US Army Corps of Engineers

Final Decision Document

Tongue Point Landfill
Former Tongue Point Naval Air Station
Astoria, Clatsop County, Oregon

DERP-FUDS Site No. F10OR048303

U.S. ARMY CORPS OF ENGINEERS
KANSAS CITY DISTRICT
601 East 12th Street
Kansas City, Missouri 64106

August 2018

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Acronyms

ARAR	applicable or relevant and appropriate requirement
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CSM	conceptual site model
DD	decision document
DDD	dichloro-diphenyl-dichloroethane
DDE	dichloro-diphenyl-dichloroethylene
DDT	dichloro-diphenyl-trichloroethane
DERP	Defense Environmental Restoration Program
DoD	U.S. Department of Defense
EE/CA	engineering evaluation and cost analysis
EPA	United States Environmental Protection Agency
FFS	focused feasibility study
FUDS	Formerly Used Defense Sites
HDPE	high-density polyethylene
HI	hazard index
HTRW	hazardous, toxic, and radioactive waste
LNAPL	light non-aqueous phase liquid
LPE	landfill protectiveness evaluation
LRI	limited remedial investigation
MCL	maximum contaminant level
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MLLW	mean lower low water
NAS	Naval Air Station
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NOAA	National Oceanic and Atmospheric Administration
NTCRA	non-time critical removal action
O&M	operation and maintenance
ODEQ	Oregon Department of Environmental Quality
ODSL	Oregon Division of State Lands
OW	observation well
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PP	proposed plan
ppm	parts per million
PTW	principal threat waste
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
STOW	short-term observation well
TSCA	Toxic Substances Control Act
TDS	total dissolved solids
TPH	total petroleum hydrocarbons
TPMS RI	Tongue Point Multi-Sites remedial investigation
µg/L	micrograms per liter
UGIDT	upgradient interceptor drainage trench
USACE	U.S. Army Corps of Engineers
VOC	volatile organic compound

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Part 1
Declaration

This Decision Document (DD) presents the Selected Remedy for the Former Tongue Point Naval Air Station (NAS) Landfill at Astoria, Clatsop County, Oregon. The project is being conducted as part of the U.S. Army Corps of Engineers (USACE) program for response actions addressing hazardous, toxic, and radioactive waste (HTRW) within the Formerly Used Defense Sites (FUDS) Program (USACE 2004b). The USACE as the lead agency, with support from the Oregon Department of Environmental Quality (ODEQ), presents the Selected Remedy.

1. Site Name and Location

- Site Name: Former Tongue Point NAS Landfill (Landfill)
- Site Location: Astoria, Clatsop County, Oregon
- FUDS Property/Project Number: F10OR048303

This DD addresses the Landfill.

The project area is located at the former Tongue Point NAS in a rural area on the southwest shore of Cathlamet Bay at Columbia River mile 18. The Former NAS is on the tidelands and adjacent to Mill Creek, east of Old Highway 30 approximately 3 miles east of Astoria, Oregon (**Figure 1**). The U.S. Department of Defense (DoD) used the area from 1941 through 1962 after which the Navy deactivated the facility and transferred the property to the Government Services Administration in January 1962.

2. Statement of Basis and Purpose

Investigation and cleanup decision for the Selected Remedy were conducted with the authorities of the Defense Environmental Restoration Program (DERP) within the FUDS program. These programs follow requirements and regulations of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record file for the project.

Oregon Department of Environmental Quality agrees with the Selected Remedy.

3. Assessment of the Site

The response action selected in the DD is necessary to protect public health and welfare or the environment from actual or threatened releases of pollutants, contaminants, and/or hazardous substances into the environment.

4. Description of the Selected Remedy

The Landfill Selected Remedy addresses contamination that could be attributable to past DoD practices. The initial action was implemented as a non-time critical removal action (NTCRA) to excavate areas, contain contamination, and cap the Landfill. The post-removal risk assessment conducted by the USACE found no unacceptable risk in post-NTCRA conditions for soil, groundwater, landfill gas, sediment, surface water, or aquatic biota attributable to past DoD practices.

The NTCRA landfill containment components were constructed to contain contaminated media within the Landfill. The Selected Remedy involves maintaining the integrity and conditions of the landfill components, implementation of landfill security measures, and providing information to the public, to ensure protectiveness of human and ecological receptors in the future. The integrity of the following components will continue to be maintained and monitored to ensure the remedy remains protective of human health and the environment.

- Barrier wall surrounding the perimeter of the Landfill to prevent migration of contaminants outside the Landfill
- Landfill cover to minimize infiltration into the Landfill and prevent migration of contaminants outside the Landfill
- Gas collection system to minimize buildup of gas within the Landfill

The major components of the Selected Remedy for addressing the potential risks at the Landfill include:

- Containment of contaminated media within the Landfill
- Maintenance of the landfill components
- Monitoring the landfill hydraulic containment
- Institutional controls
- Access controls

5. Statutory Determinations

The Selected Remedy attains the mandates of CERCLA, and to the extent practicable, the NCP. The Selected Remedy is protective of human health and the environment, complies with the sole federal requirement that was determined to be relevant and appropriate to the remedial action, is cost-effective, and utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable.

The Selected Remedy does not satisfy the statutory preference for treatment as a principal element of the remedy. The Focused Feasibility Study (FFS) presented a presumptive remedy decision framework evaluation, which determined that excavation of soil and landfill waste is impractical at the Landfill because of site-specific considerations, including but not limited to sensitive aquatic environments surrounding the Landfill and co-mingled, potentially hazardous, solid media (soil and landfill waste) and aqueous media (light non-aqueous phase liquid [LNAPL] and contaminated groundwater/leachate) within the Landfill. In addition, hot spots were not identified that could be specifically targeted for excavation and/or treatment (USACE 2016).

The Selected Remedy includes long-term maintenance, monitoring, and institutional controls, consistent with 40 Code of Federal Regulations (CFR) Part 264.310(b)(1, 5, and 6) for closure and post-closure care for landfills, which are the only applicable or relevant and appropriate requirement (ARAR) for the remedial action. The substantive requirements identified for post-closure care of landfills, including monitoring and maintenance of the landfill cover system at the Landfill, are relevant and appropriate to the Selected Remedy.

Because the remedy will result in hazardous substances, pollutants, or contaminants remaining on site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted

within 5 years after initiation of the remedial action to ensure the remedy is or will be protective of human health and the environment.

6. Data Certification Checklist

The following information is included in the Decision Summary section of this DD. Additional information can be found in the Administrative Record file for the Landfill.

- Chemicals of concern and their respective concentrations (Section 5.3 of the Decision Summary)
- Summary of risks (Section 7 of the Decision Summary)
- How source materials constituting principal threats are addressed (Section 11 of the Decision Summary)
- Current and reasonably anticipated future land use assumptions and current and potential future beneficial uses of groundwater (Section 6 of the Decision Summary)
- Potential land and groundwater use that will be available at the site as an outcome of the Selected Remedy (Section 12.4 of the Decision Summary)
- Estimated capital, annual operation and maintenance, and total present worth costs; discount rate; and the number of years over which the remedy cost estimates are projected (Section 12.3 of the Decision Summary)
- Key factor(s) that led to selecting the remedy (Section 12.1 of the Decision Summary).

Cleanup levels established for chemicals of concern and the basis for these levels are not included in the Decision Summary section of this DD. As detailed in Decision Summary Section 2.9, most potential points of contact to releases from the Landfill have been eliminated by the Landfill NTCRA components. Barring failure of the containment components, the only remaining point of contact with contaminants present at the Landfill is contact with emissions from the passive landfill gas system via inhalation. However, based on landfill conditions and available data, exposure to landfill gas is considered insignificant, with no threat to human receptors. For these reasons, media-based remedial goals have not been established for the Landfill.

7. Authorizing Signatures

An authorizing signature on the following approval page denotes USACE Northwestern Division's acceptance of this DD as the final response action for the Landfill. This DD will be part of the Administrative Record and available for public viewing at the public information repository at the Astoria Public Library located at 450 10th Street, Astoria, Oregon.

FINAL DECISION DOCUMENT

TONGUE POINT LANDFILL DECISION UNIT
FORMER TONGUE POINT NAVAL AIR STATION
ASTORIA, CLATSOP COUNTY, OREGON

APPROVAL

This Decision Document (DD) presents the selected decision for the Landfill at the Formerly Used Defense Site (FUDS) known as the Tongue Point Naval Air Station, Astoria Oregon. The U.S. Army Corps of Engineers is the lead federal agency, with authority from the Defense Environmental Restoration Program, and has prepared this DD consistent with the Comprehensive Environmental Response, Compensation, and Liability Act, as amended, and the National Oil and Hazardous Substances Pollution Contingency Plan. This DD, presenting a selected remedy, is approved by the undersigned, pursuant to Memorandum, CENWD-ZA, December 19, 2017, Subject: Re-delegation of Assignment of Mission Execution Functions Associated with Department of Defense Lead Agent Responsibilities for the Formerly Used Defense Sites Program, and Engineer Regulation 200-3-1, FUDS Program Policy.

APPROVED:

David J. Ponganis, SES
Director, Programs
Northwestern Division

2 0 SEP 2018
Date

Part 2
Decision Summary

The following Decision Summary provides a substantive summary of information that is available in the Administrative Record file to support the remedy selection decision.

1. Site Name, Location, and Brief Description

Site Name:	Former Tongue Point NAS Landfill (Landfill)
	DERP-FUDS No. F10OR048303
Location:	Astoria, Clatsop County, Oregon
Lead Agency:	U.S. Army Corps of Engineers
Support Agency:	Oregon Department of Environmental Quality
Funding Source:	Funding for remedial activities is provided by the Defense Environmental Restoration Account, a funding source approved by Congress to clean up contaminated sites on DoD installations.
Site Type:	Formerly Used Defense Site Landfill
Site Description:	The Landfill at the former Tongue Point NAS area is located near the mouth of the Columbia River (Cathlamet Bay) adjacent to Highway 30 and is within the city limits of Astoria, Oregon. The Landfill comprises 2.5 acres, and the depth of soil and/or landfill waste varies from 5 to 30 feet below ground surface (bgs). **Figure 1** shows the layout and the relative project location as an inset map.

2. Site History and Enforcement Activities

The DoD originally acquired 395 acres in 1921 deeded from Clatsop County for use as a submarine and destroyer base; however, the base never became fully operational. Use was limited to the uplands area and some tidelands and was essentially dormant until dredging and filling began in 1939 for conversion to a NAS for seaplanes. This conversion required additional construction along the waterfront areas of eastern Cathlamet Bay. Between 1939 and 1941, the subtidal lands south of Tongue Point Island were hydraulically filled with sediment from offshore dredging operations. The hydrofilled area extended from Tongue Point Island south nearly to the mouth of Mill Creek and east to the shore of the Columbia River, creating a peninsula. Nearly all the hydraulically filled area was subsequently paved. Hydrofilling enlarged the NAS to approximately 550 acres. After additional property was deeded from Clatsop County to the United States, the former NAS encompassed approximately 840 acres. Activities at the NAS from 1946 to the end of 1961 included handling of electrical transformers, pesticide application, ship deactivation and reactivation, preservation of deactivated ships, and ship overhauls.

The landfill area was created by filling subtidal lands near the mouth of Mill Creek with sediment from offshore dredging operations. DoD operated the Landfill from 1941 until 1962 when the NAS was deactivated. Because of the diversity of industrial activities that operated at Tongue Point NAS, disposal of an assortment of solid and liquid wastes occurred at the Landfill. Wastes included construction debris and other solid wastes generated at the NAS. Waste materials associated with ship maintenance, repair,

and mothballing (e.g., waste oil, diesel fuel) have been observed in the Landfill as well as machine shop wastes, building and landscape demolition debris, various oils/paints/solvents, metals, wood waste, buried drums, car engines and frames, large appliances, crockery, wire, glass, and bricks.

In January 1962, the Navy deactivated the NAS facility, and the property was subsequently transferred to the General Services Administration that same year. The DoD-era activity is therefore considered to coincide with the Navy's active occupation of shore facilities from 1941 through 1962 as described above.

In 1971, a portion of the property was formally transferred to the U.S. Department of Labor. Subsequent property transfers included transfer of the southern portion of the former NAS to ODSL in 1980. This transfer included the former landfill area. The post-DoD activity at the Landfill included miscellaneous disposal activity by various local business enterprises consistent with the light industrial, marine, and wood products related activities of the local area.

The Landfill was subject to a series of investigations and limited remedial investigations (LRI), leading to an NTCRA, followed by development of an FFS. The investigations and studies were conducted per requirements of DERP and CERCLA. The process followed includes the CERCLA activities listed below.

- Remedial investigations related to the Landfill, 1992 to 2002
- Baseline risk assessment and EE/CA, 1999
- Action Memorandum, March 2003
- NTCRA design and construction, 2006
- NTCRA monitoring, maintenance, and operation of the LNAPL recovery system 2007 through 2017
- Post-NTCRA investigation of landfill aquatic area and risk assessment, 2008
- FFS for the Landfill, 2014 to 2016
- Proposed Plan and Public Meeting, 2018

To address risks related to the Landfill, USACE implemented the NTCRA in 2006/2007. The NTCRA included contaminated soil and sediment removal, construction of a barrier wall that encompasses the Landfill, construction of a landfill cover and associated landfill gas collection system and stormwater controls, and installation and operation of an LNAPL recovery and separation system. USACE completed a detailed investigation in 2008 and evaluated residual risk to human and ecological receptors after completion of the Landfill NTCRA. A protectiveness evaluation was completed as part of the FFS to evaluate the effectiveness of the Landfill NTCRA components to provide containment of contaminants.

