Warmhouse Beach Dump Superfund Site Proposed Plan

Neah Bay, Washington – Makah Tribe Reservation **April 28, 2025**

U.S. Environmental Protection Agency, Region 10

Proposed Plan for Public Comment

Introduction

The United States Environmental Protection Agency (EPA) is issuing this Proposed Plan as part of its public participation requirements under Section 117(a) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), commonly known as Superfund, and Section 300.430(f)(2) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The objective of this Proposed Plan is to present EPA's Preferred Alternative for a remedial action for the Warmhouse Beach Dump Superfund Site (Site). The Site is located on Makah Tribal lands, about 3 miles northwest of Neah Bay in Clallam County, Washington (Figure 1).

This Proposed Plan provides information on the history of the Site, the risks associated with contamination, the cleanup alternatives that were evaluated, identifies EPA's Preferred Alternative and explains the reasons for this preference. This Proposed Plan summarizes information that can be found in greater detail in the remedial investigation (RI) report, feasibility study (FS) report, and other documents contained in the Administrative Record for this Site. EPA encourages the public to review these documents to learn more about the Site and Superfund activities that have been conducted. These documents are available on the EPA project webpage at https://www.epa.gov/superfund/warmhouse-beach. The public is encouraged to consider all alternatives, not just the Preferred Alternative. After considering public comments and consulting with the Makah Tribe, EPA anticipates issuing its decision on the selected remedial alternative in a Record of Decision (ROD) which will provide the rationale for its decision. The ROD will also include EPA's responses to comments received during the public comment period. EPA may modify the Preferred Alternative or select another cleanup alternative after consideration of

Public Comment Period: April 28 – May 28, 2025

EPA will accept comments on the Proposed Plan during the 30-day public comment period (**April 28, 2025** to **May 28, 2025**).

Comments may be submitted in the following ways:

By mail:

ATTN: Warmhouse Beach Proposed Plan
c/o Ashley Grompe
US EPA Region 10, 1200 6th Ave., Suite 155
Superfund Records Center, Mail Stop 17-C04-1
Seattle, WA 98101

By email: region10@epa.gov

Attending public meetings and providing oral and/or written comments.

EPA will hold an in-person public meeting in English on:

Tuesday, May 13, 2025

4:30 to 6:30 p.m. – Open House
(Light refreshments provided)
5:30 p.m. – Presentation and Public Comment

Location:

Makah Tribal Community Hall
81 3rd Ave, Neah Bay, WA 98357

Read the Proposed Plan and related documents online at:
www.epa.gov/superfund/warmhouse-beach.

comments received on this Proposed Plan. Therefore, the public is encouraged to review and comment on any or all alternatives presented in this Proposed Plan. The ROD and responsiveness summary will also be posted to the EPA project webpage.

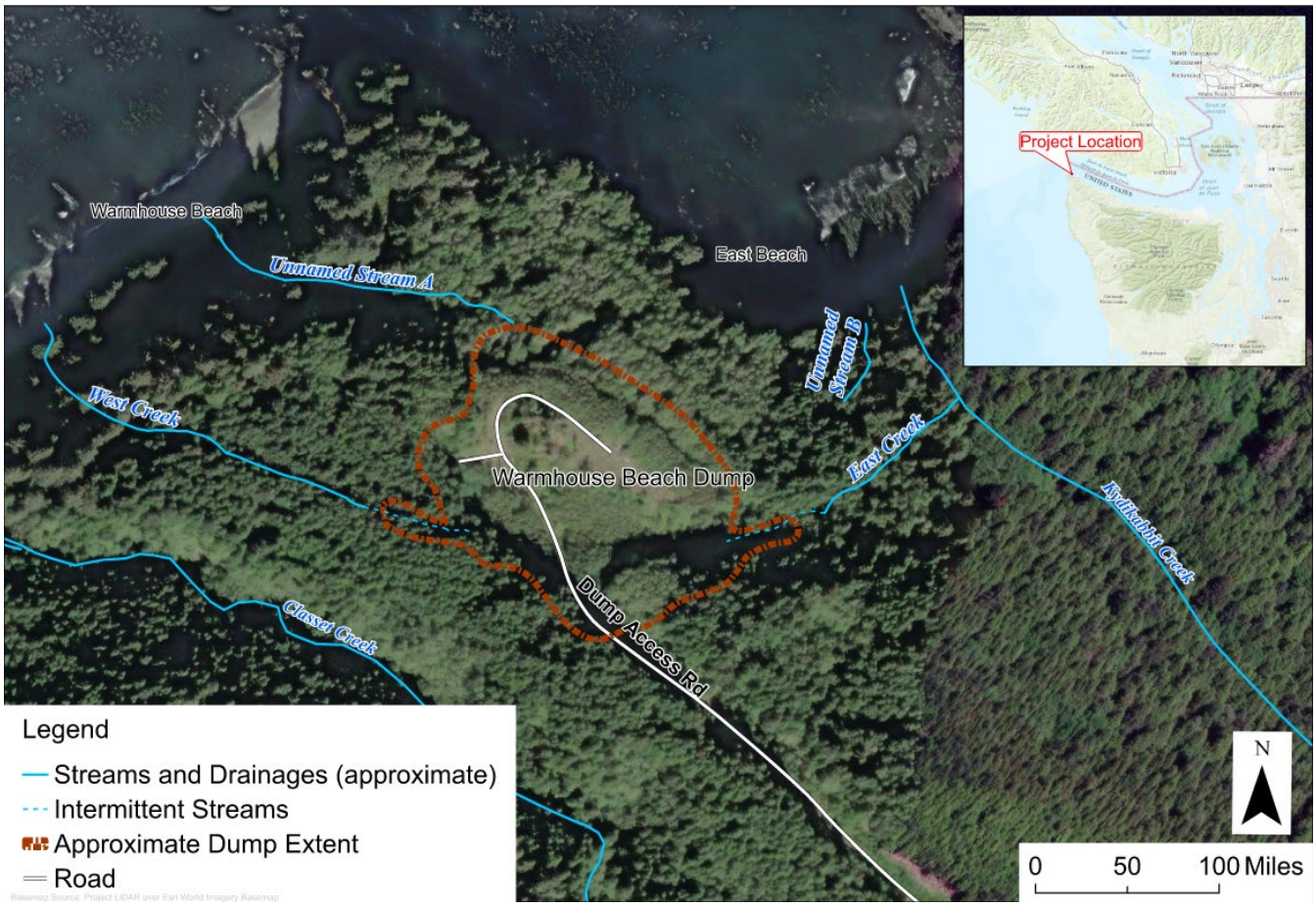


FIGURE 1. LOCATION OF THE WARMHOUSE BEACH DUMP SUPERFUND SITE

Site History

The Warmhouse Beach Dump was used in the late 1960s to 2012, when a solid waste transfer station run by the Makah Tribe opened near Neah Bay. The dump received mostly municipal and some hazardous wastes prior to closure.

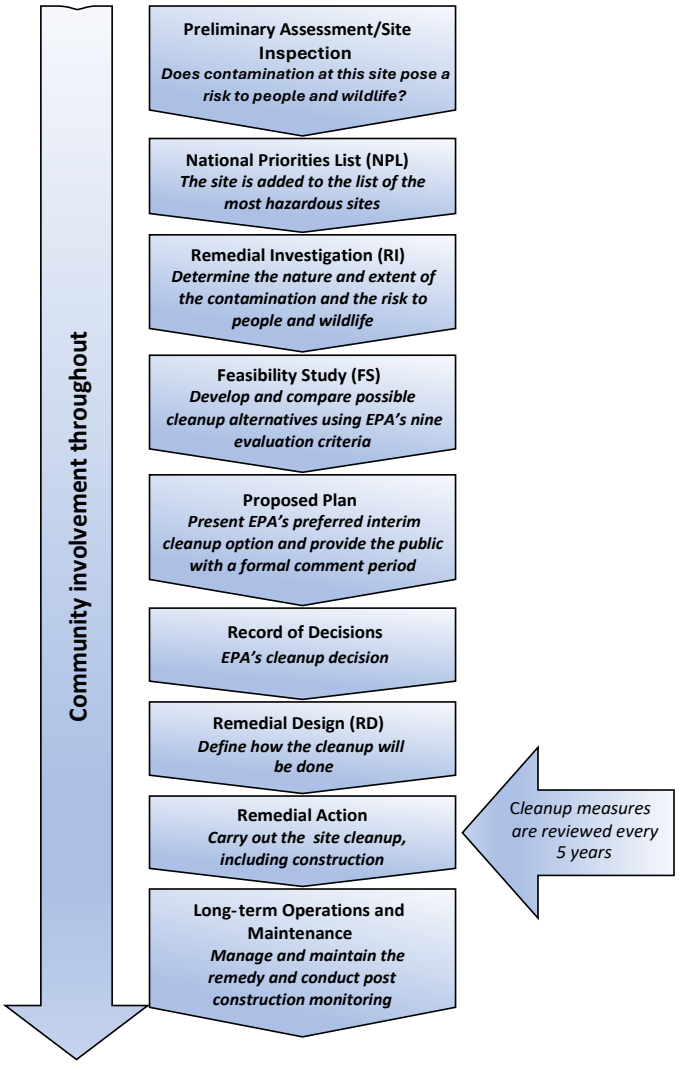
The Warmhouse Beach Dump Site was added to the Superfund National Priorities List (NPL) in December 2013. Placement on the NPL means Warmhouse Beach is a Superfund site under CERCLA. The Makah Tribe is the support agency and therefore plays a role in the review and concurrence of the remedial process. The State of Washington is not involved because the Site is located on Tribal lands.

