrial ecological receptors at the Site. The SMS and literature-based criteria are used as a reference for cleanup levels protective of benthic biota at the Site.

## Terrestrial ecological evaluation

A site is required under WAC 173-340-7490 to perform a TEE to determine whether a release of hazardous substances to soil may pose a threat to ecological receptors. A site may be excluded from a TEE if any of the following conditions are met:

- All contaminated soil is or will be located below the point of compliance;
- All contaminated soil is or will be covered by physical barriers such as buildings or pavement;
- The site meets certain requirements related to the nature of on-site and surrounding undeveloped land; or
- Concentrations of hazardous substances in soil do not exceed natural background levels.

This Site does not meet any of the exclusionary criteria, nor does it qualify for a simplified evaluation. Each of the shoreline sites are a part of a riparian corridor that is undeveloped and presents an area where plants, soil biota, and wildlife are expected to frequent, and as a result, a site-specific TEE is required for the Site. Since each of the shoreline areas share the same general characteristics (riparian zone, surrounded by undeveloped land, high likelihood of use by terrestrial receptors, and chemicals of concern) a singular TEE was performed for the Site.

During the problem formulation step of the site-specific TEE, an exposure pathway to deposited sediments contaminated with arsenic, cadmium, lead, and zinc through direct (burrowing, ingestion while feeding) and indirect contact (metal uptake from vegetation and subsequent ingestion) was identified. Terrestrial receptors likely to be affected are soil biota, vascular plants, ground-feeding birds, and small mammals and herbivorous small mammals. The receptors identified in Table 749-4[18] will serve as surrogate receptors for this TEE, as there is abundant toxicological information about these receptors and they have been observed or have a high likelihood to frequent the Site.

To establish criteria that are protective of terrestrial wildlife, the TEE allows for the use of Table 749-3.[18] Since all three types of receptors are expected to be present at the Site, the lowest value for each contaminant of the three receptors will be used as the terrestrial cleanup level. Table 2 in Appendix B depicts the terrestrial cleanup levels.

## Aquatic biota evaluation

Washington State promulgated freshwater sediment standards in 2013. These standards, however, are not reliably predictable of benthic toxicity at sites that are impacted by mining, smelting, and milling, such as these Sites are. The CSL values from the SMS are included as part of the overall cleanup value selection process to serve as a reference. In addition, the literature-based PECs freshwater benthic standards developed by MacDonald et al (2000) are also included for reference. Table 2 in Appendix B depicts the referenced sediment values.

## Selected cleanup levels for the Sites

The Sites undergo significant hydrologic changes where, during portions of the year, the majority of each Site is completely inundated with water and, during other times of the year, it is dry. The amount of inundation also can vary from year to year. Where contamination has come to be at the Site, the majority of it meets the definition of sediment. During low river flows, these areas of sediment also act as upland areas for terrestrial receptors. To terrestrial receptors as well as human receptors, the delineation between upland soil and sediment areas is inconsequential. The lowest cleanup level for each contaminant was selected regardless of media type to be protective of all potential receptors (human, terrestrial biota, and aquatic biota) that may use the Site. The selected cleanup levels for the Sites are arsenic (9 mg/kg), cadmium (2 mg/kg), lead (50 mg/kg), and zinc (86 mg/kg) (Table 2, Appendix B).

# Conclusions

Upon completing this Periodic Review, Ecology has made the following determinations:

- The cleanup remedies implemented at the Sites continue to protect human health and the environment from capped contaminated sediments.

[18] WAC 173-340-900 (https://app.leg.wa.gov/WAC/default.aspx?dispo=true&cite=173-340&full=true#173-340-900)

- The increasing concentration trends and continued new sediment deposition indicate that potential upstream sources exist that are continuing to impact the river and could pose a risk to human health and the environment if they are not controlled.
- Continued monitoring to ensure that the Sites continue to be safe for human health and the environment.
- A monitoring study evaluating sediment load entering the Site at the Washington-Idaho border would be beneficial to assess the potential for recontamination.

## Next review

The next review for the Site will be scheduled five years from the date of this periodic review. In the event that additional cleanup actions or institutional controls are required, the next periodic review will be scheduled five years from the completion of those activities.