The following subsections summarize the previous investigations and response action.

2.1 Summary of Previous Investigations, Risk Assessments, and Engineering Evaluations

Specific investigations and evaluations conducted at the Landfill by USACE Seattle District are summarized as follows:

- Tongue Point Landfill LRI (1992 to 1993). Eight sediment grab samples (S1 to S8) were collected in the intertidal region of the Landfill. In addition, seven groundwater monitoring wells and seven seeps near the Landfill were sampled and analyzed (USACE 1993a). This report includes documentation of a previous limited site investigation, performed by ODEQ in 1983, in which groundwater samples collected from a shallow well in the Landfill contained oil and grease, phenols, naphthalene, and polychlorinated biphenyls (PCBs) (USACE 1993a).

- Phase II Tongue Point Landfill LRI (1995 to 1998). Twenty "nearshore" surface sediment grab samples (SD-01 to SD-20) were collected from the shoreline area at the toe of the Landfill. Sixty surface sediment grab samples (FGS 101 to FGS 160) were collected from the nearshore, mudflats, and offshore areas adjacent to the Landfill. Additional work completed during this investigation included geophysical surveys; soil, soil vapor, and groundwater screening surveys; drilling of soil borings and installation of shallow and deep monitoring wells; installation of LNAPL monitoring wells; soil sampling and analysis; groundwater, seep, and LNAPL sampling and analysis; physical testing of soil and sediment samples; and aquifer testing (USACE 1999b). The Landfill LRI Report (USACE 1999b) concluded that contaminants and petroleum products are present in soils, groundwater, seeps, and sediments at the perimeter of the Landfill, and the primary sources of chemical releases are buried refuse and petroleum products. The data indicated a need to limit landfill impacts to Cathlamet Bay.

- Tongue Point Landfill EE/CA (1999). Additional data were collected, and evaluations conducted to complete an EE/CA and risk assessment (USACE 1999a). A summary of these evaluations and findings related to the risk assessment is presented in the FFS.

- Final Addenda to the Tongue Point Landfill LRI (USACE 2000–2002). Pre-design activities for the Landfill NTCRA were conducted to provide necessary information for the Phase I and Phase II design, including wetlands delineation, biological assessment, 404(b)(1) analysis, sediment report, geotechnical exploration, pilot pumping test, LNAPL evaluation, and investigation-derived waste management.

USACE evaluated the data collected during these investigations and completed a baseline risk evaluation for the Landfill. The primary sources of chemicals released at the Landfill are buried refuse and petroleum products. Metals, polyaromatic hydrocarbons (PAHs), total petroleum hydrocarbons (TPH), pesticides, PCBs, and dioxins/furans were identified as chemicals to be evaluated further based on the conservative risk-based toxicity screening performed. An EE/CA with risk assessments was prepared and evaluated alternatives to perform an NTCRA to address risks posed by the Landfill. Estimated human health risk for combined exposures was 7 in 1,000,000, which is within the United States Environmental Protection Agency (EPA) established acceptable excess cancer risk range of 1 in 10,000 to 1 in 1,000,000 over a person’s lifetime. The ecological risk assessment identified a potential threat to aquatic receptors adjacent to the Landfill from chemicals, such as PCBs and pesticides, in seep water and sediment.

2.2 Summary of Landfill NTCRA and Subsequent Modifications

Based on the results of the EE/CA (USACE 1999a), an NTCRA was performed at the Landfill. The objective of the Landfill NTCRA was to address risks identified in the human health and ecological risk assessments as presented in the EE/CA for the Landfill (USACE 1999a) and consisted of the activities listed below:

- Excavation of nearshore waste material and contaminated sediments
- Disposal of onsite waste and sediment
- Construction of a low-permeability subsurface barrier wall that encircles the Landfill and is keyed into low-permeability bedrock along most of its length, with exceptions described in Section 2.2.3
- Placement of an engineered landfill cover system, with consideration of future land use (potential future use includes light open space or light industrial use)
- Collection of LNAPL via collection trench, treatment via oil/water separation, disposal of oil off site, and discharge of separated water on site
- Restoration of nearshore area and placement of the habitat restoration features, including a post-construction biological survey completed in accordance with the biological opinion and approved by the National Marine Fisheries Service in January 2016
- Shoreline erosion protection repairs, fence line maintenance, and relocation of habitat restoration features completed in November 2016

The design and construction of the Landfill NTCRA was conducted in two phases. Phase I of the NTCRA consisted of constructing access and haul roads; installation of utilities, including water, electricity, and telephone; installation of three permanent survey benchmarks; landfill surface preparation for preloading by re-grading; consolidating waste material from clearing and grubbing and construction of LNAPL collection trench; installation of an interim LNAPL recovery and separation system; and staging of approximately 12,000 cubic yards of soil for landfill preloading and nearshore slope restoration under Phase II. The Phase I remedial action report stated that abandonment and protection of existing monitoring wells would be performed as part of Phase I construction (USACE 2003); however, these activities were deferred to Phase II construction (USACE 2008). The following subsections summarize details of Phase II of the Landfill NTCRA construction and subsequent modifications, including additional restoration and maintenance in 2016.

2.2.1 Erosion and Sediment Control and Construction Dewatering

A silt curtain was installed to control offsite and offshore soil and sediment transport that would result in undesirable turbidity, and sheet piling was installed to facilitate the nearshore slope excavation. A temporary water filtration and processing system was used for onsite treatment and disposal of potentially contaminated water generated during construction activities.

2.2.2 Contaminated Sediment and Soil Excavation and Backfill

The primary intent of the nearshore slope excavation (above 5 feet mean lower low water [MLLW]) was to replace the existing mixed soil and debris present in the landfill embankment with clean backfill to provide a stable bank for slurry trench construction on the east side of the Landfill. The quantity of nearshore slope area excavation was approximately 11,300 bank cubic yards.

Sediment excavation was conducted to remove contaminated sediments adjacent to and continuous with the Landfill and restore the nearshore area. The approach to the sediment excavation was to remove contaminated sediment that exceeded TPH concentrations (total diesel plus motor oil/lube oil) of 1,000 milligrams per kilogram (mg/kg) to the extent practicable, dewater the sediment, and place dewatered sediment within the Landfill. The threshold concentration of 1,000 mg/kg TPH for the sediment excavation limit was demonstrated to be a conservative cleanup goal for delineation of sediment remediation areas based on the results of a statistical evaluation that correlated landfill contaminant (PCBs, PAHs, and dioxins) concentrations in sediment with TPH concentrations in sediment (USACE 2004c). No confirmation sampling was performed in the excavated areas because the subtidal area was backfilled and generally inaccessible and because a risk assessment would be conducted after the Landfill NTCRA was completed to evaluate residual risk. In 2008, sediment adjacent to the Landfill was sampled as part of the 2008 Tongue Point Multi-Sites remedial investigation (TPMS RI) to document the post-NTCRA contaminant concentrations in sediment and determine the residual risks (See Section 7).

Approximately 19,600 cubic yards of sediment/soil was handled and ultimately incorporated into the waste layer of the Landfill (USACE 2008). Approximately 22,000 cubic yards of nearshore slope backfill and foundation soil were used for slope restoration. Nearshore sediment excavation areas and slope protection areas were backfilled and reinforced using quarried riprap. This nearshore sediment backfill was not subjected to contaminant testing because it was a quarried, rock/gravel-based product.

2.2.3 Barrier Wall

A soil-bentonite barrier wall was installed along the perimeter of the Landfill to contain contaminants inside the limits of the barrier wall and prevent them from migrating outside of the Landfill. The location and alignment of the barrier wall construction is shown on **Figure 2**. The total effective length is approximately 1,550 linear feet.

The barrier wall was designed as a continuous wall, with the top of the wall several feet above the expected groundwater elevations both inside and outside of the containment area and the bottom of the wall keyed into the low permeability siltstone of the Astoria Formation or basalt bedrock. The top of the barrier wall ranges from a maximum elevation of 13 feet MLLW along the west perimeter to a minimum elevation of 11 feet MLLW along the east perimeter adjacent to Cathlamet Bay.

The barrier wall was keyed into the siltstone or basalt a minimum distance of 1 foot, with a 1-foot margin of error (+/- 1 foot). However, observations made during barrier wall construction, confirmed by post-construction exploratory sonic borings, identified one section of the barrier where the barrier wall was not keyed into the Astoria Formation. Along this section, the barrier wall was constructed to a depth of approximately 60 feet bgs, and the top of the Astoria Formation ranged from 5 to 38.5 feet below the bottom of the wall. Although the barrier wall was not keyed into the Astoria Formation, the wall did penetrate a layer of siltstone above the Astoria Formation at a depth of approximately 55 feet bgs. Based on the fine-grained composition and laterally continuous distribution between borings, the siltstone layer is expected to restrict flow of groundwater under the barrier wall along the section of the wall that is not keyed into the Astoria Formation.

The section of the barrier wall adjacent to the shoreline of Cathlamet Bay and Mill Creek is protected from shoreline erosion by several construction elements. The top of the barrier wall is integrated with the landfill cover, which is comprised of multiple natural and synthetic protective layers that extend beyond the top of the barrier wall and are secured in an anchor trench. Construction details of the barrier wall and landfill cover integration are included in the FFS (USACE 2016)**.** Shoreline erosion by wave action is

also prevented by riprap layers and protective stone that USACE installed along the shoreline in 2011 and 2016. An offshore sheet pile wall, which was left in place and cut off at the mudline during the Landfill NTCRA, provides an additional element of protection from shoreline erosion. The combined protectiveness of the integrated landfill cap, protective layer of riprap, the landmass between the riprap and the barrier wall, and the offshore sheet pile wall is adequate to prevent shoreline erosion along the barrier wall. Regular inspections and maintenance of the riprap, which are part of the landfill operations and maintenance (O&M) plan, ensure that the protection remains in place.

2.2.4 Upgradient Interceptor Trench

An interceptor trench drainage system was installed on the upgradient side of the barrier wall (with respect to shallow groundwater flow direction) to mitigate groundwater mounding along the western alignment of the barrier. The 7-foot deep upgradient interceptor drain was constructed to an elevation about 3 to 5 feet below the top of the barrier wall. The drainage system consists of a slotted pipe embedded in drainage gravel and surrounded with a filter fabric. Water collected in the pipe for discharge includes groundwater from areas outside the barrier wall. Upgradient water collected in this drainage system is piped along the north and south ends of the Landfill and discharged to Cathlamet Bay via duckbill outfalls. These outfalls are situated along the shoreline in rip-rap armored north and south outfall channels. A low permeability soil was placed above the drain gravel to limit surface water seepage into the upgradient interceptor drainage trench (UGIDT) system.

During trench excavation, contaminated soil was discovered in a relatively localized area outside the west portion of the barrier wall. Exploratory excavation resulted in removal of the petroleum contaminated soils. The contaminated soils were incorporated into the waste layer of the Landfill before construction of the Landfill cover system. Analytical results for confirmation samples document that contamination in this location was effectively excavated. The trench excavation was backfilled.

Samples of water discharging from the two outfalls of the UGIDT were collected over multiple sampling events, and the discharge sampling results are presented in the landfill protectiveness evaluation (LPE), Appendix C of the FFS (USACE 2016). The quality of the discharge water was evaluated and found to be consistent with the water quality in the upgradient or background well MW13S.

The UGIDT, constructed as part of the NTCRA to mitigate potential effects of groundwater mounding along the northwestern alignment of the barrier wall remains in place. The UGIDT will continue to function passively and be inspected and maintained.

2.2.5 Gas Collection System

A landfill gas collection system, installed to minimize buildup of landfill gas, includes two major components, an upper and lower set of gas collection piping. Each section utilizes a series of horizontal trenches containing perforated collection pipes and gravel (USACE 2004c).

The lower section of the gas collection system was installed in the LNAPL collection trench. It consists of a 4-inch-diameter perforated gas collection pipe at the top of the trench's drain rock throughout its entire length. The upper section consists of a series of shallow trenches located approximately 1 foot below the geomembrane surface, which is about 3 feet below the topsoil surface. Strips of 3-foot-wide pervious synthetic materials (gas collection geocomposite) were placed at 30-foot centers across the landfill surface beneath the geomembrane foundation layer. The gas collection geocomposite provides a path for gas accumulating near the geomembrane surface to reach the upper gas collection system to more

efficiently vent the gas to the atmosphere. The combined length of the upper gas collection system is approximately 1,200 feet long. The trench for the upper section was backfilled with vent gravel.

The discharge from the upper gas collection system is released passively to atmosphere from four vent points. The discharge from the lower gas collection system is released passively to atmosphere from two vent points and through LNAPL collection sumps. The basis of design estimated a maximum of 4.0 million cubic feet of annual landfill gas production; the discharge in each vent should be less than 2 cubic feet per minute. The four upper and two lower gas vents are connected to the upper and lower gas collection system piping, respectively, through a riser casing in the geomembrane. Penetrations through the geomembrane consist of a 6-inch high-density polyethylene (HDPE) riser casing, which is factory welded to a 300-mil HDPE geomembrane plate. A concrete support monument was installed to minimize stresses on the geomembrane surface-by-surface forces such as wind loading. The LNAPL recovery and separation system building includes a passive gas venting riser pipe. To promote mixing of venting landfill gas with ambient air, the venting riser pipe was extended to a height of 7.5 feet above the landfill surface and equipped with passive turbine ventilators.