The Warmhouse Beach Dump is a fund-lead site, meaning that EPA is paying for studies and cleanup work. CERCLA 104(c)(3) and 40 CFR 300.510(a) provide that Federally recognized Indian tribes are not required to provide CERCLA section 104(c)(3) assurances, which would otherwise include a 10 percent cost share and operation and maintenance (O&M) costs for Fund-financed response actions.

Public Participation to Date

EPA's goal is to work collaboratively and transparently so that the final decisions are understood by the public. After the Site was listed on the NPL, EPA conducted community interviews and discussions to help understand the unique concerns and issues about the Site, and how to get information to, and input from, the community. This information informed the Community Involvement Plan (CIP) which organizes and guides EPA's public participation efforts. The CIP is a living document which is typically updated after the site cleanup decision is issued. A local cultural consultant is also contracted to provide research-based information to the process. Further input will help design a cleanup that considers the Makah Tribe's needs and interests. The CIP can be found on EPA's webpage for the Warmhouse Beach Site: https://www.EPA.gov/superfund/warmhouse-beach.

Inside this Proposed Plan



STEPS IN THE SUPERFUND PROCESS

The Superfund Process

The Superfund process is established by CERCLA and the NCP to guide the investigation and cleanup of contaminated sites. The process includes defined steps, illustrated to the left, starting with the discovery of a site, and continuing through investigation, remedy selection, remedy implementation, post-remedy evaluation, and site completion. The NCP includes procedures, expectations, and program management principles to guide the process. EPA has developed technical guidance and policies on a range of issues so that decisions are based on sound science and to ensure that cleanup actions will ultimately be protective of human health and the environment.

Memorandum of Understanding between EPA and the Makah Tribe

EPA and the Makah Tribe entered into a memorandum of understanding (MOU) in 2015. The MOU details how the Tribe and the EPA shall coordinate on a government-to-government basis in their efforts to meet their respective

responsibilities under Superfund and other applicable Federal or Tribal laws to address the releases or threatened releases of hazardous substances associated with the Site. For example, the MOU requires that EPA coordinates review of Superfund documents with the Makah Tribe and responds to tribal input throughout the Superfund process. Additionally, EPA and the Makah Environmental Program have regular meetings to discuss the ongoing Superfund work for the Site.

Warmhouse Beach Dump Feasibility Study and Preferred Alternative

The Feasibility Study (FS) was completed in 2025. It proposed and screened potential remedial options and evaluated the alternatives using the NCP criteria (see page 15). The FS details the four alternatives that were evaluated for the Site. These alternatives included taking no action, capping the entire site, partial excavation and capping of contaminated media, and the removal of all contaminated media. The four alternatives are described beginning on page 12. The key elements of the Preferred Alternative are shown below; a more complete description is presented on pages 16 and 17.

In this Proposed Plan, EPA is proposing Alternative 3, which includes partial excavation and capping of contaminated media at the Site.

The Preferred Alternative:

The Preferred Alternative includes the following elements:

- Excavation of shallow contaminated media (located at the ground surface to 10 feet below ground surface) and disposal at an off-site facility. Contaminated sediment in East and West Creeks would be removed and replaced. This would include regrading and revegetating excavated areas to promote positive drainage and minimize erosion.
- Contaminated media left in place will be covered with a barrier to prohibit exposure.
- Excavated contaminated media would be loaded into containers on-site for transport and disposal off-site at an appropriately permitted facility. This Proposed Plan and the cost estimate includes the assumption that waste would be transported by barge. However, the specific transportation methods and disposal facility locations will be determined during the remedial design phase. Road improvements and the construction of barging infrastructure are included in this alternative.
- Institutional controls to prevent exposure and protect the integrity of the remedy.
- Long-term monitoring will be conducted periodically after cleanup levels are achieved. Cleanup levels will be selected in a future decision document.
- Consistent with CERCLA, five-year reviews will be conducted to assess whether the remedy remains protective.

Site Background

The Site was added to the NPL in 2013. The RI was conducted between 2013 and 2023, and included sampling soil, sediment, and surface water at the dump, as well as assessing the waste material itself. The RI report (EPA 2023a) presents the results of these investigations, which also includes the human health risk assessment (Appendix G of the RI report), and the baseline ecological risk assessment (Appendix H of the RI report). The studies determined that contaminants present at the site, including lead, other metals, polychlorinated biphenyls (PCBs), dioxins and furans were present in the waste. These chemicals have been placed in the landfill footprint and released into the environment thereby causing contamination in soil, sediment, and surface water.

During a 2018 site visit, approximately 12 bags labeled as asbestos-containing material were observed in the dump. The bags were ragged and worn, and had the potential to release asbestos into the environment. EPA conducted a time-critical removal action in 2019 to remove and dispose the asbestos-containing material.

EPA developed the feasibility study after the remedial investigation. The feasibility study (EPA 2025) identified, developed, screened, and evaluated remedial alternatives to address risks to human health and the environment from waste at the dump.

Site Characteristics

The Site is located 0.1 miles uphill of East Beach and Warmhouse Beach on the Strait of Juan de Fuca, which is part of the Olympic Coast National Marine Sanctuary. The land was originally forested but was cleared as part of a timber sale in 1966. Dumping began in the 1960s.

Dumping started in a deep ravine that runs east and west along the southern edge of the dump. A bedrock ridge is approximately 70 feet above the top of the ravine. Initially, waste materials were dumped into the ravine from the access road on the south side of the ravine. As the ravine filled with waste material, the access road eventually extended to the top of the ridge. Waste materials then dumped from the top of the ridge down toward the ravine to the south. Waste was also dumped from the top of the ridge toward the north and northeast.

At present, the Warmhouse Beach Dump covers approximately 8 acres. There are no structures. Alder, blackberry vines, and other shrubs have grown over and now mostly cover the dump surface. The dump is located approximately 2 miles away from Neah Bay via the unpaved Cape Loop Road and Dump Access Road (Figure 1). A locked gate at the start of Dump Access Road prevents unauthorized access. The Makah has inherent land use rights through Tribal sovereignty established by the 1855 Treaty of Neah Bay. The Makah Tribal Council has not codified land use or zoning.

The dump is located on Cape Flattery, a rugged headland rise made of sandstones, siltstones, and conglomerate rocks. Due to the presence of bedrock immediately below the dump, and the topography of the site, water is conveyed to the surface water creeks or becomes perched in the volume of waste. No seeps were identified in the remedial investigation. Surface water runoff from the western and eastern sides of the dump flows into two seasonal creeks (East and West Creeks) and two intermittent streams (flow that occurs immediately after rainfall) on the northern side of the dump (Unnamed Stream A and Unnamed Stream B) (Figure 1). Groundwater is inconsistently present in small amounts within the dump area, does not meet the regulatory definition of an aquifer, and therefore is not considered a drinking water source.

A temperate rainforest surrounds the dump footprint. The Makah Environmental Program manages the wildlife and habitat at the dump and across Tribal lands. The remedial design phase will engage the department to provide current biological surveys and site-specific information, including information about sensitive species.

Current and Future Site Uses

In 2022, the Makah Planning Council reported that its vision for future use of the dump and the surrounding area includes building a cultural camp at Warmhouse Beach. The vision also includes building a visitor center and marine environmental institute on the reclaimed Warmhouse Headlands (Makah Tribe 2022). More recent discussions have also included the potential to use the Site as a resiliency hub in the event of natural disasters and the location of temporary or permanent housing. These discussions informed the exposure scenarios considered in the risk assessment process and the development of remedial alternatives.

Contamination in Site Media

The Warmhouse Beach Dump was an uncontrolled dumping area, which means the contents or volume of wastes disposed were not regulated or monitored during the period of active use. Studies looked at the general composition and extent of waste, but it is not possible to know every type of waste in the dump. Previous studies noted that the most common items in the dump were organic materials, household waste, metal, and glass. Wastes that contain hazardous substances or are designated as hazardous waste are less common and include batteries, containers labeled as motor oil, tires, and appliances (White Shield 1995). The total estimated volume of contaminated media (soil, sediment, and the waste itself) in the dump is 118,700 cubic yards over an areal extent of 8.1 acres, including 1,700 cubic yards (0.5 acres) of contaminated sediment in East and West Creeks. Studies estimated that 5 percent of contaminated media is hazardous waste and the remaining 95 percent is non-hazardous waste.

Distribution of Contamination

Surface soil sampling was conducted where human and ecological exposure is expected to occur. Areas with the highest waste accumulation are co-located with areas of high contaminant concentrations in soils. The site was divided into decision units (DUs) for the purpose of evaluating the nature and extent of contamination. The highest concentrations are detected consistently in the ravine south of the main ridgeline and at the ridgetop. Contaminant concentrations in soil are consistently higher in DUs within the dump than concentrations in perimeter soil DUs, where reported concentrations are consistently within the same order of magnitude as background. Based on these data, the RI concluded that the principal contamination is confined within the approximate extent of the dump, and that contamination does not extend downstream to the beach or marine habitat

The highest concentrations in sediment are observed consistently in the upper reaches of East and West Creeks, which are partially within the dump extent. At the most downstream location sampled, concentrations are either close to or below the background concentrations. Concentrations for these analytes generally decrease from upstream to downstream in each stream. Containment concentrations in surface water exhibit a similar distribution to those in sediment The highest concentrations are observed consistently in the upstream reaches of East and West Creeks located within the dump extent. The lower reaches consistently have surface water concentrations that are either below or slightly above background concentrations.

