PROPOSED PLAN

Cleanup Action at Operable Unit 1 (Site A)

Naval Base Kitsap Bangor
Silverdale, Washington

May 2024

INTRODUCTION

This Proposed Plan for a Record of Decision (ROD) Amendment presents rationale for a proposal to amend the cleanup actions at Operable Unit (OU) 1, also known as "Site A" or Ordnance Disposal Site, at Naval Base Kitsap (NBK) Bangor in Silverdale, Washington (Figure 1). The proposed amendment to the ROD is needed to continue to protect human health and the environment by changing the groundwater remedial strategy.

The U.S. Navy (Navy) is seeking comments from the public on the proposed amendment to the ROD. Information will be provided regarding the cleanup of Site A to the public through a public meeting, the Administrative Record file for Site A, and an announcement published in the Kitsap Sun. The public is encouraged to gain a comprehensive understanding of NBK Bangor and the remedial activities that have been conducted at Site A. The dates for the public comment period and public meeting details are provided in the box below. The public is encouraged to review and comment on all aspects of this proposed plan.

The ROD was issued by the Navy, United States Environmental Protection Agency (USEPA), and Washington Department of Ecology (Ecology) on December 20, 1991. The OU 1 ROD was signed pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986.

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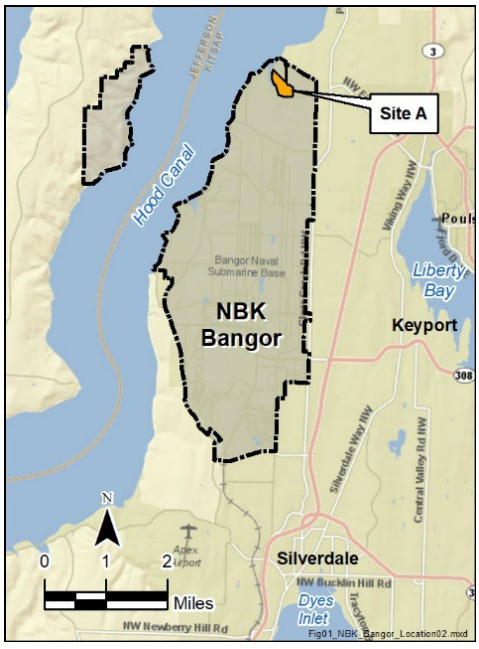


Figure 1. Site A Location

The purpose of the ROD Amendment is to revise the existing selected remedy to add treatment to the perched zone through an expanded pump and treat system or biostimulation in the perched zone and/or shallow aquifer. The addition of expanded pump and treat and/or biostimulation will allow direct treatment of munitions constituents (MCs) in the source area to expedite site cleanup. Five remedial alternatives were evaluated as part of a focused feasibility study (FFS) completed on September 6, 2022. Four active treatment alternatives (Alternative 1 and Alternatives 3 to 5) and one passive treatment alternative (Alternative 2) were developed. Alternative 1, the current treatment in place at Site A, is included for comparison to the other alternatives. Other alternatives evaluated include biostimulation in both the perched zone and shallow aquifer (Alternative 2), active groundwater treatment within the perched zone and shallow aquifer such as expanded pump and treat (Alternative 3), and a combination of biostimulation of the perched zone and pump and treat of the shallow aquifer (Alternatives 4 and 5). The preferred alternative (Alternative 4) was selected by the Navy during the FFS is the subject of this Proposed Plan.

In January 1990, the Navy, USEPA, and the Washington State Department of Ecology (Ecology) entered into a Federal Facility Agreement (FFA) to ensure that environmental impacts associated with past practices at the base are investigated and remedial actions are completed as needed to protect human health and the environment. This document is issued by the Navy, as owner and operator of this Federal facility and lead agency for Site

The Navy invites you to:

- **Comment on the Proposed Plan, May 13 to June 12, 2024.**
- **Attend a Public Meeting, May 15, 2024, 5:00 PM, JPHC Landings Community Center, 2785 Cascades Pass Blvd, Bremerton, WA 98312.**

A, the USEPA, as lead regulatory agency, and Ecology, as a key stakeholder within the FFA. This Proposed Plan has been prepared as part of public participation responsibilities under CERCLA § 300.430 (f)(3) and applicable provisions of the National Oil and Hazardous Substance Pollution Contingency Plan, and summarizes information that can be found in greater detail in the FFS, site investigation reports, remedial action reports, and other documents. These documents are contained in the Administrative Record that is maintained at NBK Bangor, 1101 Tautog Circle (Building 1101, 2nd floor), Silverdale, Washington. Members of the public may review these items by contacting the Naval Facilities Engineering Systems Command Northwest (NAVFAC NW) Public Affairs Officer, Sarah Lincoln, at navfacnwpao@us.navy.mil or at NAVFAC NW public website. The Navy and USEPA encourage the public to review these documents in order to understand the remedial activities conducted at Site A to date.