2.2.6 LNAPL Recovery and Separation System

The Landfill NTCRA involved the installation of an LNAPL recovery and separation system, including interconnected trenches, five separate recharge trenches, five collection sumps, and four observation sumps.

The LNAPL recovery and separation system consisted of a high-permeability sand- and gravel-filled trench in the areas where LNAPL thicknesses historically had been measured in wells. These areas correspond to the central portion of the Landfill. LNAPL was collected from the trench using four sumps.

LNAPL was separated from the water in a separation plant and transferred to a storage tank for offsite disposal. The separated water was transferred back for infiltration via five recharge trenches without treatment for dissolved-phase constituents. A distribution vault on the landfill surface allowed the operator to direct the flow toward a combination of the five recharge trenches. Piping consists of 2-inch-diameter secondarily contained (double-walled) HDPE outside the barrier wall or above the geomembrane. The piping transitions through the geomembrane with a booted tee to provide access for pipe cleanout.

Before operation of the LNAPL recovery and separation system, the estimated volume of LNAPL present at the Landfill was 45,000 gallons (USACE 2004c). The system was started in 2007, and the operational lifetime, which was defined as the period required to recover 9,000 to 13,500 gallons of LNAPL, was anticipated to be less than 10 years based on recovery rates estimated during the design (USACE 2004c). The LNAPL collection and recharge system recovered 1,270 gallons of LNAPL between 2007 and 2017.

The LNAPL recovery and separation system was shut down, disassembled, removed, steam cleaned, and components placed in long-term extended lay-up in July 2017.

2.2.7 Well Installation

Twelve shallow observation wells (OWs) from 17.5 to 18.5 feet bgs were installed along with four deep wells from 48.5 to 62.5 feet bgs. Eight shallow monitoring wells were installed inside the barrier wall to monitor groundwater levels inside the Landfill. Four shallow monitoring wells were installed outside of the barrier wall to monitor for potential migration of LNAPL or dissolved contaminants past the barrier wall. Four deep monitoring wells were installed inside the barrier wall to evaluate vertical gradients and

potential migration of landfill contaminants in groundwater. These deep monitoring wells were installed in the area where the barrier wall was not keyed into the Astoria Formation to monitor for potential migration of contaminants down and around the bottom of the barrier wall. The well locations are shown on **Figure 2**.

2.2.8 Cover System

The Landfill NTCRA involved installation of a landfill cover system that includes the following components:

- Foundation soil
- Geomembrane and geocomposite
- Subdrain system
- Cover soil
- Topsoil
- Surface water runoff control elements (with geosynthetic clay liner base)
- Roads for perimeter access and crown access
- Permanent chain link fence

Following installation of the geomembrane and geocomposite liner system over foundation soil, the cover subdrain system was installed to direct precipitation that infiltrates the topsoil and cover soil layers to the outfalls. With completion of the subdrain system and initial backfill with cover soil, a geosynthetic clay liner was used to line the bottom of the perimeter drainage ditch. One foot of compacted cover soil, finely crushed, ground, rock, or stone (quarry-based) material was installed above the completed geomembrane and geocomposite liner system. Six inches of compacted topsoil was installed above the completed cover soil layer.

A total of 2,581 cubic yards of the source material was imported and blended at about a 2:1 ratio with the cover soil material. Seeding of the landfill cover and planting of woody species in the riparian zone (along the water line below perimeter access road) occurred once the topsoil layer was complete. Finally, the perimeter and crown access roads and the permanent chain link fence completed the cover system. In November 2016, the shoreline erosion protection was enhanced, and near-shore habitat restoration structures were re-installed and secured in place.

2.2.9 Site Restoration

Stream restoration along Mill Creek and its confluence with Cathlamet Bay included placement of boulders, specific gravel products, logs, and root wads to restore the shoreline and rehabilitate fish habitat after the nearshore sediment and slope excavation/restoration work was completed. Concurrent with the stream restoration work, emergent marsh soil was backfilled, and wetland-specific flora species were planted in the nearshore sediment and slope excavation/restoration areas. Near-shore habitat restoration structures were installed.

3. Community Participation

The Proposed Plan (PP) for the Landfill was made available to the public on March 27, 2018 as part of the Administrative Record file. Copies of the Administrative Record file reside at the USACE Kansas City District office and in the repository at the Astoria Public Library. Selected documents are available online for review at: http://www.nwk.usace.army.mil/Missions/Environmental/Environmental-

Projects/Former-Tongue-Point-Naval-Air-Station/. The notice of the availability of the PP and the date of the public meeting were published in the March 23rd, 26th, and 27th, 2018 editions of *The Daily Astorian* newspaper. A public comment period was held from March 27 through April 27, 2018, and the public meeting to present the plan was held on April 11, 2018 at the Astoria Public Library. The public was encouraged to participate in the decision-making process by providing comments on the PP and attending the public meeting. Representatives from USACE and ODEQ were present at the meeting. In addition, USACE provided a summary presentation of the background and preferred alternative to the State of Oregon and distributed copies of the PP to local and regional Native American tribes and associated organizations. Pertinent documents supporting the decision, including the investigations and studies mentioned in Section 2, are available as part of the Administrative Record file for public viewing at the public information repository at the Astoria Public Library located at 450 10th Street, Astoria, Oregon. Public comments and USACE's responses are provided in the Responsiveness Summary, Part 3, of this DD.

4. Scope and Role of Response Actions

Investigation and cleanup decision activities at the Tongue Point NAS were conducted with the authorities of DERP for FUDS and are consistent with CERCLA, as amended, and the NCP. The Landfill was subject to a series of investigations and an NTCRA. In a post-removal risk assessment, USACE found no unacceptable risk in post-NTCRA conditions for soil, groundwater, landfill gas, sediment, surface water, or aquatic biota attributable to past DoD practices at the Landfill, the subject of this DD.

This Landfill DD presents the final action to address potentially unacceptable future risks to human health and the environment remaining at this site after implementation of the Landfill NTCRA. This action would be the last action for HTRW projects at the Tongue Point NAS.

5. Site Characteristics

This section summarizes the physical characteristics of the Tongue Point NAS project area, including the nature and extent of chemicals associated with the Landfill.

5.1 Landfill Conceptual Site Model

The conceptual site model (CSM) for the Landfill after completion of the 2007 removal action is shown on **Figure 3**. The CSM provides a summary of contaminant source locations, how contaminants will migrate, and where they will migrate. Landfill waste, LNAPL, and contaminated soil and groundwater are the primary sources of contamination at the Tongue Point Landfill. Before the removal action, the following contaminant transport pathways existed at the Tongue Point Landfill:

- Infiltration of precipitation and leaching of contaminants from buried landfill waste to shallow groundwater
- Transport of LNAPL, leachate, and shallow groundwater from the Landfill through seeps to Mill Creek and Cathlamet Bay that affected surface water, sediment, and fish/shellfish
- Erosion of contaminated soil and overland runoff to Mill Creek and Cathlamet Bay affecting surface water and sediment
- Aerial transport of contaminants from surface soil through wind and/or volatilization

The migration of contamination to deeper groundwater and potential drinking water sources was not a complete exposure pathway at the Tongue Point Landfill (USACE 1999a). The primary receptors of concern before the removal action were recreational visitors/trespassers.

The 2007 Landfill removal action was implemented to address all complete contaminant transport pathways discussed above. The removal action components providing containment are shown on **Figure 3** and consist of a landfill cover, barrier wall, and a landfill gas collection system. The landfill cover was constructed to prevent human and ecological receptors from being exposed to landfill contents, prevent stormwater contact with the waste, and prevent precipitation from infiltrating the landfill waste and leaching contaminants. The landfill cover consists of an impermeable geomembrane, soil cover, and a stormwater collection system. The barrier wall was constructed to contain LNAPL, leachate, and groundwater within the Landfill. The barrier wall extends from above the seasonal high groundwater level to the top of the Astoria Formation or into low permeability siltstone. The barrier wall comprises a mixture of bentonite clay and soil designed to control LNAPL and dissolved contaminant migration through a reduction in hydraulic conductivity and the increased adsorption of metals and organic contaminants onto the clay and organic matter of the soil-bentonite wall. As shown on **Figure 3**, the barrier wall completely encircles the Landfill to provide containment and prevent migration of LNAPL, leachate, or contaminated groundwater to surface water of Mill Creek and Cathlamet Bay. The landfill gas collection system controls the migration of landfill gas within the Landfill and vents it at controlled locations via vents located on the crown of the Landfill.

Post-removal action monitoring was conducted to verify that the landfill removal action components were successful in providing containment of contaminant sources and preventing complete contaminant exposure pathways. The post-removal action monitoring included:

- Groundwater elevation monitoring at wells located inside and outside the barrier wall.
- Tidal studies to monitor the groundwater elevation response to tidal fluctuations of Cathlamet Bay at monitoring wells located inside and outside of the barrier wall.
- Groundwater sampling at shallow and deep monitoring wells located inside the barrier wall and shallow monitoring wells located outside the barrier wall sampled in 2008, 2010, 2011 and 2013.
- Landfill gas monitoring.

Sediment excavated during the Landfill NTCRA in 2006/2007 mitigated the human health and ecological risks that were identified in the 1999 EE/CA. In 2008, sediment was sampled as part of the 2008 TPMS RI to document the post-NTCRA contaminant concentrations in sediment and determine the residual risks. The Near Landfill Aquatic Decision Unit sediment sample area overlapped the footprint of the pre-removal sediment sample locations that cover the nearshore, mudflat, and offshore sediment areas that were evaluated in the 1999 EE/CA. Therefore, the sediment dataset from the Near Landfill Aquatic Unit that was used in the TPMS RI and risk assessment is appropriate for determining the residual risks in the 2006/2007 sediment removal area at the Landfill.

Because the near landfill aquatic area is a depositional environment from the Columbia River, multiple sources contribute to contamination of sediment, surface water, and biota near the Landfill. Post-removal sediment characterization detected TPH diesel and oil-range organics, PAHs, total dichloro-diphenyl-trichloroethane (DDT), and metals. Post-removal surface water characterization detected PAHs, lindane, and inorganic constituents in surface water. Chemicals that bioaccumulate, including DDT,

dioxins/furans, and some inorganic constituents, were reported in fish and shellfish. Chemical concentrations found in surface water, sediment, and biota near the Landfill are generally comparable to concentrations found in the upgradient reference area. Therefore, the presence of these chemicals is unlikely to be related to previous DoD activities in the area. They may be attributable to other upstream source areas because the Columbia River receives surface water runoff and stormwater discharge from various industrial and agricultural areas upstream. A detailed description of the fate and transport of contaminants at the Landfill is provided in the LPE (Appendix C of the FFS [USACE 2016]).

As presented in the FFS, the post-removal receptor of primary concern was evaluated as the maintenance worker because potentially complete exposure pathways to landfill gas for these receptors are different than for recreational visitors/trespassers. However, exposure to toxic air contaminants in landfill gas is not expected to be significant for maintenance workers at the Tongue Point Landfill for several reasons. First, based on pre-removal soil gas data, concentrations of gases in ambient air emanating from the vents are not expected to exceed acute or chronic regulatory levels for workers. Second, the post removal evaluation included gas samples collected from the sample ports on the six passive vents on September 21, 2015 and April 18, 2016, analyzed for VOCs, and evaluated in the Landfill FFS. The conclusion was that the site workers would not be exposed to unacceptable risks. In addition, maintenance workers are not expected to spend a significant amount of time on the landfill surface or near the landfill vents.

The results of the post-removal action monitoring and an evaluation of the data presented in the FFS report indicate that the landfill cover system and barrier wall are effectively containing contamination and preventing a complete pathway to the Mill Creek and Cathlamet Bay surface water, sediment, and aquatic receptors (USACE 2016).

5.2 Geology and Hydrogeology

The following subsections provide summaries of geological and hydrogeological information documented in the TPMS RI report (USACE 2012b), the *Draft Tongue Point Landfill Observation Well Installation and Rotosonic Exploration Phase II Tongue Point Landfill Remedial Action* (USACE 2007), and the Tongue Point Landfill LRI (USACE 1999b).

5.2.1 Geologic Setting

Tongue Point is in the Astoria structural basin (Astoria Basin) within the Coast Range physiographic province. The bedrock within the Astoria Basin consists of Miocene marine deposits of the Astoria Formation. The lithology of this formation comprises primarily fossiliferous siltstone and claystone (USACE 1993a). The Astoria Formation is estimated to be 2,000 feet thick near the TPMS Study Area (USACE 1999a). Columbia River flood basalts, of similar age to the Astoria Formation, are present in the vicinity. An outcrop of Columbia River basalt creates the prominent “point” of Tongue Point. Recent alluvium consisting of floodplain and estuarine deposits of the Columbia River and tributaries is present throughout the Astoria Basin. The alluvium comprises clay, silt, sand, and gravel (Walsh 1987).

An inactive fault is mapped in the vicinity with a northeast-trend located along the drainage course of Mill Creek (Walsh 1987).

5.2.2 Tongue Point Geology and Hydrogeology

Geology and hydrogeology specific to the Landfill are presented in the following subsections.