Contaminants most frequently detected at elevated concentrations in soil and sediment are metals (including arsenic, copper, lead, and zinc), total dioxins and furans, PCBs, pesticides such as DDT, and polycylic aromatic hydrocarbons (PAHs).

Site Strategy

EPA has determined that multiple operable units are not required, and one decision to cover the entire site is sufficient. The source of the contamination at this site is the waste located in the dump, and this will be addressed by the selected remedy.

EPA intends to issue a ROD for the Site and design the selected remedy that will allow implementation of the ROD. Due to the Site complexity and location, multiple work seasons may be needed to compete the remedy.

Once the remedy is constructed, EPA will monitor the remedy to ensure that it is meeting the selected remedial action objectives (RAOs). If waste is left in place, EPA will conduct reviews every five years to assess protectiveness. EPA is encouraging public input on this proposed plan and that input will be taken into account when EPA selects a remedy in the ROD.

Summary of Site Risks

Human health and ecological risk assessments were conducted for the Site to estimate the risks associated with exposure to contaminants based on current and likely future uses of the Site. These risk assessments are detailed in Appendix F and Appendix G of the RI Report.

Human Health Risks

The baseline human health risk assessment (BHHRA, Appendix F of the RI Report)) evaluated cancer and non-cancer health hazards associated with exposure to site-related contamination in soil, sediment, and surface water that may occur considering potential residential/subsistence and non-residential future use of the Site. Consistent with CERCLA requirements, a reasonable maximum exposure (RME) that portrays the highest level of exposure that could reasonably be expected to occur was evaluated.

Populations were identified that could potentially be exposed to site-related contamination through a variety of activities consistent with both current and future use of the Site. Potential routes of exposure evaluated included routes of incidental ingestion (oral exposures), inhalation, and dermal contact with soil, sediment and surface water. Populations and routes of exposure that were evaluated were estimated as follows:

Current/future Tribal Residential: Possible future use of the Site for residential/subsistence use and potential exposures to soil, sediment, and surface water were evaluated.

Current/Future Non-Residential Tribal Members: While the current Site use is non-residential in nature, culturally significant practices by Tribal members such as hunting and gathering activities may occur at the Site. These activities could result in contact with contaminated environmental media, including soils within the dump extent and surface water and sediment in creeks.

Future Visitor Center Worker: A future visitor center worker was assessed to evaluate the most likely future use scenario for the Warmhouse Headlands. Full-time workers at the visitor center could be exposed to contaminants in soil via windborne dust and by teaching various cultivation practices.

The site was divided into decision units (DUs) for the purpose of evaluating exposure to soil, and exposure by residential tribal members was evaluated on a DU-by-DU basis. Because exposures for nonresidential tribal members and outdoor workers are expected to occur across the entire Site, the individual DUs were combined into two larger areas, defined as all DUs within the footprint of the dump itself, and the perimeter DUs that fall outside the dump footprint.

WHAT IS HUMAN HEALTH RISK AND HOW IS IT CALCULATED?

A CERCLA baseline human health risk assessment (BHHRA) is an analysis of the potential adverse health effects caused by the hazardous substances released from a site in the absence of any actions to control or mitigate under current and future land uses. A four-step process is used for assessing site-related human health risks.

Hazard Identification: The first step is the identification of contaminants based on toxicity, fate and transport in the environment, and chemical concentration, mobility, persistence, and bioaccumulation.

Exposure Assessment: This step involves identifying the different exposure pathways through which people might be exposed to site-related contaminants. Examples include consumption of contaminated fish or shellfish or dermal contact with, or incidental ingestion of, contaminated sediment. For each pathway, factors needed to compute the dose of a chemical to which individuals may be exposed are estimated (exposure concentrations, rates at which humans come into contact with contaminated media [such as sediment ingestion rates], and the frequency and duration of that exposure). Using this information, contaminant doses are calculated for each receptor group (adult or child) and exposure pathway.

Toxicity Assessment: In this step, the types of adverse health effects associated with chemical exposures and the relationship between magnitude of exposure (dose) and severity of adverse effects (response) are determined. Potential health effects are chemical-specific and may include the risk of developing cancer over a lifetime or other non-cancer health hazards. Some contaminants may cause both cancer and non-cancer health hazards.

Risk Characterization: This step combines output from the exposure and toxicity assessments to provide a quantitative assessment of site risks for each COC. Exposures are evaluated based on the potential risk of developing cancer and the potential for non-cancer health hazards. Only risks associated with exposures from the site are considered; those risks are termed excess risk and do not include other health risks to which people may be exposed.

Cancer risks are expressed as the probability of an individual developing cancer over their lifetime. For example, a 10^{-4} cancer risk means a 1 in 10,000 excess cancer risk or 1 additional cancer in a population of 10,000 people as a result of exposure to site contaminants. Superfund generally considers remedial action warranted when risks are greater than the acceptable risk range of 1 in 10,000 to 1 in 1,000,000 (1×10^{-4} to 1×10^{-6}).

Non-cancer health effects are evaluated using a hazard quotient (HQ) approach, calculated as the exposure concentration relative to a reference dose representing an exposure unlikely to cause adverse health effects. An HQ less than 1 indicates that adverse health effects are unlikely. In general, the more the HQ is greater than 1, the greater the level of concern. However, the HQ is not a statistical probability, nor does the level of concern increase linearly. EPA also examines the hazards posed by groups of chemicals with the same non-cancer toxic endpoint using the hazard index, or HI. The HI is computed by summing the HQs of all chemicals with the same toxic endpoint. The significance of HI values is evaluated in a manner identical to that of HQ values.

Contaminants that exceed a 1×10^{-6} cancer risk or have HQ or HIs exceeding 1 are typically those that will be addressed by the remedial action and are referred to as COCs in the Proposed Plan.

Conclusions of the BHHRA

The lifetime cancer risk from exposure to contaminants in surface soils ranged from 4×10^{-5} to 2×10^{-4} for future residential tribal members. The primary contaminants contributing to risk estimates include arsenic, dioxin/furans, and PCBs. Estimated risks in the perimeter DUs are generally equivalent to background.

Estimated risks for the non-residential tribal members and visitor center worker scenarios were within or less than EPA's acceptable risk range.

Potential for adverse health effects from lead was evaluated through the use of an exposure model that can be used to predict blood lead concentrations in exposed individuals and estimate the probability of a blood lead concentration exceeding a level of concern. This model informs whether exposure to lead meets the risk reduction goal for a contaminated site. The risk reduction goal for this Site is to limit the probability of a child's blood lead concentration exceeding 5 µg/dL at a 95 percent confidence level. Concentrations of lead in soil were predicted to result in a blood lead concentration greater than 5 µg/dL in children in several DUs for the tribal residential scenario. The evaluations for all other scenarios did not predict blood-lead levels of concern.

Ecological Risks

EPA completed a baseline ecological risk assessment (BERA) (Appendix G of the RI Report) in 2023 to assess the risks to ecological receptors from exposures to site contaminants. The BERA considered potential impacts to wildlife, aquatic life, invertebrates, and plants from direct contact with the chemicals in surface water, sediment, and soil. Invertebrates include organisms like worms and insects that live in the soil and sediment and play important roles in ecosystems.

The BERA concluded that potentially unacceptable risks to plants, invertebrates, and wildlife from exposure to chemicals in soil and sediment are possible throughout the dump extent. Potentially unacceptable risks to aquatic invertebrates that live in sediment are possible in the upper reaches of East and West Creeks within the dump extent. No unacceptable risks for aquatic life from surface water exposures. Outside the dump extent, the estimated risks were similar to background conditions.

WHAT IS ECOLOGICAL RISK AND HOW IS IT CALCULATED?

A CERCLA Baseline Ecological Risk Assessment (BERA) is an analysis of the potential adverse effects to biota caused by hazardous substance releases from a site in the absence of any actions to control or mitigate these under current and future land and resource uses. The process used for assessing site-related ecological risks includes:

Problem Formulation: In this step, the contaminants of potential ecological concern at the site are identified in a manner similar to the BHHRA.

Exposure Assessment: In this step, a quantitative evaluation is made of what plants and animals are exposed to and to what degree they are exposed.

Ecological Effects Assessment: In this step, literature reviews, field studies or toxicity tests are conducted to describe the relationship between chemical contaminant concentrations in sediment (toxicity reference values) or in tissue (critical tissue levels) and their effects on ecological receptors, on a media-, receptor- and chemical-specific basis.

Risk Characterization: In this step, the results of the previous steps are used to estimate the risk posed to ecological receptors. Individual risk estimates for a given receptor for each chemical are calculated as a hazard quotient (HQ), which is the ratio of contaminant concentration to a given toxicological benchmark. In general, the more the HQ is greater than 1, the greater the level of concern. However, the HQ is not a statistical probability, nor does the level of concern increase linearly.