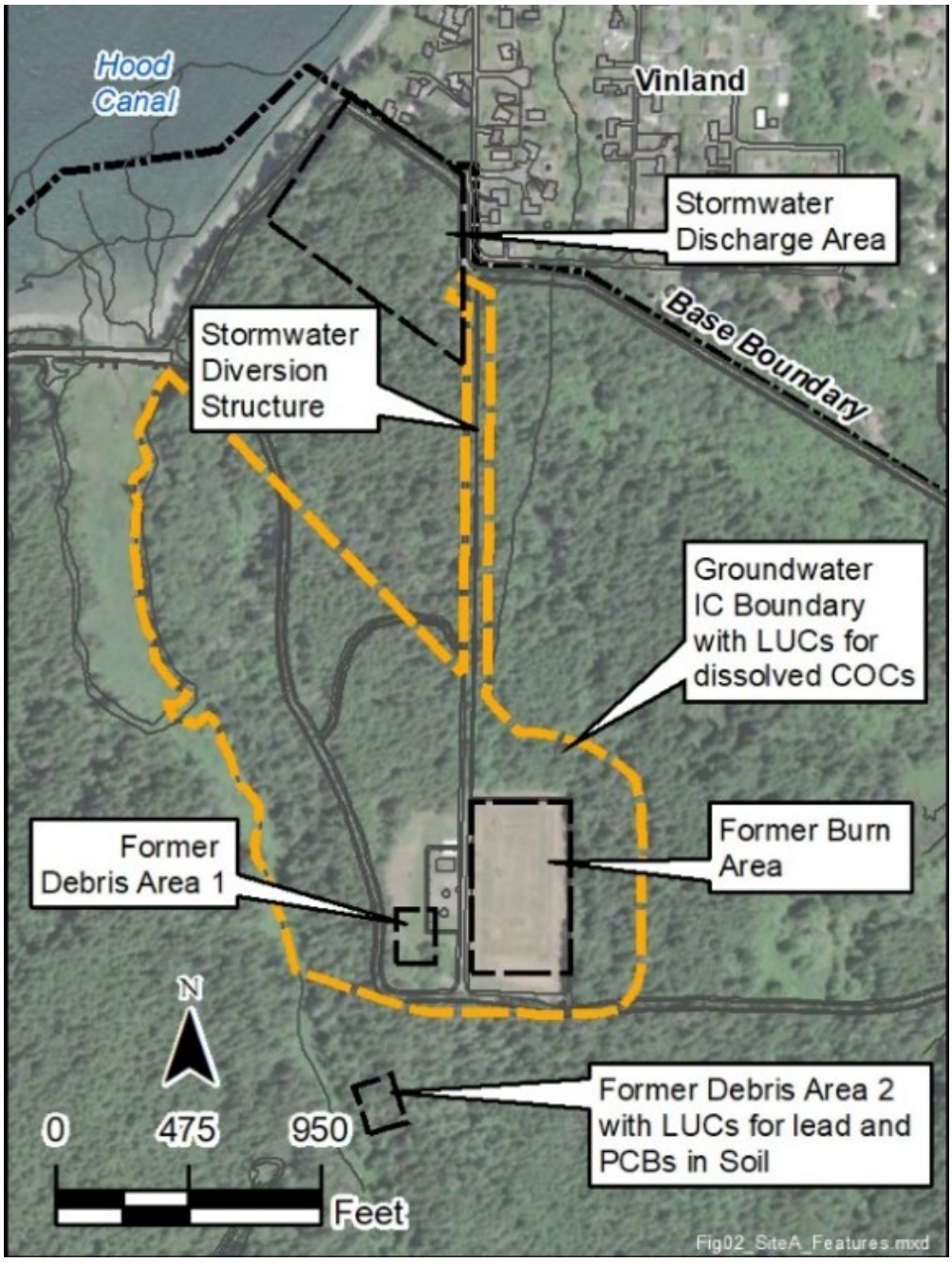


Figure 2. Site A Features

As the lead agency, the Navy, in consultation with USEPA (lead regulatory agency) and Ecology (key stakeholder) will issue the ROD Amendment after reviewing and considering all information submitted during the 30-day public comment period. The Navy, in consultation with the USEPA and Ecology, may modify the Preferred Alternative or select another response action presented in this Plan based on new information or public comments. Therefore, the public are encouraged to review and comment on all aspects of the Proposed Plan for a ROD Amendment. Following comment resolution (as necessary) and signature by the Navy, the ROD Amendment will be placed in the Administrative Record and a notice of availability will be published.

SITE BACKGROUND

Naval activities began at Bangor in 1944 when the U.S. Naval Magazine, Bangor was officially established as a Pacific shipment point for ordnance. The Bangor Naval complex primarily functioned as an ammunition depot from 1950 to 1973. In 1973, the Secretary of the Navy announced that SUBASE Bangor had been selected as the West Coast homeport for the Trident Submarine Launched Ballistic Missile System. SUBASE Bangor was commissioned in 1977. The first submarine arrived in 1982. NBK was created in 2004 by merging the former Naval Station Bremerton with Naval Submarine Base Bangor. The Mission of NBK is to serve as the host command for the Navy's fleet throughout West Puget Sound and to provide base operating services.

Site A was historically used as an explosive ordnance disposal facility located in the northern portion of NBK Bangor (Figure 1) and consists of a 12-acre ordnance disposal site. Notable site areas include the following: Burn Area, Debris Areas 1 and 2, and Stormwater Discharge Area (as shown in Figure 2). From 1962 to 1975, the Navy used Site A to detonate and incinerate various MCs. The site originally consisted of burn mounds, facilities for personnel, fire suppression vehicles and equipment, an incinerator for ammunition, and a blast pit for ordnance

detonation. These past practices contaminated soil and groundwater at the site.

Buildings at the site were demolished and burned on site in 1977. Grading and soil disruption/distribution at the Site A Burn Area continued through 1984. In 1983, the Navy built a stormwater diversion structure to move surface water discharges from the Site A Burn Area to the Stormwater Discharge Area, to minimize potential contamination to Vinland (a nearby community north of Site A). Once in the Stormwater Discharge Area, runoff travels into a shallow zone through porous surface soils and then exits near the beaches of Hood Canal. Table 1 presents a timeline of Site A investigation and regulatory activities.

Table 1. History of Cleanup Action at NBK Bangor Site A

1972	500 cubic feet of MC-bearing soil was excavated from the top several feet of the former lagoon at Site F and taken to Site A
1978	Assessment and Control of Installation Pollutants program began to evaluate waste disposal sites, including Site A
1981	Work continued at Site A as part of an Initial Assessment Study conducted at SUBASE Bangor
1986	A Characterization Study was conducted at Site A under the Navy Assessment and Control of Installation Pollutants program
1987	Site A was placed on National Priorities List as the Bangor Ordnance Disposal Site
1988	A Current Situation Report was prepared to analyze existing data at Site A to identify data gaps and the need for Interim Remedial Measures
1988-1989	Field investigations were conducted from April 1988 to March 1989 as part of the Site A Management Plan and field investigations of groundwater, surface water, sediment, and shellfish tissue were conducted between August and October 1989
1990	The Navy, EPA, and Ecology entered into a Federal Facility Agreement
1988-1991	A Remedial Investigation/Feasibility Study was conducted and a ROD for Site A was prepared
1993	Remedial action for soil of Burn Area began by forming a lined leach basin to conduct soil washing for removal of ordnance compounds
1994	ESD No. 1 was issued to amend the ROD remedy
1997	Remedial action for Burn Area soil and construction of pump and treat system to begin groundwater remedial action were completed
1998	ESD No. 2 was issued to amend the ROD remedy by adding composting for soil and granular activated carbon for groundwater treatment
2000	ESD No. 3 was issued to amend the ROD remedy for leachate discharge and the first five-year review (FYR) was completed
2005	Second FYR was completed
2010	Third FYR was completed
2013	RDX biodegradation potential at Site A was evaluated
2015	Fourth FYR was completed
2017-2018	Additional site characterization was performed, focused on defining the vertical extent of contamination in the shallow aquifer and installing wells to support pilot tests of in situ RDX degradation
2019	Monitored natural attenuation evaluation, RDX fate and transport assessment, and trench pilot test optimization at Site A were completed
2020	Fifth FYR was completed
2022	FFS report (basis for this Proposed Plan) was completed
2023	Initiate a pilot test for the perched zone to assess the ability to distribute the bacterial nutrient fructose (carbon substrate) effectively (ongoing)

Public participation activities related to ongoing investigations and cleanup activities at NBK Bangor have occurred throughout the history of the project, guided by a community relations plan last updated in July 2009. The Navy previously has conducted Restoration Advisory Board (RAB) meetings (active from 1995 to 2005), town hall meetings hosted by the Commanding Officer, and other meetings to address specific issues of public interest. The Navy continues to publish information about the progress of investigation and cleanup activities in project-specific notices.