Stratigraphy

The general stratigraphy at the Tongue Point NAS is fill, overlying alluvium, overlying either siltstone of the Astoria Formation or basalt of the Columbia River Basalt Group. Fill includes hydraulically placed fill, solid waste and debris associated with the Landfill, and landfill cover system materials.

Fill thickness ranges from 10 to 32 feet and consists of landfill cover system foundation soil underlain by landfill waste and hydraulic fill. The landfill cover system foundation soil ranges in thickness from 2 to 6 feet and is comprised of yellow-orange silty sand. The underlying landfill waste is 15 to 20 feet thick and comprised of silt, sand, gravel, wood, glass, concrete, and metal materials. The hydraulic fill layer ranges from 3 to 25 feet in thickness and is comprised of brown and gray, fine- to medium-grained sand with silt (USACE 2007).

The alluvium underlying the fill ranges in thickness from 15 to 45 feet and consists of gray, silty sand, and silt with organic materials and occasional gravel. Friable, brown, siltstone (interpreted as the Astoria Formation) is present below the alluvium and the silty gravel unit.

The stratigraphy at the Landfill was presented in the *Draft Tongue Point Landfill Observation Well Installation and Rotosonic Exploration Report* (USACE 2007) and summarized in the FFS (USACE 2016). The geological cross sections for the Landfill and the construction as-built figures of the barrier wall are presented in the FFS (USACE 2016). The cross sections, used unaltered from the rotosonic report (USACE 2007), depict stratigraphy along the soil-bentonite barrier wall encircling the Landfill based on soil borings advanced before and after construction of the wall.

Hydrogeology

Groundwater occurs under unconfined conditions within fill and alluvium at the Landfill. The low permeability siltstone and claystone of the Astoria Formation functions as a lower confining layer, limiting groundwater migration from the alluvial groundwater system to deeper groundwater aquifers.

Hydraulic properties of soil in the Landfill were evaluated as part of the *Tongue Point Landfill LRI* (USACE 1999b) and during post-cap and barrier wall construction testing (USACE 2007) through laboratory soil permeability tests and slug tests. Results indicate that hydraulic conductivity was highest in the matrix-supported gravel that is present at the base of the alluvium. The Astoria Formation siltstone and claystone have low permeability, as determined by laboratory permeability testing (USACE 1999b). While permeability values determined by laboratory permeability tests are different from hydraulic conductivity values calculated from field slug tests, both parameters provide an estimate on the ability of groundwater to migrate through the subsurface.

Groundwater Occurrence and Hydraulic Gradients

Groundwater elevations at the Landfill are strongly influenced by the presence of the barrier wall, the UGIDT, the landfill cover system, and past operation of the LNAPL recovery and separation system.

The February 2012 groundwater elevation contour map presented as Figure 2-5 in the FFS (USACE 2016) represents static conditions after groundwater levels equilibrated following shutdown of the LNAPL recovery and separation system. The June 2012 contour maps map presented as Figure 2-6 in the FFS (USACE 2016) reflect operational conditions when the groundwater levels inside the barrier wall are affected by groundwater extraction and reinjection processes related to the LNAPL recovery and separation system. The groundwater elevation contours indicate a relatively flat gradient inside the barrier wall during static conditions. During operational conditions, the horizontal gradient inside the barrier wall

is directed toward the south. The data also indicate that during both static and operational conditions, the groundwater elevations inside the barrier wall are depressed 1 to 2 feet relative to groundwater levels outside the barrier wall. Outside of the barrier wall, the horizontal gradient is directly to the south along the west side of the Landfill and toward the southeast along the south and east sides of the Landfill. The horizontal gradient is steepest on the east side of the Landfill, adjacent to Cathlamet Bay.

Vertical gradients at the Landfill were evaluated in *Draft Tongue Point Landfill Observation Well Installation and Rotosonic Exploration Report* (USACE 2007) by calculating the vertical hydraulic gradient between shallow and deeper alluvial well pairs located inside the barrier wall. A downward vertical gradient was observed at each well pair throughout the period evaluated (September 2006 through February 2007), except for one upward vertical gradient observation. The magnitude of the downward vertical gradient ranged from -0.01 to -0.048.

Tidal Effects and Groundwater Discharge to Surface Water

To evaluate the hydraulic connectivity between groundwater inside and outside the barrier wall, USACE conducted a tidal survey in September 2008 (USACE 2009). A subsequent tidal survey was conducted in November 2014 (USACE 2015). The results of this tidal survey are presented in a technical memorandum, which was prepared by USACE and is presented in Appendix B of the FFS of the Administrative Record (USACE 2016). The tidal surveys were conducted using pressure transducers to monitor piezometric head throughout the tidal cycle at monitoring wells located inside and outside the barrier wall and comparing the piezometric head response to changes in tide level.

Resulting hydrographs presented in the FFS (USACE 2016) show the piezometric head observed in the groundwater monitoring wells and at the local tidal monitoring station (National Oceanic and Atmospheric Administration [NOAA] gauge at the Tongue Point U.S. Coast Guard Station). The FFS (USACE 2016) presents a full discussion of the tidal fluctuations and groundwater discharge based on evaluation of the data.

A comparison of the hydrographs indicates a consistent piezometric response at the shallow and deep monitoring wells located inside the barrier wall during the 2008 and 2014 tidal surveys. In summary, the piezometric head response to tidal fluctuations at shallow wells inside the barrier wall is more than 50 times lower than the piezometric response at nearby wells located outside of the barrier wall, indicating the barrier wall is effective at limiting shallow groundwater flow in and out of the Landfill. In addition, groundwater discharge calculations presented in Appendix C of the FFS (USACE 2016) do not indicate significant movement of groundwater from the deep alluvium within the barrier wall to Cathlamet Bay.

As shown on Figures 2-5 and 2-6 of the FFS (USACE 2016), the UGIDT is present along the west and south sides of the Landfill, exterior to the barrier wall. The UGIDT was installed to minimize potential mounding of groundwater on the upgradient side of the barrier wall. Groundwater collected in the UGIDT is conveyed in a pipe to two outfalls located on the banks of Cathlamet Bay, west and northwest of the Landfill. The groundwater is discharged through “duckbill” style outlet (check) valves at each outfall. Groundwater discharges during all seasons, except summer (USACE 2012e).

Surface Water Hydrology

The Columbia River is the primary surface water feature at the Tongue Point NAS. Tongue Point protrudes into the Columbia River approximately 1.2 miles upstream of the mouth of the Columbia River in Cathlamet Bay, which is considered a lower energy slack water environment (USACE 2000). The Columbia River is influenced by tidal fluctuations and the release schedule of upstream Bonneville Dam.

The magnitude of the tidal fluctuation at the Tongue Point NAS is 7 to 8 feet based on tidal information from the NOAA gauge at the Tongue Point U.S. Coast Guard Station (USACE 2000).

Mill Creek discharges to Cathlamet Bay just south of the Landfill and provides drainage for the upland areas southwest of the Landfill (**Figure 1**). Stormwater runoff at Tongue Point NAS flows into stormwater inlets and is conveyed via storm drains to discharge points at the edge of the Columbia River. An unlined drainage ditch runs along the west and southern sides of the Landfill and provides drainage for upland areas and the western portion of the Tongue Point NAS. The drainage ditch discharges to Mill Creek.

5.3 Nature and Extent of Contamination

This section presents a summary of the nature and extent of contamination within the Landfill based on previous investigations. Nearshore sediment and surface water data collected in 2008, following the Landfill NTCRA, are presented in the TPMS RI (USACE 2012b), but only data related to contaminated media within the Landfill are presented in this section.

5.3.1 Soil and/or Landfill Waste

Waste materials present in the Landfill are associated with ship maintenance, repair, and mothballing and include, but are not limited to, waste oil, diesel fuel, and sludge removed from mothballed ships. Additional waste was placed in the Landfill, including machine shop wastes; building and landscape demolition debris; various oils, paints, and solvents; metals; wood waste; and other types of solid waste (USACE 1999b). In addition, the Landfill contains waste such as buried drums, car engines and frames, large appliances, dinner plates and cups, wire, glass, bricks, wood, wood chips, and mulch. An estimated 19,600 cubic yards of potentially contaminated sediment and soil were handled and ultimately incorporated into the waste layer of the Landfill (USACE 2008) during the NTCRA. The landfill surface area is 2.5 acres, and the depth of soil and/or landfill waste varies from 5 to 30 feet bgs along the barrier wall.

5.3.2 Groundwater/Leachate at the Landfill

Groundwater monitoring was performed at OWs installed during the Landfill NTCRA. The objective of the groundwater monitoring was to obtain data through regularly scheduled groundwater sampling and analysis events to ensure functionality of the Landfill cover system and barrier wall. As a result of the change in site conditions after the Landfill NTCRA, data post-2006 (except for LNAPL characterization) were used to address the nature and extent discussion below.

During four groundwater monitoring investigations (September 2008 [USACE 2012d], March 2010 [USACE 2012c], August 2011 [USACE 2012a], and August 2013 [USACE 2013]), groundwater was sampled and analyzed consistently for metals and PCBs. TPH (Northwest Total Petroleum Hydrocarbon Analytical Methods) was sampled during the first three rounds. Explosives (Method 8330A) were sampled in 2008, and VOCs (Method 8260C) were sampled in August 2011 and August 2013. Pesticides (Method 8081B) were sampled only in August 2013.

General water quality parameters, including temperature, pH, specific conductance, dissolved oxygen, oxidation reduction potential, turbidity, and ferrous iron, were measured during each groundwater sampling event. Groundwater outside the barrier wall and adjacent to Cathlamet Bay had low specific conductance, with values ranging from 0.17 to 0.86 mill siemens per centimeter at wells OW-6 through OW-9 during the August 2013 sampling event (USACE 2014). These low specific conductance values indicate that groundwater outside the barrier wall has a low total dissolved solids (TDS) concentration,

well below the 10,000 milligrams per liter (mg/L) TDS limit that EPA uses to designate non-potable groundwater (Class III).

Tables 3-3 through 3-6 in the LPE (Appendix C of the FFS [USACE 2016]) summarize the data from these groundwater sampling events, and a comparison was made to federal maximum contaminant levels (MCLs) per Chapter 40 of CFR Part 141, state MCLs per Oregon Administrative Rules 333-061-0030, and treatment technique action levels (lead and copper) per 40 CFR Part 141. The tables also present background concentrations as established in the TPMS RI (USACE 2012c). Results for the dissolved-phase groundwater contaminants are summarized below.

Arsenic

Results from groundwater samples collected from wells inside the barrier wall generally ranged from non-detect to 7 micrograms per liter (µg/L) for arsenic, except for STOW-2D that had detected concentrations of arsenic ranging from 46.5 to 62 µg/L and OW-2 at 17.6 µg/L in August 2013. These observation wells exceeded the groundwater MCL of 10 µg/L. Both wells were screened near a light grey siltstone layer that may be a volcanic ash deposit. This localized volcanic ash may be a contributor to the increased concentrations of arsenic at these groundwater sample locations.

Results from groundwater samples collected from wells outside of the barrier wall were below the groundwater MCL and have ranged from 0.2 to 1.3 µg/L. These results are relatively consistent with the reference value of <1.0 µg/L, as established in the TPMS RI (USACE 2012b).

Copper

Concentrations of copper in groundwater within the barrier wall ranged from 0.5 to 1,300 µg/L. The 1,300 µg/L detection occurred at well OW-3 in 2008. This concentration is equal to the groundwater screening criteria. Since 2008, the concentrations of copper at OW-3 have been below the groundwater screening criteria. The concentration of 19.3 µg/L occurred in March 2010 at OW-6, which is located outside of the barrier wall but adjacent to OW-3. The groundwater screening criteria used in this comparison was the treatment technique action level for copper per 40 CFR Part 141. Except for the isolated groundwater exceedance at OW-3 in September 2008, all other results for copper were low. At OW-3, the copper concentration in September 2008 was 1,300 µg/L and in August 2013 was 52.8 µg/L; it appears this isolated copper concentration exceedance has dissipated over time.

Lead

Concentrations of lead in groundwater within the barrier wall exceeded the groundwater screening criteria of 15 µg/L at wells OW-3, OW-4, OW-5, OW-5D, and STOW-2 based on samples collected in September 2008, March 2010, August 2011, and August 2013. Lead concentrations exceeding the groundwater screening criteria at these wells ranged from 16 µg/L at OW-4 to 510 µg/L at OW-3. Concentrations of lead in groundwater outside of the barrier wall were below the groundwater screening criteria and have ranged from non-detect (0.5U) to 3 µg/L. During the most recent round of sampling in August 2013, lead was not detected above 0.4 µg/L at wells located outside of the barrier wall. The groundwater screening criteria used in this comparison was the treatment technique action level for lead per 40 CFR Part 141.

PCBs

Concentrations of total PCBs in groundwater within the barrier wall exceeded the groundwater MCL of 0.5 µg/L at wells OW-3, OW-4, and STOW-2 based on samples collected in September 2008, March 2010, August 2010, and August 2013. Total PCB concentrations exceeding the groundwater MCL at

these wells ranged from 3.1 µg/L at STOW-2 to 162 µg/L at OW-4. Concentrations of total PCBs in groundwater outside of the barrier wall were non-detect (0.01U µg/L) during the September 2008 and March 2010 sampling events. In August 2013, total PCBs were non-detect at all wells outside the barrier wall, except for well OW-7 that had a total PCB concentration of 0.031 µg/L.