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# Appendix A: Site Map

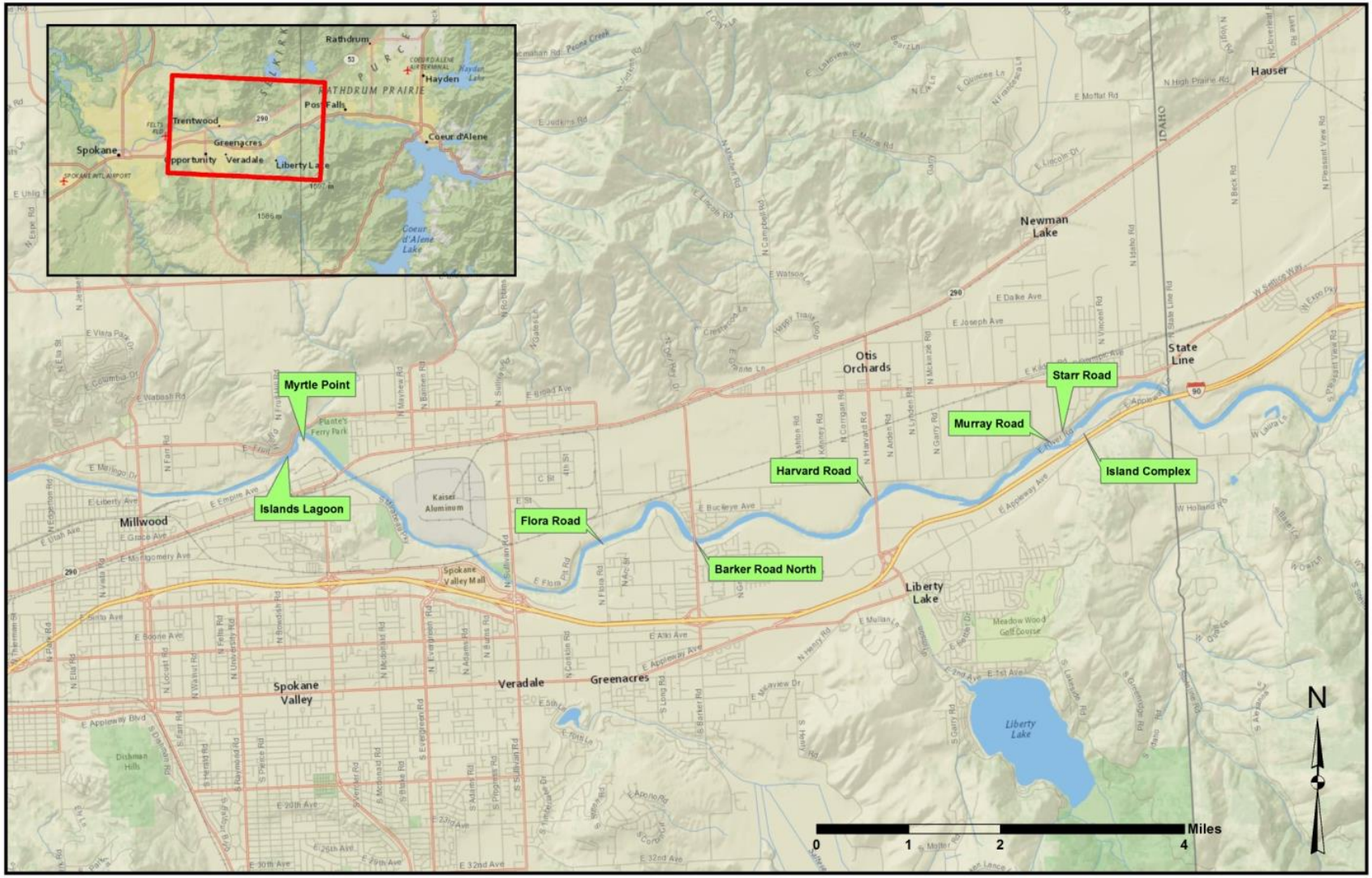


Figure 1: Map of the Spokane River Shoreline Metals Sites.