The risk to ecological receptors is then described, including the overall degree of confidence in the risk estimates, summarizing uncertainties, citing evidence supporting the risk estimates and interpreting the adversity of ecological effects.

Basis for Taking Action

The Preferred Alternative, or one of the other active measures considered in this Proposed Plan, is necessary to protect public health or welfare and the environment from actual or threatened releases of hazardous substances into the environment.

Arsenic, lead, dioxin/furans, and PCBs present unacceptable risks to human and ecological health within the footprint of the Warmhouse Beach Dump.

WHAT ARE THE PRIMARY CONTAMINANTS OF CONCERN?

EPA has identified several contaminants in the soil and sediment in the Warmhouse Beach Dump. Of the contaminants detected in the dump area, the following pose the greatest risks to human health and the environment.

Polychlorinated biphenyls (PCBs) are man-made chemicals banned from further production in the U.S. in 1979. However, they persist in the environment and can accumulate in fish and shellfish. PCBs may affect the immune system and may cause cancer in people. PCBs can also affect learning abilities in children.

Arsenic is a naturally occurring element that is widely distributed in the Earth's crust. It is found in water, air, food, and soil. Arsenic compounds have been widely used as wood preservatives and as pesticides. These uses and other industrial activities can result in much higher concentrations of arsenic in soil than would be present naturally. Exposure to arsenic can increase the risk of certain types of cancer and other health effects.

Lead is a naturally-occuring element. There are many sources of lead in the environment including lead-based paints, construction supplies, and batteries. Exposure to lead can result in neurotoxicity and development delays and behavioral changes in children.

Dioxins and furans are by-products of burning (either in natural or industrial settings), chemical manufacturing, and metal processing. Dioxins are persistent in the environment can accumulate in fish and humans. Specific toxic effects related to dioxins include reproductive effects, effects on fetal/early childhood development, immune system function, and an increased risk of certain types of cancer.

Additional COCs include metals and organic chemicals that are in the soil and sediment at concentrations that are considered to have the potential to adversely affect human or ecological health. Human health COCs and Ecological COECs are presented in Table 1.

Remedial Action Objectives and Preliminary Cleanup Goals

In accordance with the NCP, EPA developed remedial action objectives (RAOs) to describe what the cleanup is expected to accomplish to protect human health and the environment. RAOs help focus the development and evaluation of remedial alternatives and form the basis for establishing preliminary remediation goals (PRGs). Final RAOs and cleanup levels (CULs) will be included in the ROD. The RAOs for the Warmhouse Beach Dump are listed below.

RAOs for Protection of Human Health

- RAO 1: Reduce cancer and noncancer risks to people from incidental ingestion of and dermal contact with COCs in soil to exposure levels that are acceptable for future residential and ceremonial uses.

- RAO 2: Prevent potential current and future unacceptable risks to people from direct contact with lead in soil at concentrations greater than the cleanup level

RAOs for Protection of Ecological Receptors

- RAO 3: Reduce ecological hazards resulting from direct contact exposures to contaminants of ecological concern (COECs) in contaminated soil to levels protective of terrestrial plants and soil invertebrate communities.
- RAO 4: Reduce ecological hazards resulting from incidental ingestion and food chain exposures to COECs in contaminated soil to levels protective of invertivore birds and mammal populations.
- RAO 5: Reduce ecological hazards resulting from direct contact exposures to COECs in contaminated sediment in East and West Creeks to levels protective of sediment-dwelling aquatic invertebrate communities.

RAO for Minimizing Contaminant Migration

- RAO 6: Prevent the migration of COCs/COECs in soils at concentrations that would result in unacceptable human health and/or ecological risks.

Preliminary Remediation Goals

Preliminary remediation goals (PRGs) represent concentration of contaminants that are protective of human health and the environment. In developing PRGs, EPA considers applicable or relevant and appropriate requirements (ARARs), acceptable exposure levels, and other factors such as background levels of contaminants in various media, and other pertinent information. The Record of Decision (the next step of the Superfund process) considers the PRGs and documents the final cleanup levels based upon risk. Where background concentrations are greater than risk-based values, background was selected as the PRG consistent with the NCP and EPA guidance. PRGs are presented in Table 1.

Summary of Remedial Alternatives

This section presents the remedial alternatives considered to address the risks at the Warmhouse Beach Dump and meet the RAOs. These alternatives were developed following the requirements established in CERCLA and the NCP.

- **Alternative 1** – No Action
- **Alternative 2** – In-Place Containment of Contaminated Media with Controls
- **Alternative 3** – Excavation and Off-Site Disposal of Shallow Contaminated Media and In-Place Containment of Remaining Contaminated Media with Controls
- **Alternative 4** – Excavation and Off-Site Disposal of Contaminated Media

Remedial Technologies Applied to the Alternatives

The following subsections present some of the remedial components that may be utilized by one or more of the alternatives considered. These are described in more detail in the feasibility study report (EPA 2025).

Makah Engagement

- EPA will coordinate with the Makah about removing trees/vegetation, old growth forests, and remedial activities within areas of cultural significance.

- An archaeologist will be present to monitor for encounters with sensitive materials, cultural resources, or artifacts during access road construction and work performed in areas on the periphery of the dump.
- EPA will work with the Makah Tribe to select appropriate species for revegetation of creek habitat.

Reestablishment of Creeks

All constructed alternatives include regrading and reestablishment of the creeks through regrading of slopes and revegetation with native plants compatible with riparian habitat.

Road Improvements

All constructed alternatives rely on transportation of materials on existing gravel roads to the Site. The existing access road would need to be widened and resurfaced to be used for the transportation of wastes and construction materials during the remedial action. A Tribal, archeological discovery plan would be needed for any work in previously undisturbed areas.

Institutional Controls

Institutional controls (ICs) are advisories, limitations, or restrictions put in place to protect human health and the environment by reducing exposure to contamination left in place and to protect the long-term integrity of the engineered components of the remedy. Where some contamination may be left in place, ICs will consist of administrative controls such as signs or restrictions on digging to protect the integrity of the caps.

Operation and Maintenance (O&M)

O&M would ensure the proper functioning and integrity of the caps. The specific O&M requirements will be refined during the remedial design phase.

Monitoring

Monitoring is an integral component of all the alternatives to ensure that the selected remedy is constructed to design specifications, achieves the performance standards to evaluate short and long-term effectiveness. Where some contamination is left in place that does not allow for unrestricted reuse, monitoring will be required to ensure the caps remain intact and reliably contain the underlying contaminated material, and that surface water quality is not adversely affected.

Description of Alternatives

This section presents the remedial alternatives considered to address the risks at the Site and meet the RAOs. These alternatives were developed following the requirements established in CERCLA and the NCP.

Consistent with EPA guidance (EPA, 2000), a present value analysis was performed for the anticipated expenditures over the life of each alternative to enable a comparison of total project costs. Discount rates of zero and seven percent were used in the FS for the present value analysis, remedial action costs are typically discounted by 7 percent to account for economic growth over the period of construction and Operations and maintenance (O&M) costs, which were estimated assuming a duration of 30 years.

Alternative 1 – No Action Alternative

The Superfund process requires considering a No Action alternative, which means taking no further actions to clean up the site as a baseline comparison for other alternatives. This alternative will not achieve the RAOs or comply with ARARs.

Capital Costs:	$0
O&M Costs:	$0
Net Present Value (0%):	$0
Net Present Value (7%):	$0
Construction Timeframe:	N/A

Alternative 2 – In-Place Containment of Contaminated Media with Controls

Alternative 2 would contain all contaminated media through construction of an exposure barrier consisting of a geotextile fabric or impermeable membrane covered with approximately 72,000 tons of imported materials (soil and/or rock) for cap cover materials to contain contamination and road improvements, and revegetation of constructed areas to promote stability and control erosion. Alternative 2 would also include regrading and reestablishment of habitat in East and West Creeks. Institutional Controls Plan would identify appropriate controls (for example, warning signs) to ensure continued protectiveness of the remedy. EPA would review the remedy every five years to confirm it is performing effectively, consistent with Superfund requirements.

Capital Costs:	$16,566,000
O&M Costs:	$3,390,000
Five Year Reviews	$115,000
Net Present Value (0%):	$20,071,000
Net Present Value (7%):	**$18,015,000**
Construction Timeframe:	10 months

Alternative 3 – Excavation and Off-Site Disposal of Shallow Contaminated Media and In-Place Containment of Remaining Contaminated Media

Alternative 3 includes excavation of shallow contaminated media in the dump (l to 10 feet bgs) and disposal at an off-site facility. Approximately 60 percent of the estimated total volume of contaminated media at the dump, including contaminated sediment in East and West Creek would be removed. Excavated areas would be backfilled with soil and rock, as appropriate. Alternative 3 would include regrading and revegetating excavated areas to promote positive drainage and minimize erosion. Hazardous waste (about 5 percent of contaminated media) and non-hazardous waste (the remaining 95 percent) would be loaded into containers on-site for transport and disposal off-site to appropriate disposal facilities. The cost estimate for this alternative assumed a combination of rail and barge transportation to take contaminated media to the nearest appropriate off-site disposal facilities, which are located along the Columbia River in eastern Washington and Oregon. However, the specific transportation methods and destinations will be determined during the remedial design phase. Off-site transportation may require building temporary staging areas, road improvements, and/or additional infrastructure.