TPH

Petroleum hydrocarbon analysis is included in post-construction groundwater monitoring because it is a marker for LNAPL and may be a carrier for other substances such as PAHs and PCBs (USACE 2004a). Based on observations noted in the sampling investigation reports (USACE 2012a, USACE 2012c, and 2012d), petroleum odor or product was observed in observation wells STOW-2D (yellow tint to water with petroleum odor), OW-3D (yellow tint to water with slight petroleum odor), OW-4 (with free product visible), and OW-4D (yellow tint to water with petroleum odor). TPH was not sampled in August 2013.

- Diesel Range TPH: Diesel range TPH was reported from non-detect (0.25U mg/L) to 200 mg/L from wells inside the barrier wall. The well inside the barrier wall with the highest concentration of diesel range TPH is OW-4. In September 2008, the concentration was lowest at 22 mg/L. The concentration increased to 100 mg/L in March 2010 then to 200 mg/L in August 2011. Diesel range TPH was reported from non-detect (0.25U mg/L) to 0.63 mg/L from wells outside the barrier wall.

- Motor Oil Range TPH: Motor oil range TPH was reported from non-detect (0.2U mg/L) to 140 mg/L from wells inside the barrier wall. Similar to the trend for the diesel range TPH at OW-4, the concentration of motor oil range TPH was lowest at 18 mg/L in September 2008. The concentration increased to 69 mg/L in March 2010 then to 140 mg/L in August 2011. Wells outside the barrier wall were all non-detect.

- Gasoline Range TPH: Gasoline range TPH was only sampled in August 2011 and was detected only at well OW-4 (1.1 mg/L). All other samples from both inside the barrier well and outside the barrier wall were non-detect.

Explosives, Pesticides, and VOCs

Explosives (Method 8330A) were sampled in 2008 (with only detection of 1,3-Dinitrobenzene ranging from 0.18JB to 1.4JB µg/L) and were discontinued from the sampling program in later years. Pesticides (Method 8081B) were sampled from wells outside the barrier wall in August 2013 and were all non-detect. VOCs (Method 8260C) were sampled in August 2011 and were all non-detect, except for vinyl chloride that ranged in detection from 0.043 to 0.047 µg/L for both wells inside the barrier wall and outside the barrier wall. The federal and state MCL for vinyl chloride is 2 µg/L.

LNAPL

Characterization of LNAPL was conducted as part of the LRI (USACE 1999a). LNAPL was observed in shallow groundwater wells and Geoprobe wells throughout the Landfill. Locations were downgradient (southeast) of an identified sludge burning tank and associated pipelines. In addition, LNAPL was observed at one seep location. During the initial LNAPL characterization, the measured LNAPL thickness ranged from a sheen to approximately 2 inches (USACE 1999a). However, measured LNAPL thickness in isolated areas occasionally exceeded 24 inches. LNAPL thickness measurements were collected infrequently; however, data indicate LNAPL may be adsorbed to vadose zone soils, present as residual stranded product below the mean water table or forming a measurable and mobile layer on the groundwater in several areas of the Landfill.

Petroleum products, such as oil and fuel, are characterized as LNAPL. They are immiscible with water and less dense; therefore, they tend to float on top of groundwater. Waste oils and waste fuels may contain components of other organic materials such as solvents, PCBs, pesticides, dioxin/furans, and metals. Though the dioxin/furans originally may not have been components of the waste material, dioxin/furans may have been produced from burning of this material that contained chlorinated compounds (e.g., PCBs).

Few samples collected from the landfill area show impact from single activities or processes; most samples show mixtures of TPH types (USACE 1999a). TPH types identified include:

- Mineral spirits (paint thinner)
- Diesel #2
- Oil-based paint
- Medium weight lubricating oil or hydraulic fluid
- Heavy weight lubricating oil

In general, a mixture of diesel #2 and medium weight lubricating oil was observed in groundwater/leachate samples (USACE 1999a). Based on the chemical analysis results, LNAPL appears to be the source of and the carrier for the major contaminants observed in groundwater. However, review of TPH chromatograms along with other chemical data did reveal some probable sources of the mixtures. In general, PCBs were observed in samples that also contained the medium weight lubricating oil or hydraulic fluid TPH; however, this TPH mixture was not identified as transformer dielectric oil, a known source of PCBs (USACE 1999a). Commercial products containing Aroclors 1254 and 1260 include hydraulic fluids, plastics, and dust-control agents. A second TPH mixture of the medium weight lubricating oil or hydraulic fluid contained bis(2-ethylhexyl) phthalate (USACE 1999a). Phthalates also were observed in samples that contained the oil-based paint TPH mixture. A third TPH mixture of the medium weight lubricating oil or hydraulic fluid contained the pesticides 4,4'- dichloro-diphenyl-dichloroethylene (DDE) and 4,4'- dichloro-diphenyl-dichloroethane (DDD), suggesting this mixture may have been used as a carrier for the application of these two pesticides (USACE 1999a). DDT was occasionally observed but not necessarily in association with DDE and DDD, suggesting DDE and DDD were not derived from the in-situ breakdown of DDT. Diesel fuel was observed in some samples without any other organic chemicals (e.g., PCBs or phthalates).

Samples of waste oil were collected from the LNAPL recovery and separation system for profiling the waste oil for disposal. The samples were analyzed for PCBs and other waste acceptance criteria analyses. Results from testing in 2012 indicated that the waste oil had a total PCB concentration of 77 parts per million (ppm), which was greater than the specified total PCB concentration of 50 ppm limit, requiring the waste to be handled as Toxic Substances Control Act (TSCA)-regulated material (USACE 2012e).

6. Current and Future Land and Water Use

This section summarizes the current and reasonably likely future land and water use at the Landfill.

6.1 Current and Reasonably Likely Future Land Use

The Tongue Point project area is an inactive facility with regard to DoD activities; however, several subsequent owners and tenants used the former Tongue Point NAS for a variety of governmental,

commercial, marine industrial, and educational uses as shown on **Figure 1**. Access to the Tongue Point project area is controlled with perimeter security fencing and locked gates. The southern portion of the Tongue Point project area, where the Landfill is located, is owned by ODSL. This area is zoned S1, Marine Industrial Shorelands, by the City of Astoria. There are no residents living in the area of the Landfill.

The existing and foreseeable future land use is expected to remain industrial based upon land ownership by ODSL for the Landfill. In addition, the adjacent property (owned by Hyak Tongue Point LLC) has an industrial land use. The existing and foreseeable future land use of nearshore areas is assumed to be recreational; this is based on the presence of the Lewis and Clark National Wildlife Refuge.

6.2 Current and Reasonably Likely Future Water Use

Groundwater is not currently being used for beneficial use at Tongue Point or within the locality of the Landfill. In addition, there are no plans to develop groundwater at Tongue Point in the foreseeable future because the City of Astoria and John Day Water District provide drinking water to the Tongue Point vicinity. Given the generally wet climate in Astoria and the availability of publicly supplied water, human use of groundwater for drinking water, irrigation, livestock, and industrial and engineering use is not considered reasonably likely in the future. As a result, the current and reasonably likely future beneficial use of groundwater at Tongue Point is surface water recharge.

Key designated beneficial water uses for the Columbia River include domestic water supply (with consideration of treatment) and supporting fish and wildlife. Because of the potential or actual connection between groundwater within the shallow alluvial aquifer and surface water at the Tongue Point site, the beneficial use of groundwater is considered recharge to the Columbia River.

Groundwater at the Landfill that is adjacent to the barrier wall has a federal designation as a potentially potable source of drinking water (Class IIb) given that it does not exhibit salinity or insufficient yield that would warrant a Class III designation (non-potable).

7. Summary of Site Risks

The results of the risk assessments performed prior to the NTRCA indicated the presence of chemicals at the Landfill would not cause adverse health effects to humans under the exposure scenarios evaluated. However, the assessments found that landfill-related chemicals in sediment and seep water could pose potential ecological risks. The primary exposure areas were aquatic areas along the southern margin of the Landfill adjacent to the Mill Creek channel and landfill surface soil. Based on these results, the Landfill NTCRA was implemented at the Landfill between 2005 and 2007.

As part of the Landfill NTCRA, near landfill waste material and contaminated sediment were excavated and consolidated within the Landfill, and a landfill cap and barrier wall were installed to contain contaminants within the Landfill. This action greatly reduced contaminant concentrations in sediments near the Landfill, prevented groundwater discharge into Cathlamet Bay, effectively minimized ecological exposure to chemicals in surface sediment and seep water near the Landfill and landfill surface soil, and eliminated human exposure to chemicals in surface water and sediment. USACE collected data in 2008 to characterize the nature and extent of chemical concentrations at the Tongue Point NAS (USACE 2012b). The comprehensive summary of the post-NTCRA risks at the Landfill are presented in the FFS (USACE 2016) and organized by media.

The Landfill NTCRA addressed risks to human health and the environment because the exposure pathways that could result in unacceptable risks are being controlled. The barrier wall effectively stops the migration of contaminants in groundwater to surface water or sediment. The landfill cap system prevents any contact with contaminants contained in the Landfill and controls surface water runoff and erosion. Based on landfill conditions and available data, exposure to landfill gas is considered insignificant, with no threat to human receptors. The USACE found no unacceptable risk in post-removal action conditions for soil, groundwater, landfill gas, sediment, surface water, or aquatic biota during post-removal risk assessment attributable to past DoD practices. In summary, existing conditions at the Landfill do not pose a risk to current receptors; however, additional measures are required to assure the protectiveness of human and ecological receptors in the future. The response action selected in this DD is necessary to protect public health and the environment from actual or threatened releases of hazardous substances from the site.

8. Remedial Action Objectives

According to the NCP [40 CFR 300.430(a)(1)(I)], the goal of the remedy selection process is "to select remedies that are protective of human health and the environment, maintain protection over time, and minimize untreated waste."

Based on the exposure pathways identified for the current and potential future land and water uses at the site presented in Section 6, along with applicable or relevant and appropriate requirements, which are referred to collectively as ARARs, the following remedial action objectives (RAOs) were identified for the Landfill to provide adequate protection of human health and the environment:

- Prevent direct contact with landfill contents
- Minimize infiltration and resulting contaminant leaching to groundwater
- Contain the contaminated groundwater, LNAPL, and leachate to prevent migration from the source area
- Control surface water runoff and erosion

As presented in the CSM, **Figure 3**, potential points of contact to releases from the Tongue Point Landfill have been eliminated by the Landfill NTCRA components. Exposure to Landfill-related contaminants by current and future recreational users/trespassers is considered either incomplete (surface water, sediment, soil) or insignificant (landfill gas). Because the landfill is secure, the current and future recreational users'/trespassers' exposure pathway is considered incomplete and not evaluated. Barring failure of the containment components, the only remaining point of contact with contaminants present at the Landfill is contact with emissions from the passive landfill gas system via inhalation. However, based on landfill conditions and available data, exposure to landfill gas is considered insignificant, with no threat to human receptors. For these reasons, media-based remedial goals have not been established for the Landfill.

9. Description of Remedial Alternatives

The FFS identified, evaluated, and compared potential remedial alternatives for the Landfill that could meet the preliminary RAOs presented in Section 8. The FFS focused on containment as the presumptive remedial approach and followed relevant NCP guidance for presumptive remedies at landfill sites.

9.1 Landfill Presumptive Remedy Approach

Based on historical patterns of remedy selection and EPA's scientific and engineering evaluation of performance data on technology implementation, presumptive remedies are identified as preferred technologies for common categories of sites (EPA 1993). The EE/CA (USACE 1999a) for the Landfill NTCRA applied EPA guidance titled *Application of CERCLA Municipal Landfill Presumptive Remedy to Military Landfills* (EPA 1996) as a basis for alternatives identification and evaluation. The CERCLA municipal landfill presumptive remedy guidance presents a technical basis for the presumptive remedy, which supported the elimination of the initial technology identification and alternative identification and screening steps for the Landfill in the FFS. In addition, the EPA directive titled *Presumptive Remedy for CERCLA Municipal Landfill Sites* (EPA 1993) was also cited to identify considerations and establish that containment is appropriately applied as the presumptive remedy at the Landfill. No other remedial technologies, including those involving removal or treatment, were developed into remedial alternatives for detailed evaluation because the technical evaluations in the presumptive remedy guidance documented that other technologies were routinely and appropriately screened out based on effectiveness, feasibility, or cost.

9.2 Identification of Remedial Alternatives

Three alternatives were evaluated in the FFS (USACE 2016) as described in the following subsections.

9.2.1 Alternative 1: No Further Action

This alternative is required by NCP so that a baseline set of conditions can be established against which other remedial actions may be compared. No new removal and/or remedial activities would be initiated at the Tongue Point Landfill to further address contaminated media or otherwise mitigate the associated risks to human health from exposure to contaminated media. Although this alternative includes the existing landfill containment components, such as the landfill cover system and barrier wall, ongoing monitoring (field measurements, sampling, and analyses) and maintenance activities at the Landfill and operation of the LNAPL recovery and separation system would cease for this alternative. The estimated present value cost of this alternative is $0.