# Appendix B: Tables

Table 1: 2006 cleanup levels for the Spokane River Shoreline Metals Sites (mg/kg)

| Cleanup level | Arsenic | Cadmium | Lead | Zinc |
|---|---|---|---|---|
| USEPA RBCs | ~10[a] | 49[b] | 700[b] | 17,109[b] |
| PECs | 33 | 4.98 | 128 | 459 |
| USEPA RBCs | ~10[a] | 49[b] | 700[b] | 17,109[b] |

[a] Background for the Spokane, Washington area.

[b] Draft Final Screening Level Human Health Risk Assessment for Nonresidential Receptors. Spokane River, Washington. Coeur d'Alene Basin RI/FS.

PEC = probable effects concentration
RBC = risk-based concentration
USEPA = United States Environmental Protection Agency

Table 2: 2022 Cleanup levels for the Spokane River Shoreline Metals Sites (mg/kg)

| Contaminant | Method A Human Health | Ecological protection | SMS-CSL | PEC | Background | Selected cleanup level |
|---|---|---|---|---|---|---|
| Arsenic | 2.9[a] | 7 | 120 | 33 | 9* | 9 |
| Cadmium | 2* | 4 | 5.4 | 4.98 | 1 | 2 |
| Lead | 250 | 50* | 1,300 | 128 | 15 | 50 |
| Zinc | 6,000 | 86* | 4,200 | 459 | 66 | 86 |

[a] Background for the Spokane, Washington area.
* means most restrictive screening level.

CSL = cleanup screening level
PEC = probable effects concentration
SMS = Sediment Management Standards

Table 3: Sampling results prior to remedial actions at each site (mg/kg)

| Site | Sample ID | Arsenic | Cadmium | Lead | Zinc |
|---|---|---|---|---|---|
| Island Complex[a] | IC 1 | <24 | Not analyzed | 48 | 497 |
| Island Complex[a] | IC 2 | <34 | Not analyzed | <36 | 656 |
| Island Complex[a] | IC 3 | <32 | Not analyzed | <33 | 642 |
| Island Complex[a] | IC 4 | <47 | Not analyzed | 144 | 1,919 |
| Island Complex[a] | IC 5 | <40 | Not analyzed | 105 | 1,130 |
| Starr Road (2004)[b] | SRUP1 | 36 | 16 | 1,760 | 3,020 |

| Site | Sample ID | Arsenic | Cadmium | Lead | Zinc |
|---|---|---|---|---|---|
| Starr Road (2004)[b] | SRUP2 | 39 | 20 | 326 | 3,300 |
| Starr Road (2004)[b] | SRUP3 | 39 | 16 | 1,390 | 4,460 |
| Starr Road (2004)[b] | SRUP4 | 33 | 15 | 630 | 3,690 |
| Murray Road (2007) | Murray 1 | 28.3 | 10.1 | 584 | 2,710 |
| Murray Road (2007) | Murray 2 | 22.6 | 7.12 | 466 | 2,670 |
| Murray Road (2007) | Murray 3 | 18.1 | 13.1 | 268 | 2,400 |
| Murray Road (2007) | Murray 4 | 22.3 | 6.56 | 405 | 2,590 |
| Murray Road (2007) | Murray 5 | 19.5 | 7.13 | 611 | 2,300 |
| Murray Road (2007) | Murray 6 | 30.6 | 8.4 | 653 | 2,670 |
| Murray Road (2007) | Murray 7 | 27.7 | 11.4 | 739 | 2,100 |
| Murray Road (2007) | Murray 8 | 32 | 7.14 | 509 | 2,670 |
| Murray Road (2007) | Murray 9 | 26.6 | 8.68 | 808 | 2,300 |
| Murray Road (2007) | Murray 10 | 22.1 | 11.2 | 351 | 2,000 |
| Murray Road (2007) | Murray 11 | 18 | 7.64 | 866 | 1,800 |
| Murray Road (2007) | Murray 12 | 31.1 | 16.6 | 1,710 | 2,720 |
| Harvard Road (2007) | Harvard 1 | 16.5 | 8.48 | 414 | 1,670 |
| Harvard Road (2007) | Harvard 2 | 20.9 | 7.99 | 103 | 2,850 |
| Harvard Road (2007) | Harvard 3 | 17.6 | 8.35 | 414 | 2,840 |
| Harvard Road (2007) | Harvard 4 | 19.2 | 10.2 | 628 | 2,420 |
| Harvard Road (2007) | Harvard 5 | 16.7 | 9.8 | 816 | 2,680 |
| Harvard Road (2007) | Harvard 6 | 16.8 | 11.4 | 453 | 2,980 |

[a] Samples were analyzed using an older XRF that was not able to measure cadmium.