An exposure barrier would be constructed to contain the remaining contaminated media on-site that is located more than 10 feet below the ground surface, and would be constructed in the same manner as described for Alternative 2 (geotextile fabric or impermeable membrane covered with clean soil and rock). Monitoring will ensure that the cap material remains properly contained and that any potential for migration is controlled.

Capital Costs:	$67,050,000
O&M Costs:	$2,842,000
Five Year Reviews	$80,000
Net Present Value (0%):	$69,972,000
Net Present Value (7%):	**$66,012,000**
Construction Timeframe:	19 months

Alternative 4 – Excavation and Off-Site Disposal of Contaminated Media

Alternative 4 would excavate all contaminated media and dispose of it at an off-site facility. Deep excavations would require specialized heavy equipment, such as long-reach excavators, and an excavation support system, such as a soldier pile system. This alternative includes backfilling excavated areas with soil and rock, followed by regrading and revegetation to promote positive drainage and minimize erosion. East and West Creeks would be reestablished through regrading slopes, revegetation with native plants, and reestablishing creek habitat. Hazardous waste (about 5 percent of contaminated media) and non-hazardous waste (the remaining 95 percent) would be loaded into containers on-site for transport and disposal off-site to appropriate disposal facilities. The cost estimate for this alternative assumed a combination of rail and barge transportation to take contaminated media to the nearest appropriate off-site disposal facilities, which are located along the Columbia River in eastern Washington and Oregon. However, the specific transportation methods and destinations will be determined during the remedial design phase. Off-site transportation may require building temporary staging areas, road improvements, and/or additional infrastructure. Alternative 4 would not require institutional controls, long-term monitoring, or 5-year reviews because this alternative would remove the entire volume of contaminated media from the site.

Capital Costs:	$99,373,000
O&M Costs:	$0
Five Year Reviews	$0
Net Present Value (0%):	$9,373,000
Net Present Value (7%):	**$93,013,000**
Construction Timeframe:	27 months

Comparative Analysis of Alternatives

Superfund regulations require that alternatives be evaluated using nine criteria (described in the inset below). Using these criteria, the alternatives are evaluated independently, then compared to identify the relative advantages and disadvantages of each.

Threshold criteria must be achieved for an alternative to be considered under CERCLA. The Preferred Alternative is then selected based on the weight of evidence of the five balancing criteria. Two modifying criteria (state and Tribal acceptance, and community acceptance) will be evaluated based on comments received on the Proposed Plan during the public comment period. The balancing criteria weigh major tradeoffs among alternatives. The modifying criteria are Makah and community acceptance, which EPA cannot evaluate until after the public comment period on this Proposed Plan.

THE NINE SUPERFUND EVALUATION CRITERIA (40 C.F.R. § 300.430(e)(9)(iii))

The first two criteria are ***threshold criteria*** that must be met by each alternative.

1. **Overall Protection of Human Health and the Environment** evaluates whether an alternative adequately protects human health and the environment by eliminating, reducing, or controlling unacceptable risks posed by exposures to hazardous substances, pollutants, or contaminants.
2. **Compliance with ARARs** evaluates whether the alternative meets Federal and state environmental statutes, regulations, and other requirements that pertain to the site, or whether a waiver of any such requirements is justified.

The next five criteria are the ***balancing criteria*** upon which the analysis in this Proposed Plan is based.

3. **Long-Term Effectiveness and Permanence** considers the ability of an alternative to maintain protection of human health and the environment over time.
4. **Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment** evaluates an alternative's use of treatment or recycling to reduce the harmful effects of principal contaminants, their ability to move in the environment, and the amount of contamination present.
5. **Short-Term Effectiveness** considers the length of time needed to achieve protection and the risks or impacts the alternative poses to workers, the community, and the environment during implementation of the remedial action.
6. **Implementability** considers the technical and administrative feasibility of implementing the alternative, including factors such as the relative availability of goods and services.
7. **Cost** includes estimated capital and annual operations and maintenance costs, as well as net present value of these costs. Net present value cost is the total cost of an alternative over time in terms of today's dollar value. Cost estimates are expected to be accurate within a range of +50 to -30 percent.

The final two criteria are referred to as ***modifying criteria***, which will be evaluated following comments received during the public comment period and addressed in making the final remedy decision in the ROD.

8. **State/Tribal Acceptance** considers state and affected Tribes agree with EPA's analyses and recommendations, as described in the RI/FS and Proposed Plan.
9. **Community Acceptance** considers whether the local community agrees with EPA's analyses and Preferred Alternative. Comments received on the Proposed Plan are an important indicator of community acceptance.

Overall Protection of Human Health and the Environment

Alternative 1 (no action) The No Action Alternative would not be protective of human health and the environment. Contaminants in soil and sediment would continue to pose unacceptable risks to human health and the environment for the foreseeable future. Each of the remaining alternatives achieve a similar level of overall protection of human health and the environment by relying primarily on removing contaminated soil and sediment. Remaining risks are addressed through a combination of capping and institutional controls.

Compliance with Applicable or Relevant and Appropriate Requirements

Preliminary ARARs are discussed in detail in the FS Report (EPA 2025). Key federal ARARs include the Clean Water Act, the Resource Conservation and Recovery Act, the Toxic Substances Control Act, the Magnuson-Stevens Fishery Conservation and Management Act. Mitigating impacts to listed endangered species,

migratory birds, bald and golden eagles, or archaeological findings are also important considerations for all alternatives. Tribal water quality standards were also identified as an ARAR. The No Action Alternative is not expected to comply with ARARs, and therefore the No Action Alternative does not meet either threshold criteria, and therefore is not discussed further Alternatives 2, 3, and 4 would comply with the ARARs and TBCs.

Long-Term Effectiveness and Permanence

Alternative 4 provides the greatest long-term effectiveness and permanence because it would remove all contaminated media from the dump. Alternative 3 provides greater long-term effectiveness than Alternative 2 because it involved removed of contaminated media to a depth of 10 feet bgs. Alternative 2 offers the least long-term effectiveness and permanence because, though contained, all contaminated media would remain on-site.

Reduction of Toxicity, Mobility, or Volume Through Treatment

Alternative 2 would contain contaminated media to minimize migration and exposure; however, this alternative would not include any treatment. All other alternatives treat contaminated media as needed for disposal at off-site facilities; Alternative 4 would generate more wastes to be treated than Alternative 3.

Short-Term Effectiveness

All alternatives present short-term risks to the community during construction, consisting primarily of safety risks to workers and the community due to increased truck traffic from transporting material to and from the site during the period of construction. The estimated duration of construction for Alternatives 2 through 4 is approximately 10,19, and 27 months, respectively. Alternatives 3 and 4 would also present potential risks to the environment from off-site transportation, including loading contaminated media onto barges in Neah Bay Additionally, construction activities on steep slope also pose a short-term risk to workers.

Alternative 2 would require the most fill materials, while Alternatives 3 and 4 would require progressively smaller quantities of fill materials. Alternatives 3 and 4 would require transport of contaminated media off-site after excavation, with more excavation and off-site transportation for Alternative 4.

Implementability

Alternatives 2 and 3 are relatively implementable. with Alternative 3 considered slightly more difficult to implement due to the shallow excavation associated with this alternative. Alternative 4 is the most difficult to implement due to the technical challenges associated with the likely depths of waste materials and excavating on steep slopes, as well as the large amount of material moved for off-site disposal.

Cost

Alternative 2 has the lowest estimated cost ($18,015,000), followed by Alternatives 3 and 4 ($66,012,000 and $93,013,000), respectively.

Preferred Alternative

EPA’s Preferred Alternative is Alternative 3: Excavation and Disposal of Shallow Contaminated Media and In-Place Containment of Remaining Contaminated Media with Controls.

Based on information currently available, the Preferred Alternative meets the threshold criteria, and it provides the best balance of tradeoffs among the other alternatives. Alternative 3 was developed as a partial removal strategy to maximize the removal of contaminated media while considering feasibility and costs. At

$66,012,000, it is neither the least nor most expensive alternative. This alternative will meet all RAOs for the site.

The Preferred Alternative includes:

- Excavation: Shallow waste (up to 10 feet deep) would be excavated and disposed of off-site, removing about 61 percent of the total volume of contaminated source material at the dump. Excavation would also remove contaminated sediment in East and West Creeks.
- Containment: An exposure barrier would contain the contaminated media remaining on-site at more than 10 feet and eliminate exposure.
- Waste Handling and Disposal: Excavated contaminated media would be loaded into containers on-site for transport and disposal off-site. The feasibility study assumed a combination of rail and barge transportation to take contaminated media to disposal facilities located along the Columbia River in eastern Washington and Oregon. However, the specific transportation methods and destinations will be determined during the remedial design phase. Off-site transportation may require building temporary staging areas, road improvements, and/or additional infrastructure. Hazardous waste (an estimated 5 percent of contaminated media) would be treated, as necessary, either on-site or at the off-site disposal facility.
- Backfill and Revegetation: Excavated areas would be backfilled with soil and rock, as needed. Regraded slopes, drainage and erosion control features, and revegetation with native plants would reestablish East and West Creeks and maintain the existing natural drainage patterns.
- Institutional Controls, Monitoring, and Maintenance: Following construction, institutional controls and long-term monitoring and maintenance would protect and maintain the integrity of the containment and exposure barrier. These measures would ensure movement of and exposure to the remaining contaminated media would not occur. Adding more soil and rock, as needed, would maintain thickness of the barrier.