9.2.2 Alternative 2: Containment, Maintenance, Monitoring, Institutional Controls, and Access Controls

Alternative 2 would continue to provide protection of human health and the environment through the maintenance and monitoring of the landfill containment components. Containment components include a barrier wall along the perimeter of the Landfill to prevent migration of contaminants outside the Landfill, a landfill cover system to minimize infiltration into the Landfill, and a gas collection system to minimize buildup of gas within the Landfill. Alternative 2 includes implementation of institutional controls, comprising governmental controls and proprietary controls for land use restrictions implemented through an equitable servitude agreement and right-of-entry agreements with the property owners, and informational devices such as a notice of environmental contamination. These institutional controls are coupled with existing access controls of fencing and signage to inform the community of risks and restrict access and use of the landfill property. Maintenance of the landfill cover system, landfill gas collection system, and barrier wall and hydraulic monitoring would continue to ensure integrity of the components and protection of human health and the environment. However, operation of the LNAPL recovery and separation system and related offsite disposal of LNAPL would cease. The estimated present value cost of this alternative is $810,000.

9.2.3 Alternative 3: Containment, LNAPL Recovery and Separation, Maintenance, Monitoring, and Institutional Controls

Alternative 3 is similar to Alternative 2, with the exception that the LNAPL recovery and separation system would continue to operate through its design life for Alternative 3. Disposal of recovered LNAPL would continue at a permitted offsite facility. The estimated present value cost of this alternative is $3,450,000.

9.3 Common Elements and Distinguishing Features of Each Alternative

For Alternative 1, no new removal and/or remedial activities would be initiated. The potential for remedy failure is likely considering the lack of institutional controls and future monitoring and maintenance of the landfill containment components, which currently provide protection.

Alternatives 2 and 3 both include the presumptive remedy of landfill containment, maintenance, monitoring, institutional controls, and access controls. Containment components include a barrier wall along the perimeter of the Landfill to prevent migration of contaminants outside the Landfill, a landfill cover system to minimize infiltration into the Landfill, and a gas collection system to minimize buildup of gas within the Landfill. Institutional controls for land use restrictions will be implemented through an equitable servitude agreement and right-of-entry agreements with the property owners and informational devices such as a notice of environmental contamination. These institutional controls are coupled with existing access controls of fencing and signage to inform the community of risks and restrict access and use of the landfill property.

Because contamination would remain in-place, which does not allow for unrestricted use or unlimited exposure to human or ecological receptors, Alternatives 2 and 3 are expected to require maintenance, monitoring, and institutional controls for perpetuity. However, the period of analysis for all alternatives was assumed to be 30 years.

The distinguishing feature for Alternative 3 is operation and maintenance of the LNAPL recovery and separation system with offsite disposal of recovered LNAPL.

9.4 Expected Outcomes of Each Alternative

Alternatives 2 and 3 include remedial components and institutional controls that limit exposure to contaminated soil, landfill waste, and groundwater. Therefore, the existing and foreseeable future land and water uses are expected to remain those mentioned in Section 6.

Although the landfill containment components that are already in place provide protectiveness for Alternative 1, the lack of institutional controls and future monitoring and maintenance of the landfill containment components indicates that Alternative 1 may result in unacceptable risk to human health and the environment in the future.

10. Comparative Analysis of Alternatives

Nine criteria were used to evaluate the different soil and groundwater remediation alternatives individually and against each other to select a remedy in the Landfill FFS:

- Overall protection of human health and the environment
- Compliance with ARARs

- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume through treatment
- Short-term effectiveness
- Implementability
- Cost
- State agency acceptance
- Community acceptance

This section profiles the relative performance of each alternative against the nine evaluation criteria, noting how it compared to the other options under consideration. **Table 1** provides a summary of the comparative analysis of the three alternatives against these evaluation criteria (excluding the modifying criteria of community acceptance and state acceptance). Part 3 of this DD addresses the evaluation of the community acceptance and state acceptance balancing criteria.

10.1 Overall Protection of Human Health and the Environment

Alternatives 2 and 3 provide protection of human health and the environment by meeting the RAOs and providing remedial components and institutional controls that limit exposure to contaminated soil, landfill waste, and groundwater. Evaluation of the Landfill NTCRA in the LPE (Appendix C of the FFS [USACE 2016]) has indicated that landfill containment measures, including the landfill cover system, the landfill gas collection system, and the barrier wall, continue to provide protectiveness. Thus, these alternatives rate acceptable in this category. Although Alternative 1 provides protection of human health and the environment due to the measures put in place as part of the Landfill NTCRA, the absence of monitoring or maintenance of remedial components and lack of institutional controls establishment would allow for potential future exposures to human receptors and the environment. Thus, Alternative 1 does not provide protection of human health and the environment, and it is rated unacceptable in this category.

10.2 Compliance with ARARs

The ARARs associated with all the alternatives includes the post-closure care for landfills found in 40 CFR Part 264.310(b)(1, 5, and 6). The substantive requirements identified for post-closure care of landfills are relevant and appropriate to all the alternatives evaluated in the FFS. The long-term maintenance, monitoring, and institutional controls that comprise Alternatives 2 and 3 would be conducted in a manner consistent with 40 CFR Part 264.310(b)(1, 5, and 6) for post-closure care of landfills. Alternative 1 is not compliant with the ARARs because no further remedial action is taken to address contaminated media, and the existing remedy components could be compromised because monitoring and maintenance would be discontinued.

10.3 Long-Term Effectiveness and Permanence

Alternative 1 includes no continued monitoring and maintenance of the landfill containment components. Because continued monitoring and maintenance is needed to ensure the integrity of the landfill containment components, Alternative 1 ranks low against this criterion. Although Alternative 3 does reduce the volume of LNAPL contained within the Landfill, it is not necessary for the protectiveness of the remedy because LNAPL is contained by the barrier wall and the landfill cover. Alternatives 2 and 3 both maintain the landfill containment components and are similarly ranked moderate to high for this

criterion. The LNAPL collection and recharge system has produced an insignificant reduction of contaminant mass based upon the 1,270 gallons of LNAPL recovered between 2007 and 2017. Therefore, operation of the LNAPL recovery and separation system (Alternative 3) does not result in an appreciable reduction in magnitude of residual risk from the presence of PTW. The presence of the LNAPL does not contribute to degradation of the containment systems, and continued operation of the system causes the system components to degrade through use and wear and tear, which reduces permanence without significant benefit. The reduction of LNAPL resulting from Alternative 3 does not provide additional long-term effectiveness and permanence of the in-place landfill containment measures compared to the Selected Remedy.

10.4 Reduction of Toxicity, Mobility, or Volume through Treatment

Alternatives 1 and 2 fail to provide a reduction of toxicity, mobility, or volume through treatment since treatment is not a component of the alternatives. Alternatives 1 and 2 were given a rating of "none" for reduction of toxicity, mobility, or volume through treatment. Alternative 3 does involve removal of LNAPL from the Landfill and offsite disposal (incidental treatment could occur offsite) and thus was given a rating of "low" in the FFS. However, Alternative 3 does not have an onsite treatment component. Recovered LNAPL is transported to an offsite facility where it is disposed without onsite treatment. Therefore, the rating was revised to "none," as indicated in **Table 1**. All three alternatives were rated as having no reduction of toxicity, mobility, or volume through treatment.

10.5 Short-Term Effectiveness

Alternative 1 presents no short-term risks to workers, the community, and the environment because no further action is taken. Alternative 2 has very low short-term risks to workers because the landfill containment components are already installed and discontinuing operation of the LNAPL recovery and separation system will further reduce short-term risks to workers. Alternative 3 has some short-term risk due to ongoing operation of the LNAPL recovery and separation system and potential short-term worker exposure to LNAPL and contaminated groundwater. Short-term risks to the community include potential accidents and exposures related to transport of recovered LNAPL to an offsite facility for disposal. **Table 1** presents the qualitative rankings for each alternative. Alternatives with lower short-term risks (Alternatives 1 and 2) rate higher in short-term effectiveness than Alternative 3 with higher potential short-term risk.

10.6 Implementability

Alternative 1 ranks highest for implementability because no further action will be taken. Alternative 2 includes shutdown and mothballing of the LNAPL recovery and separation system, implementation of institutional controls, and ongoing monitoring and maintenance. These are straightforward and easily implementable; thus, Alternative 2 rates moderate to high for this criterion. Alternative 3 includes the additional component of long-term O&M of the LNAPL recovery and separation system; therefore, it has a lower implementability than Alternative 2.

10.7 Cost

In the FFS, Alternative 1 was represented as having the lowest present value cost of approximately $110,000, which included 5-year site reviews; however, as presented in **Table 1**, the cost for Alternative 1 was revised and represented as the lowest cost of $0. Alternative 2 had a higher present value cost of approximately $810,000, and Alternative 3 had the highest present value cost of approximately $3,450,000.

The present value costs for all alternatives listed in **Table 1** were evaluated over a 30-year period of analysis and include monitoring and maintenance of remedy components as pertinent for the alternative.

10.8 State Agency Acceptance

The USACE and the ODEQ, the lead regulatory agency, have worked together through investigation and removal phases, including evaluation of remedial alternatives. This collaborative effort identified the preferred alternative in the Landfill Proposed Plan. ODEQ has reviewed the Landfill Decision Document and is supportive of the Selected Remedy for the Landfill. ODEQ's acceptance letter is provided in Appendix A and in the project Administrative Record file at the USACE Kansas City District office and in the Public Information Repository at the Astoria Public Library.

10.9 Community Acceptance

Community input was obtained during the public meeting for the Landfill Proposed Plan. General public input showed community acceptance. The Confederated Tribes of Siletz Indians expressed an initial preference for a clean-up action. USACE responded to this concern and no follow-on comment was received. Assessment of community input from the public comment period on the Proposed Plan is addressed in Part 3 of this DD.

11. Principal Threat Wastes

The "principal threat" concept is applied to the characterization of "source materials" at a site. Source material is material that includes or contains hazardous substances, pollutants or contaminants that act as a reservoir for migration of contamination to ground water, surface water or air, or acts as a source for direct exposure. In general, principal threat wastes (PTW) are those source materials considered to be highly toxic or highly mobile that cannot be contained in a reliable manner or would present a significant risk to human health or the environment should exposure occur.

As presented in Section 5.3, data indicate that LNAPL has formed a measurable and mobile layer on the groundwater in several areas of the Landfill. Distribution of VOCs, semi-volatile organic compounds, TPH, PCBs and pesticides generally correspond with the extent of LNAPL. Although the LNAPL within the Landfill is reliably contained by the barrier wall and landfill cover, LNAPL is generally considered source material. According to PTW guidance, the determination of whether a source material is PTW or a low-level threat waste should be based on the inherent toxicity as well as a consideration of the physical state of the material. Results from testing in 2012 indicated that the LNAPL contains PCBs at concentrations greater than the specified 50-ppm limit total PCB concentration, requiring the waste to be handled as TSCA-regulated material (USACE 2012e). Considering the existing and foreseeable future land use of nearshore areas is assumed to be recreational based on the presence of the Lewis and Clark National Wildlife Refuge, LNAPL could present a significant risk to human health or the environment should exposure occur. Therefore, the LNAPL source material within the Landfill can be considered PTW.

12. Selected Remedy

12.1 Summary of the Rationale for the Selected Remedy

The Selected Remedy for addressing the potential risks at the Landfill is Alternative 2 – Containment, Maintenance, Monitoring, Institutional Controls, and Access Controls. This alternative was selected over other alternatives because it is protective of current and future human and ecological receptors, complies with ARARs, and has lower short-term risks and costs than Alternative 3.

12.2 Description of the Selected Remedy

The NTCRA landfill containment components were constructed to contain contaminated media within the Landfill. Containment components include a barrier wall along the perimeter of the Landfill to prevent migration of contaminants outside the Landfill, a landfill cover to minimize infiltration into the Landfill, and a gas collection system to minimize buildup of gas within the Landfill. For the Selected Remedy, these landfill containment components would continue to be maintained and monitored to ensure integrity of the components and to remain protective of human health and the environment.

Routine maintenance of the cover system will include controlling growth of trees and shrubs on the landfill cover, access road, and along the shoreline perimeter fence through mowing and/or tree removal. Additional maintenance would be required if erosion, sloughing, slumping, or surface deformation is observed on the landfill surface or if settlement or seeps are observed along the perimeter of the barrier wall. Fencing and signage around the landfill property would be repaired or replaced as necessary to maintain access controls and provide information to the public.

Hydraulic monitoring will be performed and evaluated to determine protectiveness of the remedy, and routine inspections would be conducted to identify if other remedy components (i.e., landfill cover, institutional controls, access controls) are functioning as designed. Monitoring components include recording of water levels inside and outside the landfill barrier wall (hydraulic monitoring) and regular inspections of landfill containment components and access controls. For the Selected Remedy, monitoring as necessary would continue to ensure protectiveness of human health and the environment.

Institutional controls will be implemented to minimize or prevent disturbance of the landfill cover system and barrier wall containing wastes and leachate, restrict or prevent any activities or uses of the Landfill that could pose a risk to human receptors, and provide the public with community awareness tools to enhance awareness of potential hazards from wastes and leachate within the Landfill. Institutional controls for the Selected Remedy include proprietary controls and an informational device. An equitable servitude agreement is a proprietary control that will be implemented by the property owner, ODSL. The equitable servitude agreement is a permanent property record that establishes land use restrictions to prevent disturbance of the landfill cover and containment system. The USACE will maintain right-of-entry agreements with adjacent property owners to allow access to USACE to perform maintenance and monitoring. The equitable servitude agreements and right-of-entry agreements with property owners will be re-negotiated or updated as necessary. The informational device is another institutional control and is implemented by ODEQ as the listing of the Landfill as a location of known release in Oregon's Environmental Cleanup Site Information database, site number 171. This listing, at the link below, provides ODEQ managers and the public with information on the landfill status as a contaminated site. http://www.deq.state.or.us/Webdocs/Forms/Output/FPController.ashx?SourceId=171&SourceIdType=11

Access controls consist of physical measures, warning signs, fencing, and locked gates, which notify the public of the presence of the Landfill and of the restricted access to areas within the Landfill. These controls minimize unauthorized activity, ensure integrity of the components, and prevent potential exposures to waste and other hazards at the Landfill.