SITE CHARACTERISTICS

Site A is located on a flat upland surrounded by steep slopes at an elevation of between 150 and 180 feet. Land use immediately adjacent to Site A is undeveloped forest land, with Cattail Lake downhill to the west and the off-base community of Vinland located approximately 2,000 feet to the north. Hood Canal, which borders NBK Bangor, is located to the west of Site A, Vinland, and Cattail Lake.

Groundwater occurs in two zones at Site A, as illustrated conceptually in Figure 3. The first is the perched zone, which extends from ground surface to depths of approximately 20 feet. The perched water is seasonal and fed by infiltrating rainfall. Water in the perched zone, when present, is found at depths typically ranging from 10 to 20 feet below ground surface. The perched water sits on less permeable glacial till

that slows the downward movement of water and separates the perched zone from the underlying shallow aquifer. The second zone is the shallow aquifer at a depth of 70 to 90 feet below the site, which holds water in the pores of sand and silt sediment that underlies the glacial till. Groundwater in the shallow aquifer beneath the former Burn Area flows toward the west-northwest and empties into the Cattail Lake drainage and Hood Canal. The shallow aquifer is not used as a drinking water source at NBK Bangor. Periodic sampling of the drinking water supply wells on Base and offsite shows no impact to the sea level aquifer.

Extent of Contamination

In addition to the typical operations of detonating and incinerating ordnance at Site A, 500 cubic feet of ordnance-contaminated soil was excavated from the top several feet of the former lagoon at Site F in 1972 and moved to Site A Burn Area for disposal. As a result of these activities, soil, surface water, and groundwater within areas of Site A have been contaminated with different types and quantities of MCs, their breakdown compounds, and metals.

The OU 1 Record of Decision (ROD) identified 2,4,6-trinitrotoluene (TNT), 2,4-dinitrotoluene (DNT) and 2,6-DNT, RDX, and lead as the chemicals of concern (COCs) in soil and groundwater at Site A. Cleanup of soil has been completed and the remedial action completion report was finalized in 2008 with no further action required except for land use controls in one area of Site A (Figure 2). This Proposed Plan focuses on groundwater only. Groundwater contaminated with RDX, TNT, and DNT is the target of cleanup actions at Site A, with RDX as the most prevalent contaminant. Figure 4 illustrates the approximate extent of the RDX-contaminated groundwater plume within the perched zone and underlying shallow aquifer at Site A with a depth of approximately 100 feet below ground surface and the length of the plume being approximately 500 feet in both the north-south and east-west directions. As of 2012, approximately 6,000 grams of RDX were estimated to be in the shallow aquifer soil and water, with 2,000 grams of that in water.

The RDX plume appears stable, with concentrations having reduced substantially since the 1990s. The current RDX plume has shifted in the direction of groundwater flow approximately 250 feet beyond the leach basin, with RDX concentrations decreasing throughout the plume at a slow rate. The estimated area of RDX in groundwater of the shallow aquifer is shown on Figure 4.

Current Land Uses

Site A is currently used for occasional explosive ordnance detonation. Other current activities at the site are limited to remediation of MCs in environmental media. These activities include operation and maintenance (O&M) and long-term monitoring (LTM) of the existing groundwater extraction and treatment facility (known as the "pump and treat system") and associated groundwater well network (Figure 4).

Additional site pilot testing to assess use of biostimulation to degrade RDX in the perched zone, which will be used to inform the remedial design, is ongoing at the time of preparation of this Proposed Plan. No changes in land use are expected in the foreseeable future.

GLOSSARY

Aquifer – A saturated underground layer of permeable rock, sediment (usually sand or gravel), or soil that yields water.

Aquitard – a geologic formation or stratum that lies adjacent to an aquifer and that allows only a small amount of liquid to pass.

Biodegradation – A process by which microbial organisms transform or alter (through metabolic or enzymatic action) the structure of chemicals introduced into the environment.

Biostimulation – Addition of an electron donor (carbon substrate such as fructose) and a pH buffer (such as bicarbonate) to a population of micro-organisms to stimulate growth and activity during bioremediation.

Carcinogenic – Capable of causing cancer.

Chemicals of Concern (COCs) – Chemicals that are believed to be site-related contaminants and pose risks to human health or the environment.

Cleanup Level – The concentration of a chemical in soil, water, air, or sediment that is protective of human health and the environment under specified exposure conditions.

Downgradient – The direction to which groundwater flows in an aquifer.

Exposure Pathway – The physical route by which a contaminant moves from a source to a biological organism (the receptor).

Groundwater – The supply of fresh water found beneath the earth's surface (usually in aquifers), which is often used for supplying wells and springs.

Greenhouse Gas (GHG) – Any of the atmospheric gases that contribute to the greenhouse effect by absorbing infrared radiation, including carbon dioxide, methane, nitrous oxide (N_2O), and fluorinated gasses.

Institutional Control (IC) – Any restriction or administrative action arising from the need to reduce the risk to human health and the environment.

Land Use Control (LUC) – Any restriction or administrative action, including institutional or engineering controls, arising from the need to reduce the risk to human health and the environment.

Monitored Natural Attenuation – Naturally occurring process that removes groundwater contaminants through biological and physical processes without human intervention.

Munitions Constituents (MCs) – Any materials originating from unexploded ordnance, discarded military munitions, or other military munitions, including explosive and nonexplosive materials, and emission, degradation, or breakdown elements of such ordnance or munitions.

Perched Zone – An aquifer that occurs above the regional water table due to a low permeability layer that holds water above it at a higher elevation than the main water table/aquifer but below the land surface.

Plume – A space in air, water, or soil containing pollutants released from a point source.