The remedial design would further refine and determine specific components of the remedy, including transportation methods. The estimated time to complete construction of the remedy under the Preferred Alternative is 19 months, or approximately two construction seasons. This would include excavation, transportation and off-site disposal, backfill, regrading, and revegetation. EPA would review the remedy every 5 years to ensure it continues to perform effectively, consistent with Superfund requirements.

Because the remaining contaminated media contained by the exposure barrier would remain permanently on-site, operations and maintenance activities, monitoring (including surface water monitoring), and institutional controls would remain in effect indefinitely. The total estimated present value cost of the Preferred Alternative is $66,012,000.

Rationale for Selecting the Preferred Alternative

The Preferred Alternative meets the threshold criteria and provides the best balance of tradeoffs among the balancing criteria. It will reduce contaminant concentrations contributing to human health and ecological risks, it will provide for long-term reliability by actively remediating approximately 8 acres of contaminated soil and sediment, and is implementable, cost-effective, and consistent with current and future uses of the site. Based on the information currently available and discussed above, the Preferred Alternative provides the best balance of tradeoffs compared to the other alternatives.

EPA encourages the public to continue to engage on this Site throughout the Superfund cleanup process. It is important that the public understands the work that is being done and has an opportunity to provide meaningful input on cleanup decisions. EPA's view is that the best remedies are developed and implemented

with the support of a well-informed community, and Superfund law requires that the public has an opportunity to read and comment on EPA's Proposed Plan for cleanup.