12.3 Summary of the Estimated Remedy Costs

Total present value costs estimated for the Selected Remedy are $810,000. The total capital cost is $101,000. The total annual O&M costs are $1,290,000 (for 30 years), and the total periodic costs for landfill repairs and 5-year site reviews are $516,000. Detailed costs associated with implementing the Selected Remedy are presented in **Table 2**. The information in this cost estimate summary is based on the

best available information regarding the anticipated scope of the Selected Remedy. Changes in the cost elements are likely to occur as a result of new information and data collected during the design of the remedial action. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30% of the actual project cost.

12.4 Expected Outcomes of the Selected Remedy

The Selected Remedy includes containment components, maintenance, monitoring, habitat restoration structures on the shoreline, institutional controls, and access controls that limit exposure to contaminated soil, landfill waste, and groundwater. The existing and foreseeable future land and water use are expected to remain consistent with those detailed in Section 6. The existing and foreseeable future land use is expected to remain industrial based upon ownership of the landfill site by ODSL and the light marine industrial use of adjacent property. The existing and foreseeable future land use of nearshore areas is assumed to be recreational based on ownership and management of the area by the Lewis and Clark National Wildlife Refuge. The beneficial use of groundwater is considered recharge to the Columbia River.

As detailed in Section 8, media-based cleanup levels have not been established for the Landfill. The landfill containment components that are already in place provide protectiveness; therefore, the timeframe for achievement of protection is immediate.

With consideration of the nearshore area land use as a wildlife refuge and sensitive ecosystems, the NTRCA implemented estuary habitat restoration along Mill Creek and its confluence with Cathlamet Bay. The continuing inspections and maintenance will have a beneficial outcome to the sensitive ecosystems by maintaining the essential habitat.

13. Statutory Determinations

In accordance with the statutory requirements of Section 121 of CERCLA, as amended, and the NCP, the remedial action shall be protective of human health and the environment, comply with ARARs, be cost-effective, use permanent solutions and alternative treatment technologies to the maximum extent practicable, prefer treatment as a principal element to the extent practical, and provide for a 5-year review if required.

13.1 Protection of Human Health and Environment

The Selected Remedy is protective of human health and the environment by meeting RAOs and providing remedial components and institutional controls that limit exposure to contaminated soil, landfill waste, and groundwater. Evaluation of the Landfill NTCRA in the LPE (Appendix C of the FFS [USACE 2016]) has indicated that landfill containment measures, including the landfill cover system, the landfill gas collection system, and the barrier wall, continue to provide protectiveness.

The Selected Remedy includes implementation of institutional controls, comprising governmental controls and proprietary controls for land use restrictions implemented through an equitable servitude agreement and right-of-entry agreements with the property owners, and informational devices such as a notice of environmental contamination. These institutional controls are coupled with existing access controls of fencing and signage to inform the community of risks and restrict access and use of the landfill property. These institutional controls will safeguard the integrity of the remedy. Thus, this alternative is considered protective of human health and the environment.

Implementation of the Selected Remedy will not pose unacceptable short-term risks or cross-media impacts. Ongoing monitoring and maintenance of containment elements (landfill cover system, landfill gas collection system, and barrier wall) and implementation of institutional controls pose minimal risks to workers, the community, and the environment in the short term compared to other alternatives evaluated in the FFS (USACE 2016).

13.2 Compliance with ARARs

Generally, ODEQ does not agree with USACE's definition of ARARs. However, in collaboration with the State of Oregon, ARARs identified for the Selected Remedy is the post-closure care for landfills found in 40 CFR Part 264.310(b)(1, 5, and 6). These regulations are ARARs because the substantive requirements identified for post-closure care of landfills are relevant and appropriate to the Selected Remedy, which includes monitoring and maintenance of the landfill cover system at the Tongue Point Landfill. USACE, in collaboration with the State of Oregon, has determined that the long-term maintenance, monitoring, and institutional controls that comprise the Selected Remedy would be conducted in a manner consistent with 40 CFR Part 264.310(b)(1, 5, and 6) for post-closure care of landfills. ODEQ agrees with this determination of ARARs compliance.

13.3 Cost-Effectiveness

The Selected Remedy is moderate in cost relative to other alternatives evaluated in the FFS (USACE 2016), and it provides long-term effectiveness and permanence with minimal short-term impacts at a reasonable cost compared to other alternatives.

Alternative 1 is lower in cost than the Selected Remedy; however, Alternative 1 takes no further remedial action, and existing containment elements at the Landfill would not be monitored or maintained into the future. There are no short-term impacts to workers, the community, or the environment because no action is taken, and existing remedial components currently provide effectiveness in containing contaminated media and eliminating exposures. However, without proper maintenance and monitoring, the permanence and resulting effectiveness of the remedy components currently providing containment may decrease over time. For example, the integrity of the landfill cap could decay, or the integrity of the barrier wall could be affected by erosion of riprap, which could eventually compromise the protectiveness of the remedy.

Alternative 3 is similar to the Selected Remedy, except that it includes the continuation of LNAPL recovery and separation and offsite disposal of recovered LNAPL. The present value cost of Alternative 3 is estimated to be $3,450,000, which is over four times the present value cost of $810,000 for the Selected Remedy. The Selected Remedy was chosen over Alternative 3, considering the significantly higher cost, potential short-term impacts, and lack of additional long-term effectiveness and permanence of Alternative 3 compared to the Selected Remedy.

13.4 Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

Treatment technologies are not technically feasible at the Landfill based on the volume of materials, and the complexity of the site makes implementation of treatment technologies impracticable. Implementation of a treatment-based remedy would result in greater overall risk to human health and the environment because of risks to workers or the surrounding community during implementation.

The FFS presumptive remedy decision framework evaluation determined that excavation of soil and landfill waste is impractical at the Tongue Point Landfill due to site-specific considerations, including but not limited to co-mingled, potentially hazardous, solid media (soil and landfill waste) and aqueous media

surrounding the Landfill. In addition, hot spots were not identified that could be specifically targeted for excavation and/or treatment (USACE 2016). The Selected Remedy does not employ any treatment or resource recovery technologies because long-term effectiveness and permanence is achieved through containment.

The Selected Remedy provides the best balance of trade-offs among the alternatives evaluated in the FFS with respect to the balancing criteria set out in NCP §300.430(f)(1)(i)(B) such that it represents the maximum extent to which permanence and treatment can be practicably utilized at this site.

Implementability, cost, and short-term effectiveness were the criteria that were most decisive in the selection decision.

13.5 Preference for Treatment as a Principal Element

LNAPL has been detected at groundwater monitoring wells and direct-push wells throughout the Landfill. As presented in Section 11, the LNAPL within the Landfill is considered PTW. There is an NCP expectation for treatment of PTW, whenever practicable. As stated in 40 CFR 300.430(a)(1)(iii)(B), "EPA expects to use engineering controls, such as containment, for waste that poses a relatively low long-term threat or where treatment is impracticable."

The Selected Remedy does not use treatment to address the principal threats posed by the site because treatment is impracticable. The FFS presumptive remedy decision framework evaluation determined that excavation of soil and landfill waste is impractical at the Tongue Point Landfill because the site-specific considerations, including but not limited to co-mingled, potentially hazardous, solid media (soil and landfill waste) and aqueous media (LNAPL and contaminated groundwater/leachate), are located within the Landfill and in sensitive environments surrounding the Landfill. Hot spots were not identified that could be specifically targeted for excavation and/or treatment (USACE 2016).

For the Selected Remedy, the protectiveness will be maintained by long-term maintenance of the barrier wall and cover, and hydraulic monitoring to ensure confinement of LNAPL and all other wastes within the Landfill. Long-term effectiveness and permanence is achieved through containment, and the Selected Remedy provides the best balance of tradeoffs with respect to the other alternatives evaluated.

13.6 Five-Year Review Requirements

Because the Selected Remedy will result in hazardous substances, pollutants, or contaminants remaining on site above levels that allow for unlimited use and unrestricted exposure, pursuant to CERCLA §121(C) and NCP §300.430(f)(5)(iii)(C), a statutory review will be completed within 5 years after initiation of remedial action to ensure that the remedy is, or will be, protective of human health and the environment.

14. Documentation of Significant Changes from Preferred Alternative of the Proposed Plan

The PP detailing the preferred alternative for the Landfill was released for public comment on March 27, 2018. One comment was received from the public during the comment period; however, no significant changes were made in response to that comment, and the preferred alternative becomes the Selected Remedy.

15. References

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Part 3
Responsive Summary

1. Stakeholder Issues and Lead Agency Responses

The USACE placed a public notice in *The Daily Astorian* soliciting comments on the Tongue Point Landfill PP. The notice was published for 3 days (March 23, 26, and 27, 2018), and the public comment period was open from March 27 through April 27, 2018. In addition, USACE sponsored a public meeting on April 11, 2018 in Astoria, Oregon, to present the PP, including a summary of the previous investigations and risk assessment results, and to receive public comments. A transcript of the meeting is available in the Administrative Record file at the USACE Kansas City District office and in the Public Information Repository at the Astoria Public Library. Two members of the public attended the meeting. During the public comment period, including the public meeting, the input received comprised one comment, which is presented below.

The following communication was received via email during the comment period from Robert Kentta, Cultural Resources Director for the Confederated Tribes of Siletz Indians on April 4, 2018:

> *Thanks for the info provided.*
>
> *I think we need to have an internal assessment technical review of the proposed response (which appears to be limited pretty much to maintenance/monitoring protocols)... generally, I think we would prefer a clean-up action. There was Mention of shellfish tissue samples - but I didn't see where there was detail on the results. Also did not see detail on the chemicals/compounds detected, or their potential health effects. Also: we are waiting for a big seismic event, what is the anticipated effect On this site of the shake event (liquefaction) - and Tsunami flooding... will containment plans be shot And hazardous waste released On the outgoing (and incoming) tides.*
>
> *We may need to request additional information to be able to conduct our own assessment. Tongue Pt. is important culturally, historically and environmentally. We need to assure/be assured that this cleanup/response of a DOD landfill site (which should never have been allowed to have been placed within such a sensitive area) gets the best option consideration it deserves.*

The USACE responded to the above communication by providing the following information to Mr. Kentta via e-mail on April 6, 2018:

- Dates and submittal information for the formal public comment period from March 27 through April 27, 2018;
- Summary of the background information regarding the NTCRA in 2007, which addressed ecological risks related to the Landfill and was constructed in compliance with associated rules, regulations, and laws;
- Summary of the results of the 2008 detailed investigation and subsequent human health and ecological risk assessments;

- Information regarding the availability of background documents located in the Astoria Public Library.

No follow-on detailed comment was received from the Confederated Tribes of Siletz Indians. However, the following bullets provide a response to the two substantive comments regarding seismic and tsunami risks with respect to the design of the Landfill containment:

- The Landfill design incorporated seismic analyses and slope stability evaluations as described in Section 3.3.6 and Appendix E of the Phase II Tongue Point Landfill Remedial Action Report, Prepared by URS Corp. in June 2004.
- The Local Source (Cascadia Subduction Zone) Tsunami Inundation Map of Astoria, Oregon indicates that the Landfill area is considered “dry” for all events (even in an XXL event) based on the “wet/dry” line. The Landfill facility is located seaward of the Senate Bill 379 line, a regulatory tsunami inundation line that prohibits construction of new essential structures and special occupancy structures in the tsunami inundation zone.

Consequently, no changes were made to the Selected Remedy.

ODEQ supports USACE’s Selected Remedy for the Tongue Point Landfill. ODEQ agrees that the Selected Remedy complies with ARARs, and no further construction is necessary. The Landfill is in a maintenance and inspection phase, and the post-closure care requirements for the landfill are sufficient for existing conditions.

2. Technical and Legal Issues

No technical or legal issues were identified during the public review period of the PP.