Pump and Treat – A mechanical system that minimizes further off-base migration of contaminated groundwater that pumps contaminated groundwater, removes chemicals, and returns the clean water back to the aquifer.

Remediation – Any active or passive environmental activity that results in the reduction of toxicity, mobility, or volume of chemicals at a site.

Restoration Timeframe – The period of time required to achieve cleanup levels.

Risk Assessment – The determination of quantitative or qualitative risk related to a specific situation and a recognized threat.

Upgradient – The direction from which groundwater flows in an aquifer.

Water Table – The upper surface of the zone of saturation where the pores and fractures of the ground are saturated with water.

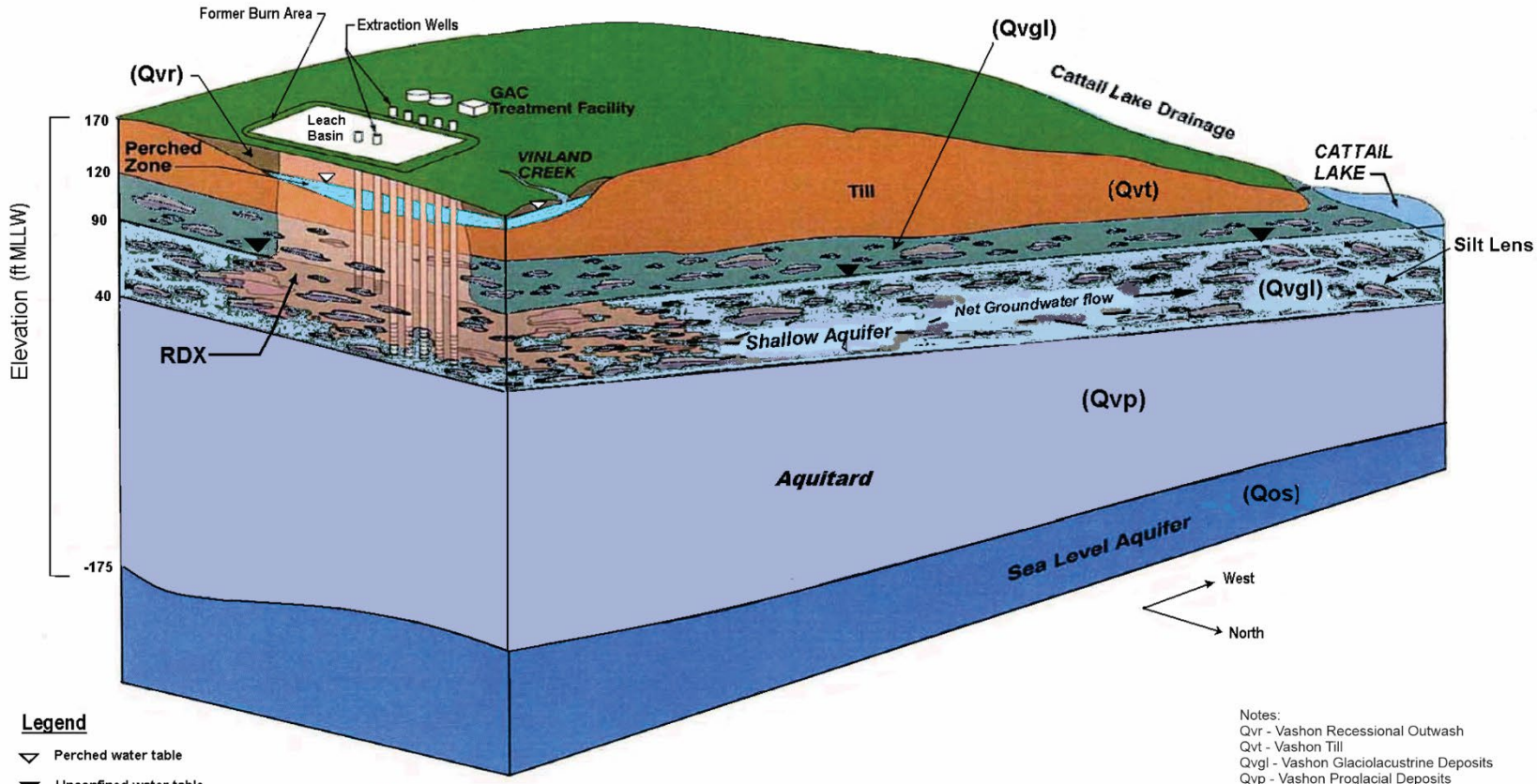
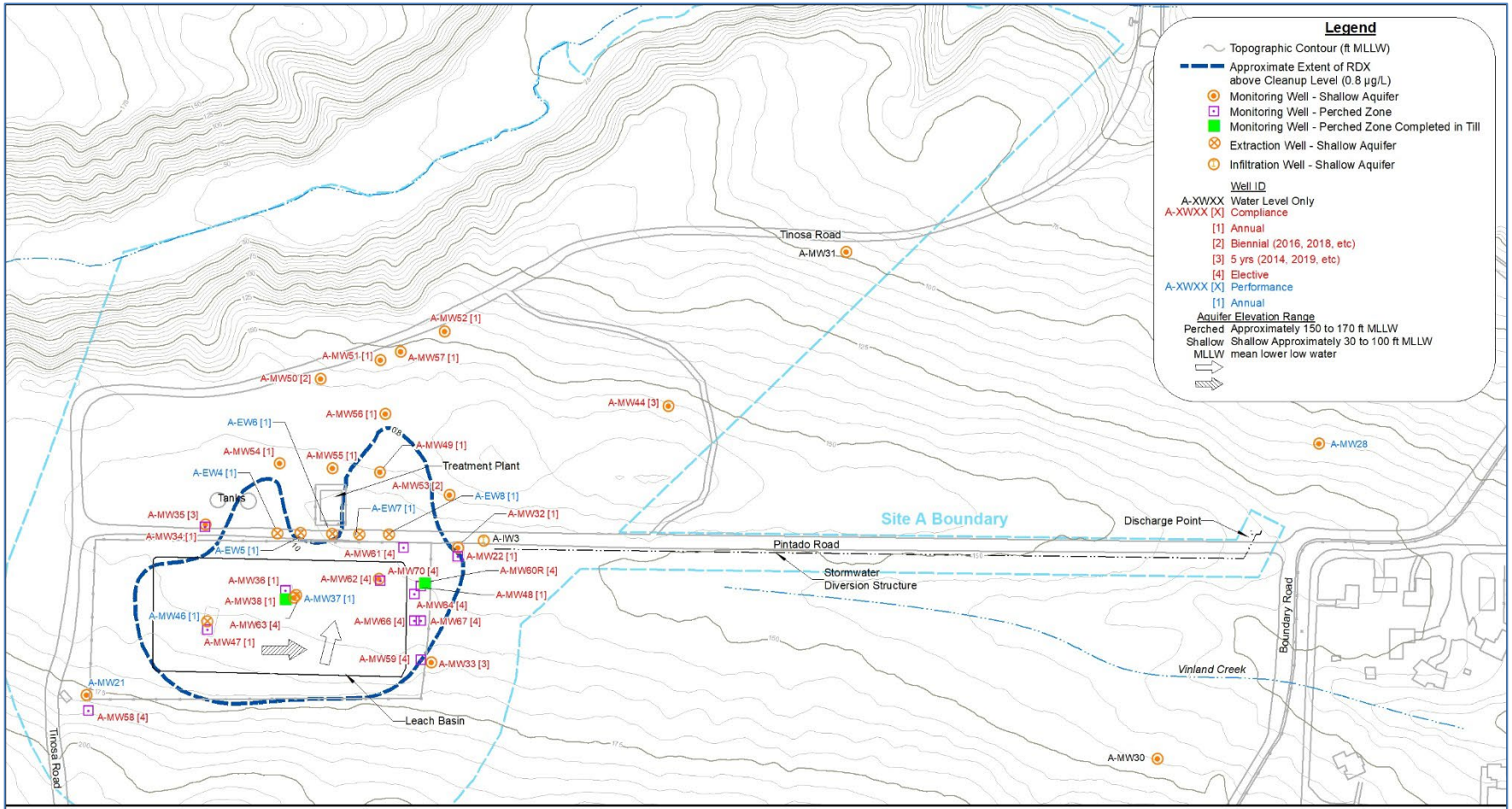