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Abbreviations and Acronyms

ARAR – Applicable or relevant and appropriate requirement

BERA – Baseline Ecological Risk Assessment

BHHRA – Baseline Human Health Risk Assessment

CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act

CUL – Cleanup level

COC – Contaminant of Concern

COEC – Contaminant of Ecological Concern

COPC – Contaminant of Potential Concern

EPA – United States Environmental Protection Agency

FS – Feasibility Study

HHRA – Human Health Risk Assessment

HI – Hazard Index

HQ – Hazard Quotient

IC – Institutional Control

NCP – National Oil and Hazardous Substance Pollution Contingency Plan

O&M – Operations and Maintenance

PCBs – Polychlorinated biphenyls

PRG – Preliminary Remediation Goal

RAO – Remedial Action Objective

RBC – Risk-based concentration

RI – Remedial Investigation

RME – Reasonable Maximum Exposure

ROD – Record of Decision

Site – Warmhouse Beach Dump Superfund Site

TBC – To Be Considered

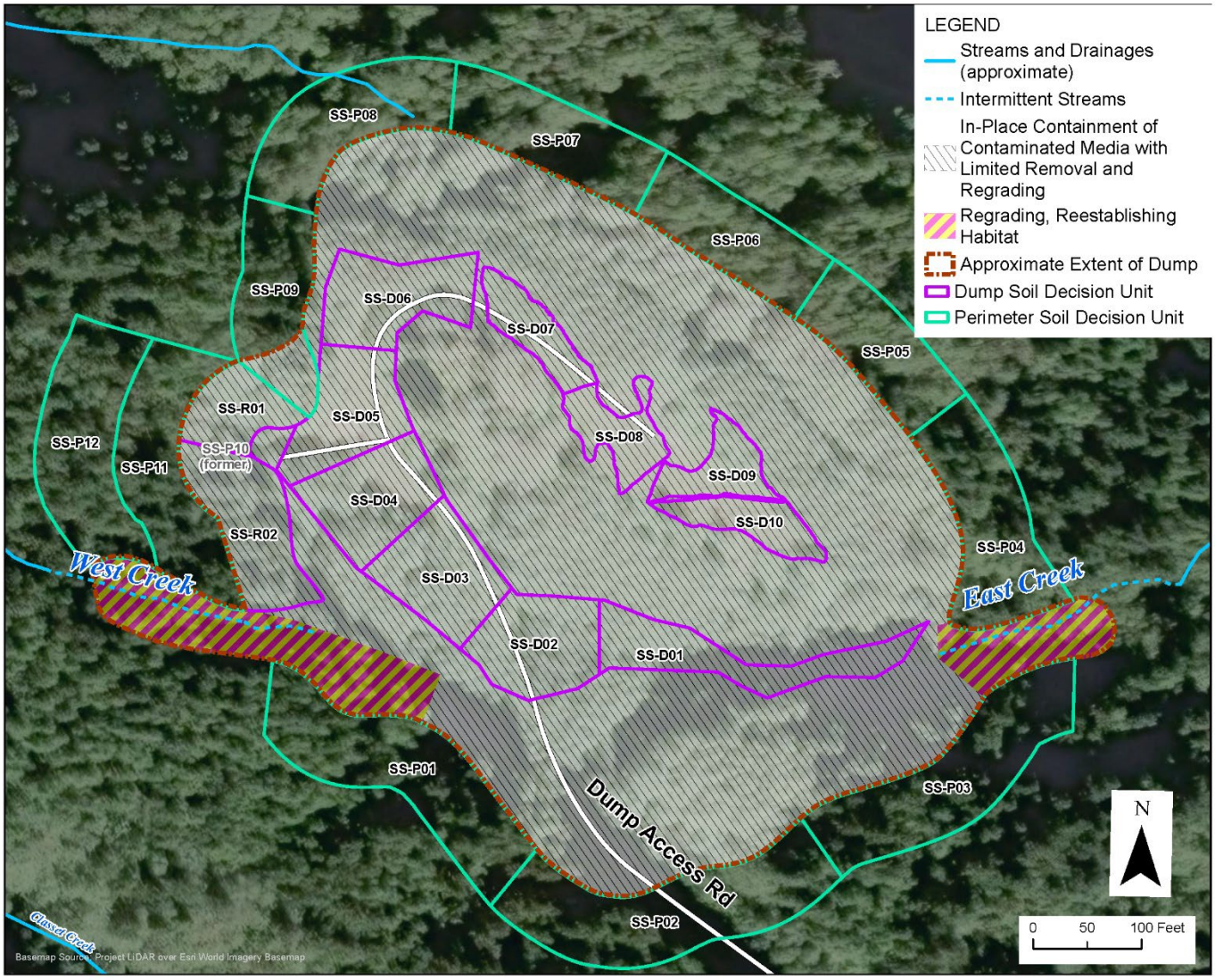

FIGURE 2. REMEDIAL ACTION CONCEPTUAL DESIGN FOR ALTERNATIVE 2

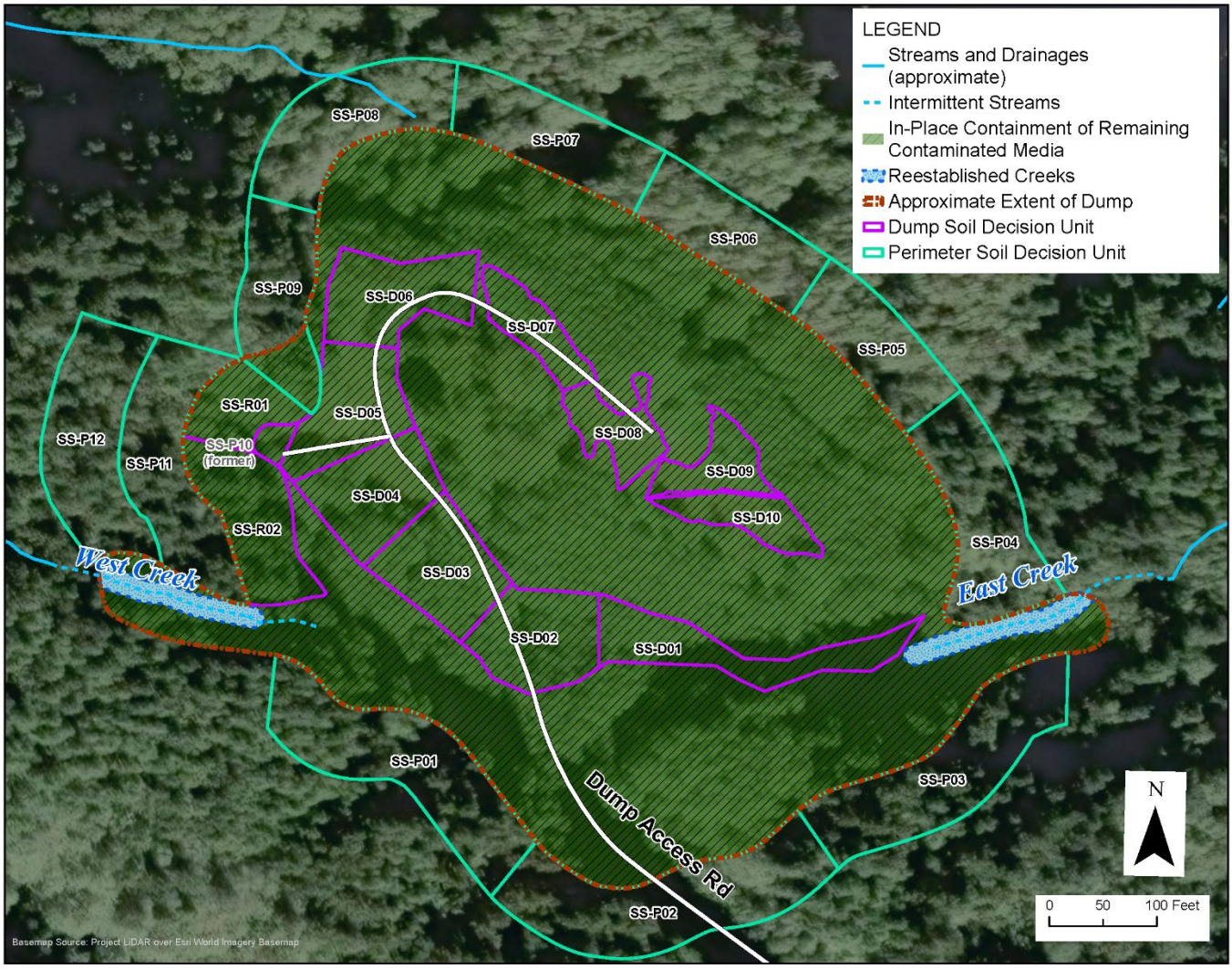

FIGURE 3. POST-REMEDIAL ACTION CONCEPTUAL DESIGN FOR ALTERNATIVE 2

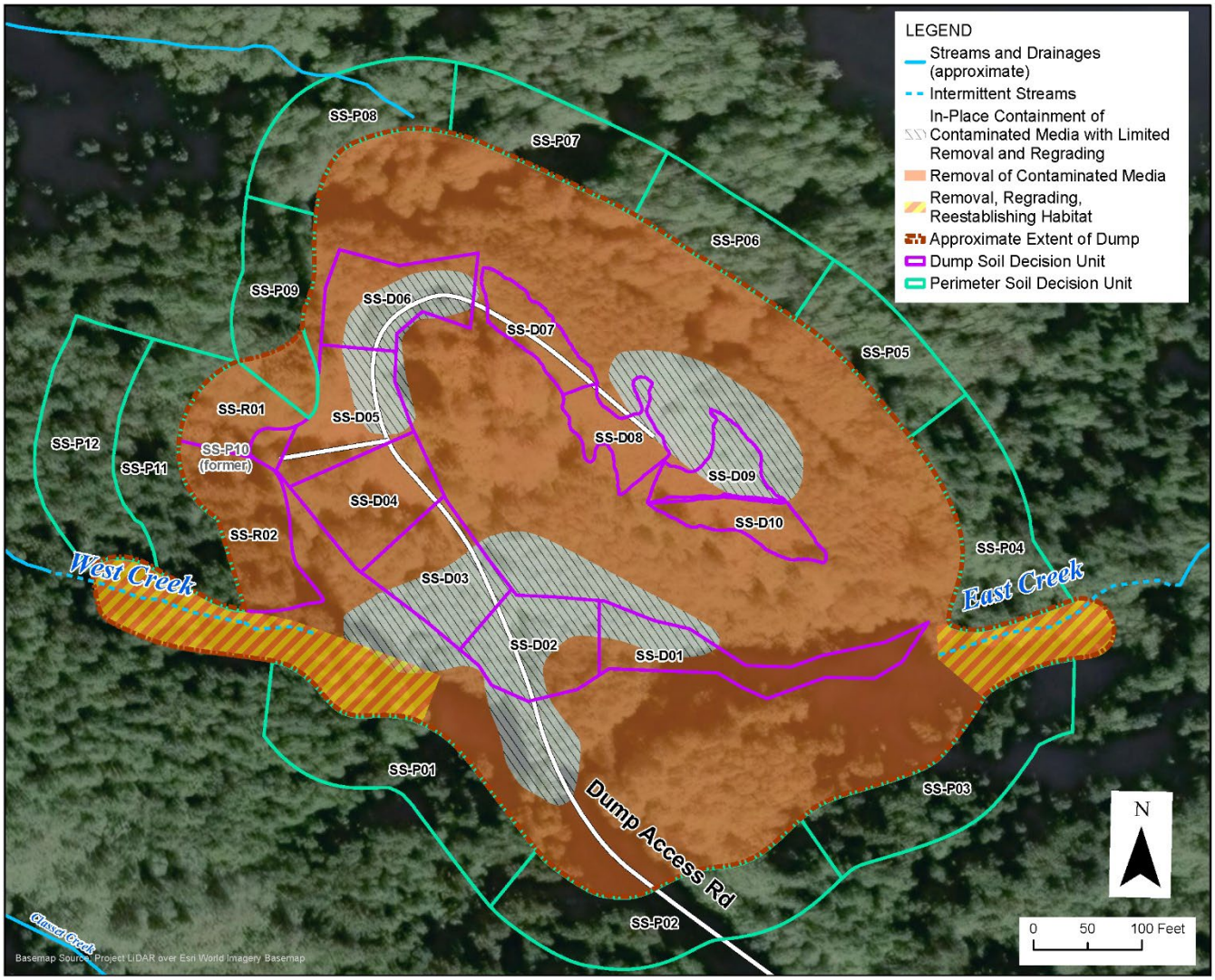

FIGURE 4. REMEDIAL ACTION CONCEPTUAL LAYOUT FOR ALTERNATIVE 3

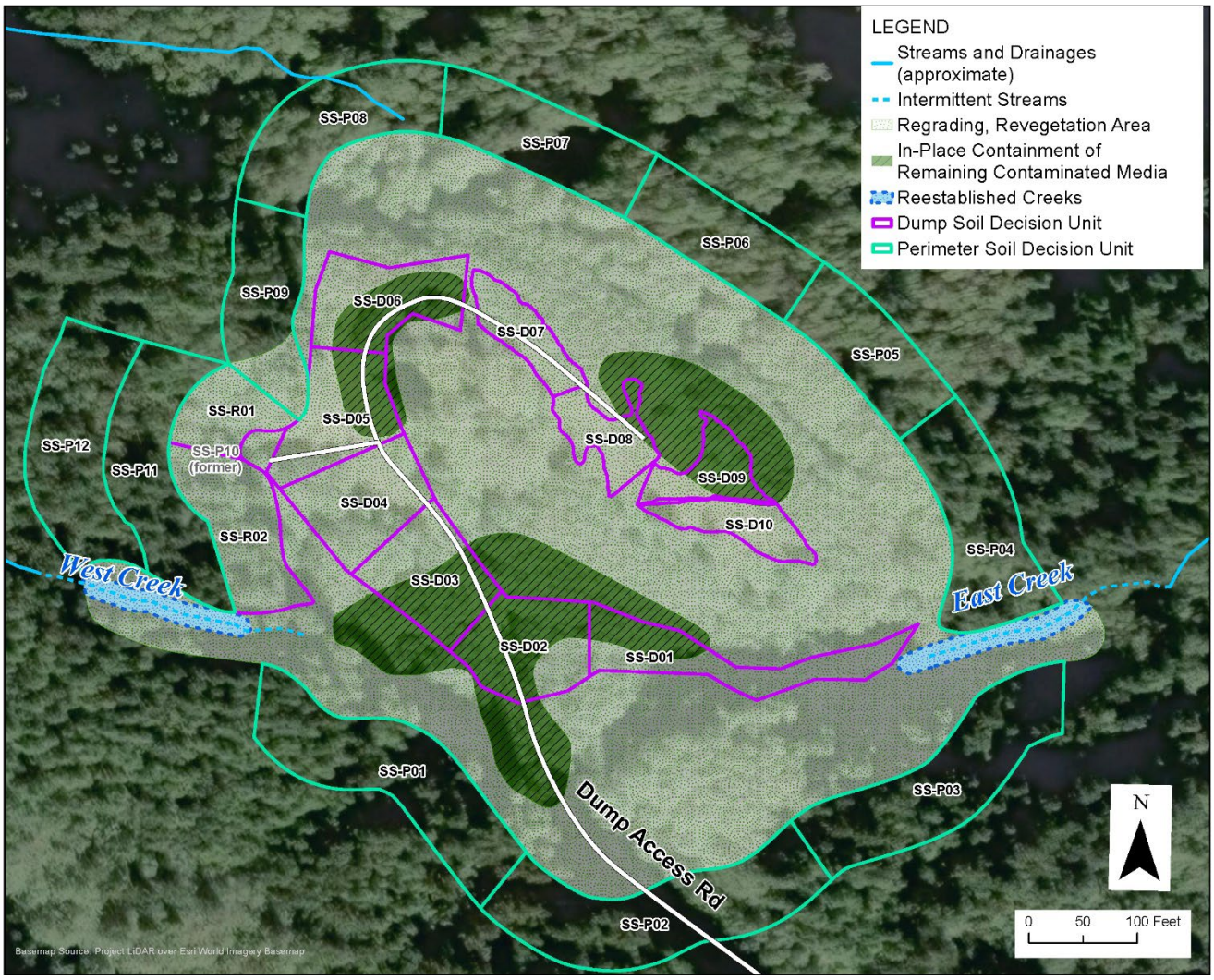

FIGURE 5. POST-REMEDIAL ACTION CONCEPTUAL LAYOUT FOR ALTERNATIVE 3