[b] U.S. Army Corps of Engineers. WA Recreational Sites Starr Road and Island Complex Field Sampling Report. 2005. Prepared for U.S. Environmental Protection Agency.

Table 4: Sampling results of the 2013 monitoring event (mg/kg)

| Site | Sample ID | Arsenic | Cadmium | Lead | Zinc |
|---|---|---|---|---|---|
| Island Complex | IC 1 | 15.6 | 19.5 | 872 | 1,830 |
| Island Complex | IC 2 | 16.6 | 3.09 | 147 | 524 |
| Island Complex | IC 3 | 16.8 | 16.8 | 733 | 1,520 |
| Island Complex | IC 4 | 11.2 | 5.94 | 308 | 1,120 |
| Starr Road | Starr 1 | 9.52 | 3.99 | 147 | 643 |
| Starr Road | Starr 2 | 10.2 | 2.82 | 89.2 | 412 |
| Starr Road | Starr 3 | 5.82 | 1.46 | 56.5 | 289 |

| Site | Sample ID | Arsenic | Cadmium | Lead | Zinc |
|---|---|---|---|---|---|
| Starr Road | Starr 4 | 5.90 | 2.23 | 86.8 | 533 |
| Starr Road | Starr 5 | 6.63 | 3.85 | 146 | 623 |
| Murray Road | Murray 1 | 10.9 | 2.01 | 74.1 | 365 |
| Murray Road | Murray 2 | 7.82 | 2.19 | 186 | 530 |
| Murray Road | Murray 3 | 10.8 | 2.33 | 71.3 | 366 |
| Murray Road | Murray 4 | 8.69 | 0.312 | 20.6 | 92.4 |
| Murray Road | Murray 5 | 17.4 | 4.57 | 151 | 650 |
| Harvard Road | Harvard 1 | 8.72 | 3.28 | 260 | 820 |
| Harvard Road | Harvard 2 | 7.84 | 2.49 | 158 | 757 |
| Harvard Road | Harvard 3 | 10.5 | 14.0 | 336 | 1,510 |
| Harvard Road | Harvard 4 | 6.70 | 14.8 | 407 | 1,390 |

Table 5: Sampling results of the 2018 monitoring event (mg/kg)[1]

| Site | Sample ID | Arsenic | Lead | Zinc |
|---|---|---|---|---|
| Island Complex | IC 1 | 3.5 | 192 | 882 |
| Island Complex | IC 2 | 3.5 | 293 | 1130 |
| Island Complex | IC 3 | 20.98 | 157 | 748 |
| Island Complex | IC 4 | 63.2 | 347 | 1330 |
| Island Complex | IC 5 | 64.8 | 751 | 2090 |
| Island Complex | IC 6 | 52.1 | 919 | 2290 |
| Island Complex | IC 7 | 3.5 | 809 | 1730 |
| Island Complex | IC 8 | 28.21 | 173 | 837 |
| Island Complex | IC 9 | 10.32 | 76.5 | 764 |
| Starr Road | Starr 1 | 29.9 | 238 | 1150 |
| Starr Road | Starr 2 | 30.4 | 63.0 | 565 |
| Starr Road | Starr 3 | 3.50 | 106 | 448 |
| Starr Road | Starr 4 | 27.6 | 169 | 1110 |
| Starr Road | Starr 5 | 13.7 | 77.6 | 436 |
| Starr Road | Starr 6 | 18.8 | 125 | 888 |
| Starr Road | Starr 7 | 16.3 | 105 | 1020 |
| Murray Road | Murray 1 | 13.0 | 29.8 | 421 |
| Murray Road | Murray 2 | 9.3 | 30.9 | 226 |
| Murray Road | Murray 3 | 23.4 | 113 | 416 |
| Murray Road | Murray 4 | 114 | 1670 | 2690 |
| Murray Road | Murray 5 | 71.2 | 775 | 1630 |
| Murray Road | Murray 6 | 53.9 | 251 | 1180 |
| Murray Road | Murray 7 | 25.2 | 331 | 1320 |
| Murray Road | Murray 8 | 3.5 | 56.4 | 329 |
| Murray Road | Murray 9 | 24.7 | 175 | 1020 |
| Harvard Road | Harvard 1 | 20.1 | 157 | 763 |