FIG03_CSM.CDR

(Modified from Hart Crowser, 2003)

U.S. NAVY	NBK Bangor Site A Proposed Plan	**Figure 3** **Conceptual Cross Section Model of Site A**



SCOPE AND ROLE OF OPERABLE UNITS

Two sites at NBK Bangor are listed on the National Priorities List (NPL). The first is Bangor Ordnance Disposal Site A (OU 1), which was listed on the NPL on July 22, 1987. On August 30, 1990, the remainder of NBK Bangor was listed on the NPL, including OUs 2 through 7 comprising 20 known or suspected hazardous waste sites. In October 1994, OU 8 was added to the FFA to include Sites 27, 28, and 29, which were originally investigated as part of OUs 3 and 7, and the Public Works Industrial Area service station. The sites were divided into eight OUs in the FFA for management purposes. Site A is geographically separate from the other OUs that comprise the second Bangor NPL Site.

No further action was recommended for OUs 4 and 5. The other six OUs have all completed the remedial construction and are in the operations and monitoring phase of the CERCLA process. The status of these OUs is detailed in the fifth five-year review.

The goal of the selected Remedial Action at Site A is to restore shallow aquifer waters for potential future drinking water use. The selected treatment technology will permanently reduce toxicity, mobility, and volume of the source materials. Reducing the principal threat of residual MCs in groundwater addresses principal and low-level risks posed by potential future water supply use of site groundwater.

SUMMARY OF SITE RISKS

The Navy evaluated the potential harmful effects from the chemicals identified at Site A in a process called a risk assessment which evaluates the chemicals called chemicals of potential concern that could potentially cause harmful effects and the ways in which people and wildlife could be exposed to those chemicals (the "exposure assessment"). The chemicals of potential concern identified in the 1991 ROD were RDX, TNT, total DNT, lead, total phthalates, and total polychlorinated biphenyls (PCBs).

Human Health Risks

No changes to the risk assessment from the 1991 ROD were made in this Proposed Plan. The risk assessment (based on workers drinking shallow aquifer groundwater) identified three MCs (2,4,6-TNT, 2,4-DNT, and RDX) in Burn Area wells as COCs for groundwater, with RDX being the biggest risk and the most persistent chemical.

The only remaining exposure pathway at the site following soil treatment is drinking water consumption. There is currently no risk to human health from drinking the groundwater beneath Site A because there is an institutional control (IC) in place that prohibits the use of this water for drinking. There will only be a risk to human health from drinking the groundwater if, in the future, the restriction against this use was removed and a shallow aquifer drinking water well was installed. Therefore, there are no current exposure risks at Site A.

Ecological Risks

An ecological evaluation was also performed for Site A as part of the 1991 ROD to assess baseline risks of the 25 indicator chemicals at the site under a no-future action scenario. Potential risks to sensitive aquatic and terrestrial biota in the site vicinity were assessed in an ecological evaluation. No aquatic life risks from Site A were identified. Testing on freshwater and saltwater organisms showed no negative impacts to aquatic life. No COCs have been detected in sediment or shellfish tissue collected from Hood Canal near the seepage exit point.

CLEANUP OBJECTIVES

For the 1991 ROD, the Navy and EPA developed a list of cleanup objectives for the revised cleanup action to meet. These cleanup objectives address the exposure pathways and COCs for which unacceptable risks to human health were identified, including exposure to shallow groundwater for construction workers. The cleanup objectives also address potentially significant and complete exposure pathways for which the risk assessment could not quantify risks because of a lack of data, but for which unacceptable risks may exist now or in the future including future ingestion of groundwater as drinking water.

Based on the risk assessment and the applicable regulatory requirements, the following cleanup objectives were developed for the protection of human health and the environment at Site A within a reasonable timeframe:

- Reduce the concentrations of COCs in soil to be protective of human health for unrestricted site use; and
- Reduce concentrations of COCs in the shallow aquifer groundwater to levels below Model Toxics Control Act (MTCA) groundwater cleanup levels (note that Ecology establishes criteria for contaminant concentrations under MTCA).

The Site A 1991 ROD estimated that the remedy would reduce MC concentrations in site soils enough that the surface water cleanup levels would be achieved within 10 years. Based on this conclusion, the 1991 Site A ROD did not create a remedial action objective (RAO) or remedy specific to surface water but did come up with COCs in surface water and remedial goals for those COCs. No changes to cleanup objectives established in the 1991 ROD are proposed in this Proposed Plan.