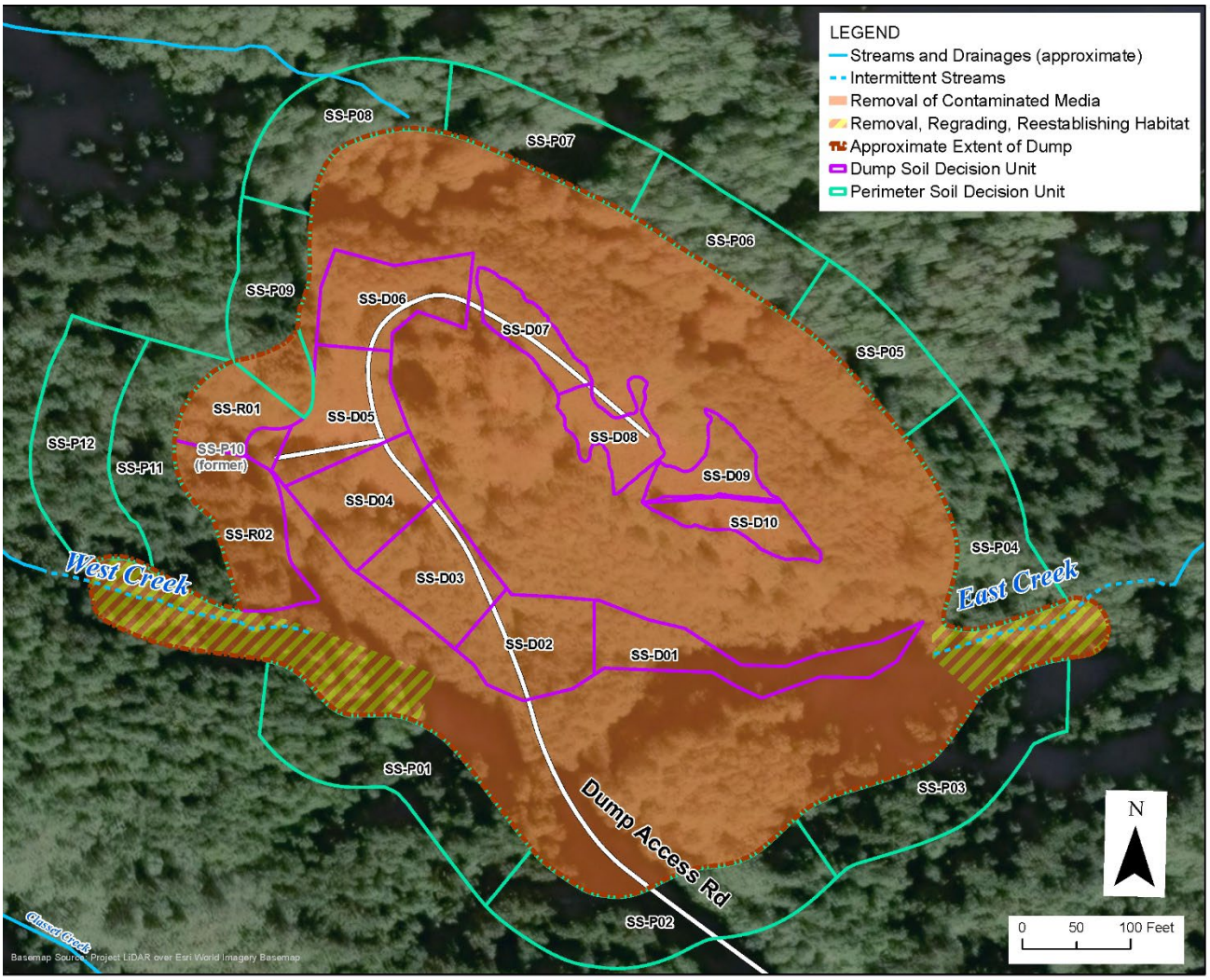

FIGURE 6. REMEDIAL ACTION CONCEPTUAL LAYOUT FOR ALTERNATIVE 4

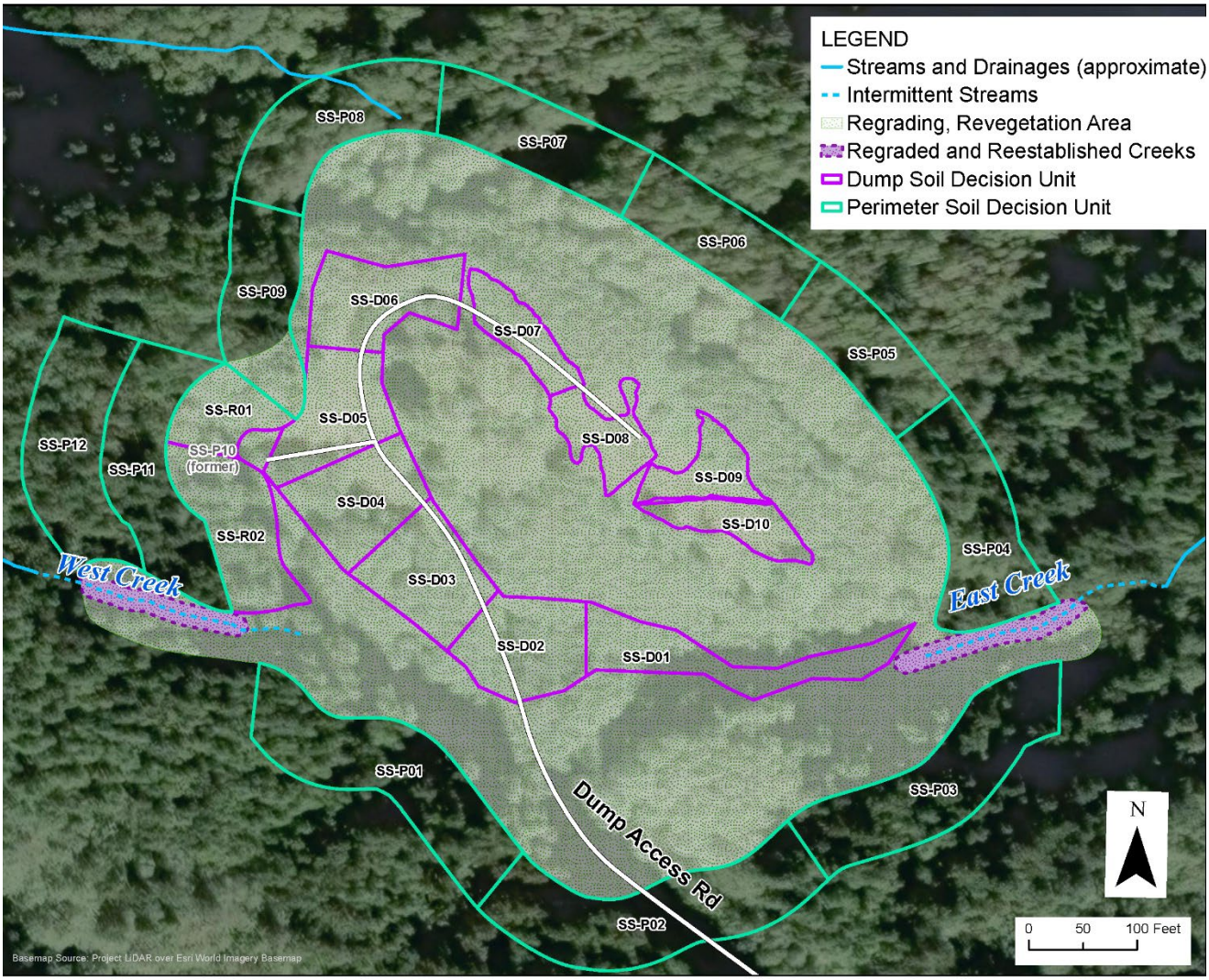

FIGURE 7. POST-REMEDIAL ACTION CONCEPTUAL LAYOUT FOR ALTERNATIVE 4

TABLE 1. RECOMMENDED PRELIMINARY REMEDIAL GOALS (PRGS) FOR CHEMICALS OF HUMAN HEALTH OR ECOLOGICAL CONCERN AT WARMHOUSE BEACH DUMP

Medium	Chemical	Human Health	Ecological	Basis
Soil	Antimony	--	0.8 mg/kg	Invertebrate-eating mammal
	Arsenic	15 mg/kg	--	Background
	Barium	--	260 mg/kg	Plants
	Cadmium	--	0.9 mg/kg	Invertebrate-eating bird
	Copper	--	53 mg/kg	Invertebrate-eating bird
	Lead	200 mg/kg	20 mg/kg	Human health: Target blood lead of 5 µg/dL Ecological: Invertebrate-eating bird
	Manganese	--	1,100 mg/kg	Plants
	Mercury	--	1 mg/kg	Soil-dwelling invertebrate
	Nickel	--	43 mg/kg	Background
	Zinc	--	81 mg/kg	Background
	Dioxin/furans	1.9 ng/kg	4.2 ng/kg	Human health: 10^{-6} cancer risk
	PCBs	95 µg/kg	50 µg/kg	Human health: 10^{-6} cancer risk Ecological: Soil-dwelling invertebrates
	Bis(2-ethylhexyl)phthalate	--	<70 µg/kg	Background detection limit
Sediment	Manganese	--	1,100 mg/kg	Sediment-dwelling invertebrate
	Nickel	--	49 mg/kg	Sediment-dwelling invertebrate
	Zinc	--	460 mg/kg	Sediment-dwelling invertebrate
	PBDEs (BDE-99, BDE-100)	--	<1.1 µg/kg	Background detection limit

mg/kg = milligrams per kilogram; µg/kg = micrograms per kilogram, ng/kg = nanograms per kilogram, µg/dL=micrograms per deciliter