Figures

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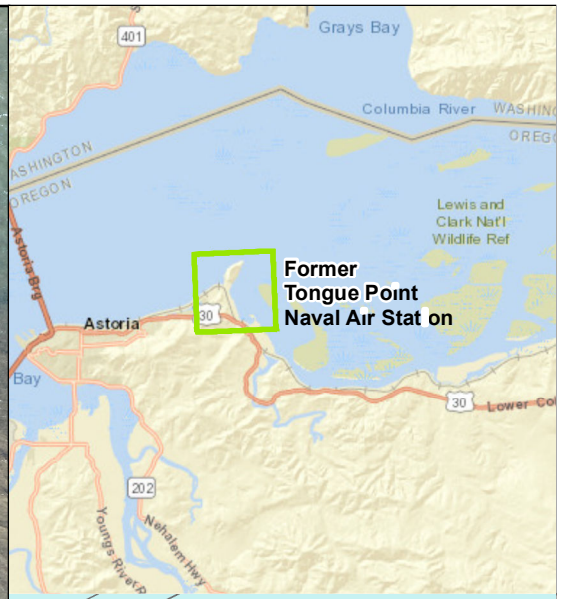

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Tongue Point Landfill

Tongue Point Landfill Proposed Plan
Former Tongue Point Naval Air Station
Astoria, Oregon

Figure 1

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Legend

- Landfill Settlement Monitoring Points (SM)
- Landfill Gas Vents (GV)
- Former Extraction Wells
- Subsurface Barrier Wall
- Property Lines

0 50 100
Feet
1 inch = 100 feet

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KANSAS CITY, MISSOURI

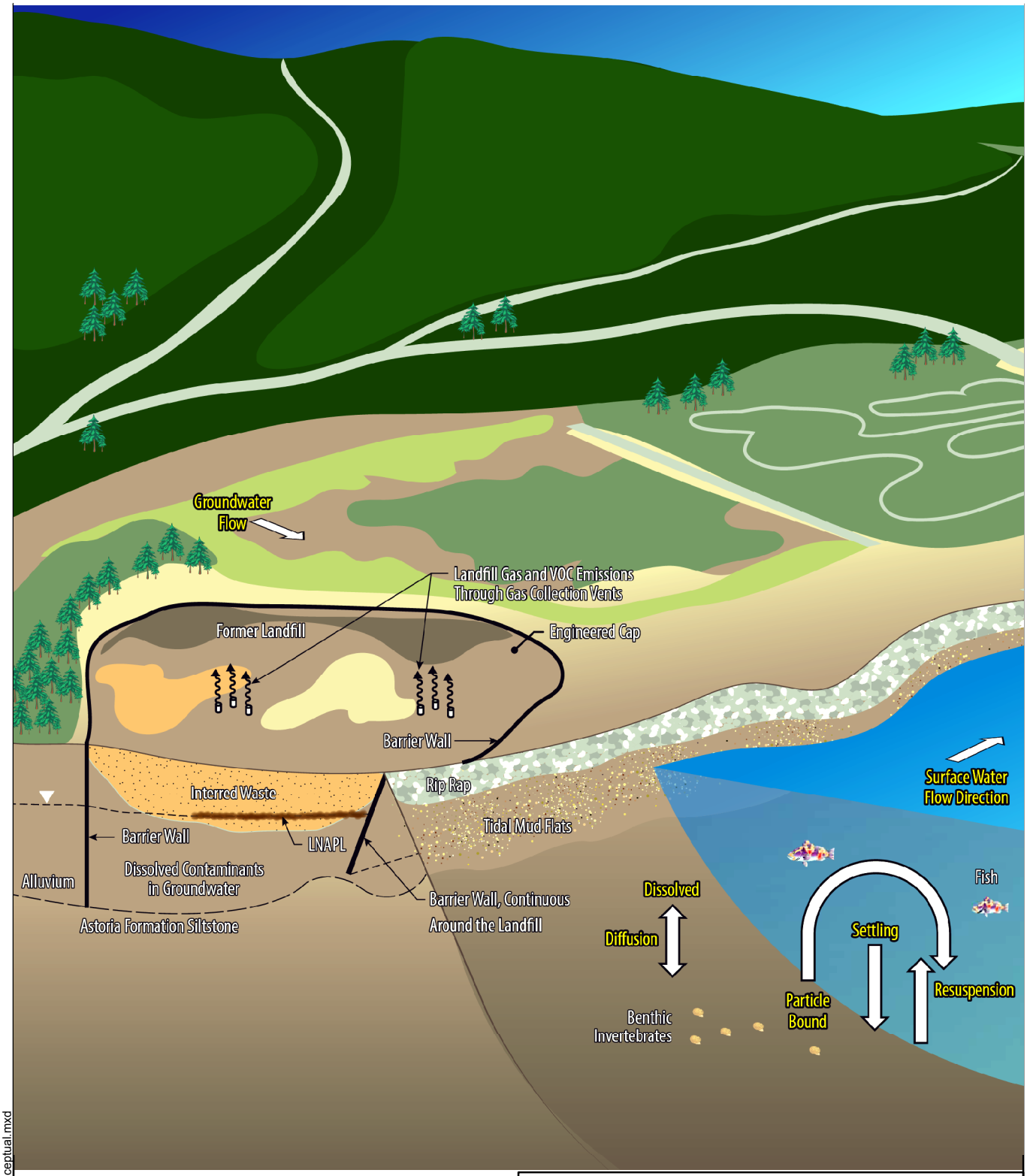
US Army Corps of Engineers

Site Feature Map

Tongue Point Landfill Decision Document
Former Tongue Point Naval Air Station
Astoria, Oregon

Figure 2

Map File: S:\100185-TonguePt\GIS\MXD\Figure_2_TonguePtLandfill_SiteMapDD_180314.mxd



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Conceptual Site Model

Tongue Point Landfill Decision Document
Former Tongue Point Naval Air Station
Astoria, Oregon

Figure 3

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Tables

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Table 1. Summary of Comparative Analysis for Remedial Alternatives

Remedial Alternative	Description	Threshold Criteria		Balancing Criteria					
		Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume through Treatment	Short-Term Effectiveness	Implementability	Present Value Cost (Dollars)	
1	No Further Action	–	–	❷	⓪	❺	❺	⓪	$0
2	Containment, Maintenance, Monitoring, and Institutional Controls	+	+	❹	⓪	❺	❹	$$	$810,000
3	Containment, LNAPL Recovery and Separation, Maintenance, Monitoring, and Institutional Controls	+	+	❹	⓪	❹	❸	$$$$$	$3,450,000

Notes:

1. The numerical designations for the qualitative ratings system used in this table are not used to quantitatively assess remedial alternatives (for instance, individual rankings for an alternative are not additive).
2. The balancing criteria ratings for Alternative 1, costs, and Alternative 3, reduction of toxicity, mobility, or volume through treatment, were modified from the FFS version of this table for consistency with USACE policy. This minor change does not affect the outcome of alternatives analysis.

Legend for Qualitative Ratings System:

Threshold Criteria

_ Unacceptable

\+ Acceptable

Balancing Criteria (Excluding Cost)

⓪ None

❶ Low

❷ Low to Moderate

❸ Moderate

❹ Moderate to High

❺ High

Balancing Criteria (Present Value Cost in Dollars)

⓪ None

$ Low ($0 through $500,000)

$$ Low to Moderate ($500,000 through $1M)

$$$ Moderate ($1M through $1.5M)

$$$$ Moderate to High ($1.5M through $2M)

$$$$$ High (Greater than $2M)

Table 2. Cost Estimate Summary

CAPITAL COSTS: (Assumed to be Incurred During Year 1)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL
· Institutional Controls	CW2-2	1	LS	$25,446	$25,446
· Shutdown and Mothballing of LNAPL Recovery and Separation System[1]	CW2-3	1	LS	$23,680	$23,680
· Abandonment of Short Term Observation Wells[2]	CW2-4	3	EA	$3,021	$9,064
SUBTOTAL					$58,190
Contingency (Scope and Bid)[3]		20%			$11,638
SUBTOTAL					$69,828
Project Management[3]		10%			$6,983
Remedial Design[3]		20%			$13,966
Construction Management[3]		15%			$10,474
TOTAL					$101,251
TOTAL CAPITAL COST					**$101,000**

ANNUAL OPERATION AND MAINTENANCE COSTS (Years 1 through 30)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL
· Groundwater Monitoring	CW2-5	1	YR	$22,014	$22,014
· Routine Landfill Cover System Maintenance	CW2-6	1	YR	$7,690	$7,690
SUBTOTAL					$29,704
Contingency (Scope and Bid)[3]		20%			$5,941
SUBTOTAL					$35,645
Project Management[3]		7%			$2,495
Technical Support[3]		15%			$5,347
TOTAL					$43,487
TOTAL ANNUAL O&M COST					**$43,000**

PERIODIC LANDFILL REPAIR COSTS (Year 30)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL
· Periodic Landfill Repairs	CW2-7	1	LS	$155,777	$155,777
SUBTOTAL					$155,777
Contingency (Scope and Bid)[3]		20%			$31,155
SUBTOTAL					$186,932
Project Management[3]		7%			$13,085
Technical Support[3]		15%			$28,040
TOTAL					$228,057
TOTAL PERIODIC COST					**$228,000**

5-YEAR SITE REVIEW PERIODIC COSTS (Years 5, 10, 15, 20, 25, and 30)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL
· 5-Year Site Review	CW2-1	1	LS	$32,698	$32,698
SUBTOTAL					$32,698
Contingency (Scope and Bid)[3]		20%			$6,540
SUBTOTAL					$39,238
Project Management[3]		7%			$2,747
Technical Support[3]		15%			$5,886
TOTAL					$47,871
TOTAL PERIODIC COST					**$48,000**

Table 2. Cost Estimate Summary

SUMMARY OF PRESENT VALUE ANALYSIS

Year[4]	Capital Costs	Annual O&M Costs	Periodic Costs	Total Annual Expenditure[5]	Discount Factor (7.0%)	Present Value[6]
1	$101,000	$43,000	$0	$144,000	1.0000	$144,000
2	$0	$43,000	$0	$43,000	0.9346	$40,188
3	$0	$43,000	$0	$43,000	0.8734	$37,556
4	$0	$43,000	$0	$43,000	0.8163	$35,101
5	$0	$43,000	$48,000	$91,000	0.7629	$69,424
6	$0	$43,000	$0	$43,000	0.7130	$30,659
7	$0	$43,000	$0	$43,000	0.6663	$28,651
8	$0	$43,000	$0	$43,000	0.6227	$26,776
9	$0	$43,000	$0	$43,000	0.5820	$25,026
10	$0	$43,000	$48,000	$91,000	0.5439	$49,495
11	$0	$43,000	$0	$43,000	0.5083	$21,857
12	$0	$43,000	$0	$43,000	0.4751	$20,429
13	$0	$43,000	$0	$43,000	0.4440	$19,092
14	$0	$43,000	$0	$43,000	0.4150	$17,845
15	$0	$43,000	$48,000	$91,000	0.3878	$35,290
16	$0	$43,000	$0	$43,000	0.3624	$15,583
17	$0	$43,000	$0	$43,000	0.3387	$14,564
18	$0	$43,000	$0	$43,000	0.3166	$13,614
19	$0	$43,000	$0	$43,000	0.2959	$12,724
20	$0	$43,000	$48,000	$91,000	0.2765	$25,162
21	$0	$43,000	$0	$43,000	0.2584	$11,111
22	$0	$43,000	$0	$43,000	0.2415	$10,385
23	$0	$43,000	$0	$43,000	0.2257	$9,705
24	$0	$43,000	$0	$43,000	0.2109	$9,069
25	$0	$43,000	$48,000	$91,000	0.1971	$17,936
26	$0	$43,000	$0	$43,000	0.1842	$7,921
27	$0	$43,000	$0	$43,000	0.1722	$7,405
28	$0	$43,000	$0	$43,000	0.1609	$6,919
29	$0	$43,000	$0	$43,000	0.1504	$6,467
30	$0	$43,000	$276,000	$319,000	0.1406	$44,851
TOTALS:	$101,000	$1,290,000	$516,000	$1,907,000		$814,805

TOTAL PRESENT VALUE OF SELECTED REMEDY[7] **$810,000**

Notes:

[1] Shutdown of the LNAPL system has occurred and the decommissioning of the system was commenced in July 2017.

[2] Well abandonment of the STOW wells has not occurred as of May 2018.

[3] Percentages used for contingency and professional/technical services costs are based on guidance from Section 5.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000.

[4] The Selected Remedy is expected to require cost expenditures for perpetuity since contamination would remain in-place that do not allow for unrestricted use or unlimited exposure to human or ecological receptors. However, the period of analysis was assumed to be 30 yrs beyond Year 1.

[5] Total annual expenditure is the total cost per year with no discounting.

[6] Present value cost by year is the total annual expenditure discounted by a factor for that year representing the 7.0% real discount rate recommended by "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000.

[7] Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

Abbreviations:

EA Each
LS Lump Sum
QTY Quantity
YR Year

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Appendix A

Letter of Support from Oregon Department of Environmental Quality

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Oregon
Kate Brown, Governor

Department of Environmental Quality
Northwest Region
700 NE Multnomah Street, Suite 600
Portland, OR 97232
(503) 229-5263
FAX (503) 229-6945
TTY 711

July 31, 2018

via electronic delivery

MIREK TOWSTER
US ARMY CORPS OF ENGINEERS
601 E 12TH STREET
KANSAS CITY MO 64106

Re: Former Tongue Point Naval Air Station Landfill Draft Decision Document
ECSI #171

Dear Mr. Towster:

The Oregon Department of Environmental Quality (DEQ) has reviewed the updated document entitled *Draft Decision Document, Tongue Point Naval Air Station, Astoria, Oregon*, dated June 2018.

DEQ agrees with the selected remedy. However, DEQ does not agree with the definition of State ARARs, which should include Oregon's cleanup standards specified in OAR 340-122-0040. DEQ requests that this letter be included in the final Decision Document.

If you have any questions, please contact me at hood.robert@deq.state.or.us or (503) 229-5617.

Respectfully,

Robert A. Hood, Jr.
Project Manager, NW Region Cleanup and Tanks

cc: Administrative File
May Carrell, USACE

(rah:RAH)

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