| Site | Sample ID | Arsenic | Lead | Zinc |
|---|---|---|---|---|
| Harvard Road | Harvard 2 | 22.7 | 248 | 1100 |
| Harvard Road | Harvard 3 | 30.1 | 165 | 1140 |
| Harvard Road | Harvard 4 | 20.1 | 113 | 1370 |
| Harvard Road | Harvard 5 | 56.4 | 462 | 2260 |
| Harvard Road | Harvard 6 | 20.3 | 84 | 778 |
| Barker Road North | Barker N. 1 | 3.5 | 122 | 634 |
| Barker Road North | Barker N. 3 | 3.5 | 93.3 | 563 |
| Barker Road North | Barker N. 3 | 3.5 | 140 | 669 |
| Barker Road North | Barker N. 4 | 3.5 | 11.3 | 58.9 |
| Myrtle Road | Myrtle 1 | 18.0 | 259 | 1090 |
| Myrtle Road | Myrtle 2 | 21.2 | 237 | 1060 |
| Myrtle Road | Myrtle 3 | 27.2 | 328 | 1020 |
| Myrtle Road | Myrtle 4 | 3.5 | 235 | 888 |
| Islands Lagoon | Islands 1 | 16.6 | 22.7 | 170 |
| Islands Lagoon | Islands 2 | 3.5 | 43.8 | 242 |
| Islands Lagoon | Islands 3 | 14.2 | 51.6 | 362 |
| Islands Lagoon | Islands 4 | 13.8 | 132 | 667 |
| Islands Lagoon | Islands 5 | 9.47 | 18.6 | 249 |
| Islands Lagoon | Islands 6 | 11.6 | 78.8 | 416 |

[1] Due to a settings error on the XRF, cadmium results were not recorded.

Table 6. Sampling results from surficial sediment collected as a part of the 2020 Upriver Dam PCB Sediment Site monitoring event (mg/kg)

| Sample type | Arsenic | Cadmium | Lead | Zinc |
|---|---|---|---|---|
| ST-01-Surface Grab | 7.5 | 3.3 | 99 | 870 |
| ST-02-Surface Grab | 5.8 | 1.8 | 83 | 820 |
| ST-03-Surface Grab | 6.1 | 2.1 | 83 | 940 |
| ST-04-Surface Grab | 8.0 | 4.3 | 93 | 870 |
| ST-05-Surface Grab | 7.4 | 1.3 | 85 | 890 |
| ST-06-Surface Grab | 5.2 | 6.9 J | 86 | 780 |
| ST-06-Surface Grab-Duplicate | 6.7 | 2.8 J | 86 | 860 |
| ST-08-Surface Grab | 5.4 | 2.2 | 61 | 580 |
| ST-10-Surface Grab | 21 | 29 | 480 | 3,000 |

J = estimated results

PCB = polychlorinated biphenyl

# Appendix C: Photo Log

## Photo 1: Island Complex – View to the east toward the chevron-shaped area

## Photo 2: Starr Road – View looking downstream to the west of the backwater area of the cleanup

## Photo 3: Murray Road – View from the road overlooking the Site to the north

## Photo 4: Harvard Road – View from the west extent of the gravel cap looking upstream

## Photo 5: Barker Road North – View looking upstream to the east along the gravel cap

## Photo 6: Flora Road – View looking downstream to the west along the gravel cap

## Photo 7: Myrtle Point – View looking upstream to the southeast on the gravel cap

## Photo 8: Islands Lagoon – View looking from the western downstream end of the cap looking to the west