Soil Cleanup Levels

The selected remedy for soils functioned as intended by the ROD and achieved the soil RAOs though the soil remediation took longer and cost more than expected. The institutional controls implemented for Debris Area 2 are effectively restricting access to soils. Groundwater Cleanup Levels

Based on these objectives, cleanup levels for groundwater are protective of a future drinking water pathway. The Navy and EPA selected the MTCA Method B groundwater cleanup level for 2,4,6-TNT, 2,4- and 2,6-DNT, and RDX and EPA's maximum contaminant level for lead as the cleanup levels protective of all pathways which have not changed from the 1991 ROD and are shown in Table 2.

Table 2. Cleanup Levels for Groundwater

Constituent [1]	Cleanup Level	Basis	Maximum Concentration Detected at Site A in 2020
Munitions constituents (µg/L)			
2,4,6-TNT	2.9	MTCA Method B	2.4
2,4- and 2,6-DNT Mixture	0.13	MTCA Method B	0.22
RDX	0.8	MTCA Method B	92

Note:
1. Lead was included on the summary of COCs in the 1991 ROD but it was not a risk driver at the site, and monitoring for lead has not been included in the LTM at Site A.

Abbreviations:
µg/L = micrograms per liter
MTCA = Model Toxics Control Act
COCs = chemicals of concern
LTM = long-term monitoring
mg/L = milligrams per liter
DNT = dinitrotoluene
RDX = 1,3,5-trinitro-1,3,5-triazinane
ROD = Record of Decision
TNT = trinitrotoluene

Surface Water Cleanup Levels

Some concentrations of COCs in groundwater in the source area may be serving as an ongoing source of contaminants to surface water. Cleanup levels are established for the COCs in surface water that protect human health and aquatic organisms. Table 3 presents the surface water cleanup levels.

Table 3. Cleanup Levels for Surface Water

Constituent	Cleanup Level	Basis	Maximum Concentration Detected at Site A in 2020
Munitions constituents (µg/L)			
2,4,6-TNT	31	MTCA Method B	not sampled [1]
2,4-/2,6-DNT Mixture	0.6	MTCA Method B	not sampled [1]
RDX	30	MTCA Method B (based on human consumption of aquatic organisms)	not sampled [1]

Note:
1. Surface water samples not collected in 2020. No exceedances of the COC remedial goal for surface water have been identified within or adjacent to Site A.

Abbreviations:
µg/L = microgram/liter
COC = chemical of concern
DNT = dinitrotoluene
MTCA = Model Toxics Control Act
RDX = 1,3,5-trinitro-1,3,5-triazinane

Basis for Taking Action

Groundwater at Site A within the contaminant plume is not safe for drinking water because it contains contaminants that exceed cleanup levels. This ROD Amendment will add bioremediation as a remedy component to the pump and treat remedy. The existing remedy has been inefficient at RDX mass removal over the last several years, will not meet the RAOs in the time frame specified in the ROD, and does not directly treat the source area in the perched zone. Adding biostimulation in the perched zone to the remedy components allows for direct treatment of the RDX source area and thereby expedites remediation.

It is the lead agency's (Navy's) current judgment that the preferred alternative identified in this Proposed Plan, or one of the other active measures considered in the Proposed Plan, is necessary to protect public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

☑ **DATES TO REMEMBER**

Comment period: May 13 to June 12, 2024

Public Meeting: May 15, 2024, 5:00 pm

Description of the Existing Remedy

An existing remedy is in place at Site A under a ROD which was issued in 1991 and modified three times by Explanations of Significant Differences (ESDs) between 1994 and 2000. The soil remedy created a "leach basin" with an underlying liner within the Burn Area to conduct soil washing. Soil cleanup was completed in 1997. The shallow aquifer RDX plume is currently being treated with a groundwater extraction and treatment ("pump and treat") system that began operation in 1997. The actions to treat groundwater have not achieved the cleanup objectives established in the ROD. The ROD estimated a cleanup timeframe of 10 years, but the remedy had been operating for 26 years with more than 25 additional years likely necessary to meet cleanup goals.

Additional investigations have been completed at Site A since the start of the remedy in 1997 to better understand the site and improve the remedy. Some of these investigations included:

- Addition of two borings to the bottom of the shallow aquifer, to determine soil and groundwater concentrations at depth and determine the vertical extent of COC distributions, with shallow aquifer monitoring wells installed in the borings.
- Trench injections of about 18,000 gallons of water, fructose (a carbon substrate) and chloride (a tracer) into the perched water zone to see if bioremediation can work to clean up RDX in groundwater.
- Tests in the perched zone were done by injecting 140 gallons of site groundwater (containing RDX, fructose, and 110 mg/L bromide as a tracer) into wells to further study bioremediation of RDX in groundwater.
- Biostimulation tests in a perched zone well and shallow aquifer wells, with single injections of site groundwater containing RDX, bromide tracer, and fructose.
- A study that used isotopic-labeled RDX injections into perched zone wells and shallow aquifer wells. Injections included biostimulation of several perched zone and shallow aquifer wells.

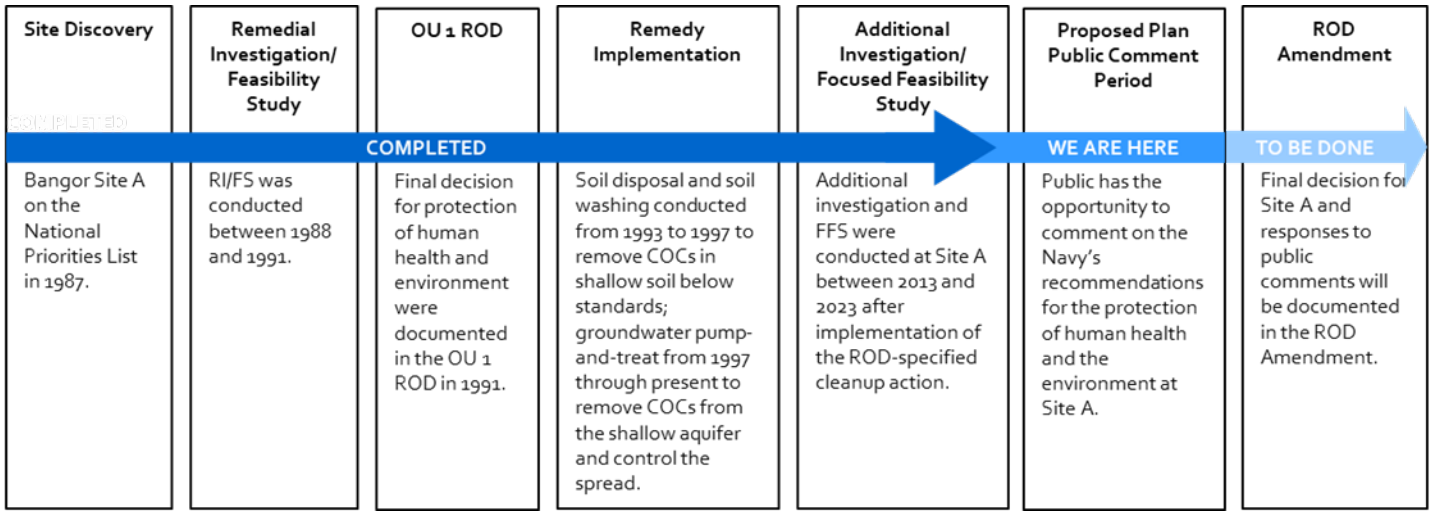
Additional information along with the results of these investigations is provided in the FFS report.

REGULATORY FRAMEWORK

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, commonly known as "Superfund" (as amended by the Superfund Amendments and Reauthorization Act of 1986), is used to identify, assess, characterize, and clean up or control contamination from past hazardous waste disposal operations and hazardous material spills. The steps in the CERCLA process for NBK Bangor are shown in the diagram on page 6.

This Proposed Plan was developed in accordance with Section 117 of CERCLA and applicable provisions of the National Oil and Hazardous Substance Pollution Contingency Plan and fulfills the public participation requirements of the lead agency, the Navy.

CERCLA CLEANUP PROCESS FOR NBK BANGOR SITE A



Submit comments on this Proposed Plan from May 13 to June 12, 2024.

For more information attend the public meeting on May 15, 2024, 5:00 PM at The Landings, Jackson Park Housing Complex.

SUMMARY OF REMEDIAL ALTERNATIVES

The Navy examined several remedial alternatives for groundwater cleanup that could satisfy the RAOs by reducing the principal threat of residual MCs in groundwater. This analysis resulted in an overall cleanup approach consisting of active cleanup of two areas of the site, the perched groundwater zone and shallow aquifer beneath and downgradient of the site.

Four active treatment alternatives (Alternative 1 and Alternatives 3 to 5) and one passive treatment alternative (Alternative 2) were developed. Alternative 1, the current treatment in place at Site A, is included for comparison to the other alternatives. Several treatment options were discussed between the Navy and regulator/stakeholder team during meetings and workshops, and through discussions around previous investigations at Site A when choosing alternatives to evaluate.

The alternatives evaluated in the FFS consisted of active groundwater treatment within the perched zone and shallow aquifer such as expanded pump and treat, a combination of biostimulation of the perched zone and pump and treat of the shallow aquifer, and biostimulation in both the perched zone and shallow aquifer. Active treatment of the groundwater beneath the source area is expected to reduce the residual source concentrations to below the cleanup levels. Active treatment is also expected to reduce the time to meet cleanup levels in both the perched zone and shallow aquifer.

Remedial Alternatives

The following remedial alternatives were evaluated in the FFS for Site A groundwater cleanup:

Alternative 1: Pump and Treat Groundwater Extraction System (Existing Remedy)

This alternative consists of extracting groundwater from the shallow aquifer from seven extraction wells at a combined flowrate of 3.5 gallons per minute. The system treats extracted groundwater with granular activated carbon (GAC) and discharges the effluent to an open ditch that leads to the Stormwater Discharge Area. To date, the treatment system has treated approximately 34 pounds of RDX over 26 years (1997 – present) of operation. The estimated time to reach cleanup levels in groundwater using the existing treatment system is 28 years followed by two years of compliance monitoring.

Alternative 2: Monitored Natural Attenuation

This alternative is the only passive remedial alternative evaluated in the FFS for Site A groundwater cleanup. This alternative consists of monitoring the perched zone and shallow aquifer for MC degradation and monitored natural attenuation (MNA) parameters. Under this scenario, the current pump and treat system would be decommissioned in the first year. The estimated time to reach cleanup levels in groundwater using MNA is approximately 58 years followed by two years of compliance monitoring.

Alternative 3: Expanded and Optimized Pump and Treat Groundwater Extraction System

This alternative involves expanding the current pump and treat system by adding three wells in the shallow aquifer and 25 wells in the perched aquifer. The pump and treat system would continue to operate as described in Alternative 1 with the possible expansion of the system if needed. The estimated time to reach cleanup levels in groundwater using expanded pump and treat is approximately 18 years followed by two years of compliance monitoring.

Alternative 4: Biostimulation in the Perched Zone

This alternative consists of injecting fructose into the perched zone annually for five years using 16 existing wells, an infiltration trench and up to eight new wells. The existing pump and treat system will continue to operate in the shallow aquifer for seven years as described in Alternative 1. The estimated time to reach cleanup levels in groundwater using biostimulation of the perched zone in conjunction with continued pump and treat is approximately seven years followed by two years of compliance monitoring.

Alternative 5: Biostimulation in the Perched Zone and Shallow Aquifer

This alternative consists of injecting fructose into the perched zone and shallow aquifer annually. In the perched zone, 16 existing wells, and infiltration trench and up to eight new wells would be injected into and in the shallow aquifer, the seven existing extraction wells and four new wells would be injected into. The current pump and treat system would be decommissioned prior to the start of biostimulation under this alternative. The estimated time to reach cleanup levels in groundwater using biostimulation of the perched zone and shallow aquifer is five years followed by two years of compliance monitoring.

Summary of Alternatives

ICs are restrictions or administrative actions applied to reduce risks to human health and the environment, such as land use controls (LUCs). Maintaining ICs to prevent the use of groundwater in the perched zone and shallow aquifer would be required until groundwater throughout the aquifer meets the cleanup level. Site-wide ICs are included as a part of all cleanup action alternatives.

The time to meet cleanup levels for the three new active remedial alternatives is estimated to be between approximately 5 and 18 years from the start of the cleanup actions. Following cleanup, monitoring would be performed for at least two additional years for all alternatives to make sure that groundwater concentrations have met cleanup objectives. All remedies also include decommissioning of the pump and treat system either prior to the start of the remedial actions (Alternative 2 and 5) or once cleanup objectives are met (Alternatives 1, 3, and 4). The Navy expects that it would take much longer to reach cleanup goals in groundwater if the cleanup actions do not take place or if the Alternative 1 pump and treat system continues to operate with no changes.

Table 4 shows the estimated costs for each alternative. The O&M cost includes the cost for active treatment through the estimated time to meet cleanup goals plus 2 years more years of monitoring. The present worth is the cost of the work in today's dollars and includes sales tax and oversight costs.

Table 4. Costs for All Alternatives

	Alternative	Capital	O&M/Duration	Present Worth
1	Pump and Treat Groundwater Extraction System	$0	$4,250,000/30 years	$4,250,000
2	Monitored Natural Attenuation	$0	$1,350,000/60 years	$1,350,000
3	Expanded and Optimized Pump and Treat Groundwater Extraction System	$261,000	$3,689,000/20 years	$3,950,000
4	Biostimulation in the Perched Zone	$138,000	$3,512,000/9 years	$3,650,000
5	Biostimulation in the Perched Zone and Shallow Aquifer	$289,000	$3,951,000/7 years	$4,240,000

Abbreviations:
O&M = operation and maintenance

EVALUATION OF REMEDIAL ALTERNATIVES

The remedial alternatives were evaluated using seven of the nine CERCLA screening criteria, defined in the box below. As part of the evaluation of long-term effectiveness, the Navy also evaluated the sustainability of each alternative. The last two of the CERCLA criteria (state acceptance and community acceptance) will be evaluated in an ROD Amendment after comments on the Proposed Plan have been received. The criteria are divided into three groups. The "threshold criteria" are requirements each alternative must meet before being considered for selection. The "primary balancing criteria" are used to help determine the best alternatives. The "modifying criteria" can be fully considered only after public comment is received on the Proposed Plan. After formal public comment is considered, the lead agency may modify aspects of an alternative or choose another based on these criteria.

Evaluation Criteria

- **Overall protection of human health and the environment**: This *threshold* criterion evaluates a remedial alternative's ability to provide adequate protection of human health and the environment and how potential risks are eliminated, reduced, or controlled through treatment or controls.
- **Compliance with regulations**: This *threshold* criterion is used to determine how each proposed alternative complies with federal and state statutory requirements.
- **Long-term effectiveness and permanence**: This *balancing* criterion addresses the ability of the cleanup action to protect human health and the environment over time. Sustainability of the cleanup action is considered as part of this criterion and includes an evaluation of energy and waste consumption, greenhouse gas emissions, and waste generation. This criterion is not part of CERCLA but is recommended by Navy and EPA guidance.
- **Reduction of toxicity, mobility, and volume through treatment**: This *balancing* criterion addresses the statutory preference for selecting treatment technologies that permanently reduce the toxicity, mobility, or volume of the contaminants.
- **Short-term effectiveness**: This *balancing* criterion addresses how quickly the cleanup action is able to protect human health and the environment and its potential to create adverse effects during construction and implementation.
- **Implementability**: This *balancing* criterion addresses the feasibility of implementing a proposed alternative and the reliability of the supply of various services and materials that would be required during its implementation.
- **Cost**: This *balancing* criterion addresses costs to build, operate, and maintain the cleanup action.

A comprehensive analysis of the seven criteria for each alternative was done for the FFS. The remainder of this section compares the alternatives to the seven CERCLA screening criteria.

Evaluation of Source Area Alternatives

Overall Protection of Human Health and the Environment (Threshold)

All alternatives were developed to satisfy the cleanup objectives and protect human health and the environment; therefore, all alternatives meet criterion. Implementation of additional treatment in the source area can improve protectiveness by reducing concentrations driving receptor risks and decreasing the time to achieving RAOs. All five alternatives require ICs for the site to remain protective during the treatment timeframe. Therefore, Alternatives 3 through 5 are the most protective as they will significantly reduce the time to reach cleanup levels.

Compliance with Applicable or Relevant and Appropriate Requirements (Threshold)

All alternatives were developed to comply with Applicable or Relevant and Appropriate Requirements (ARARs), which refer to a federal or stricter state standard that is meant for protecting human health and the environment during the cleanup. Therefore, all alternatives meet criterion. Satisfaction of drinking water ARARs throughout the site would require different restoration timeframes ranging from 5 years (Alternative 5) to 58 (Alternative 2) years. Because all alternatives are expected to satisfy ARARs, the varying timeframes are the main differentiation and addressed under short-term effectiveness. The potential state and federal ARARs for all alternatives are listed in Section 4 of the FFS.

Long-Term Effectiveness and Permanence (Balancing)

All alternatives are expected to be effective and permanent in the long term by meeting cleanup levels and not requiring engineering or institutional controls. RDX concentrations are less likely to increase at the end of the treatment period under Alternative 2 so it is considered to have the highest long-term effectiveness. The remaining alternatives rely on active treatment with some potential for MC concentration to increase some following the treatment period and therefore is considered to have slightly lower long-term effectiveness. Passive treatment of COCs by natural attenuation of the perched zone in Alternatives 1 and 2 and shallow aquifer in Alternative 2 could leave small areas with residual RDX that persist due to aquifer not being uniform throughout that locally slow the rate of degradation.

Reduction of Toxicity, Mobility, and Volume Through Treatment (Balancing)

Alternatives 4 and 5 would achieve the most rapid reduction of toxicity, mobility, and volume because both alternatives encourage high rates of biodegradation. Alternative 3 would achieve reduction at a less rapid rate through addition of contaminant removal from the perched zone. Alternative 1 would continue the current rate of reducing toxicity, mobility, and volume through extraction in the shallow aquifer and rely on natural attenuation processes in the perched zone, whereas Alternative 2 would achieve the slowest reduction by only relying on natural attenuation processes in both the perched zone and the shallow aquifer. Alternative 3 is expected to address residual contamination more aggressively in the perched zone than Alternatives 1 and 2 through active groundwater extraction. Alternatives 4 and 5 are expected to have lower residual risk resulting from aggressively altering subsurface conditions in the perched zone to induce high rates of biodegradation.

Short-Term Effectiveness (Balancing)

Site A is currently protective of human health and the environment. Restoration timeframes for Alternatives 5 and 4 to meet cleanup levels are 5 to 7 years, which makes these the most effective in the short term. Alternatives 3 and 1 are less effective in the short term, with relatively long restoration timeframes between 18 and 28 years. The slow rate of progress of 58 years estimated for Alternative 2 makes it the least effective in the short term. Under all alternatives, maintenance of LUCs would continue to prevent potential human health exposures while the remedy progresses to protect downgradient ecological receptors. Alternatives 1, 3, and 4 include continued pumping that provides some degree of plume containment, keeping contamination near the site during treatment.

Alternatives 1 and 2 have no short-term risk associated with remedy construction because all remedy infrastructure is already in place. Alternatives 3 through 5 involve short-term risk to workers associated with remedy construction; however, these risks can be effectively managed through standard health and safety protocols. All five remedies have construction-related risks associated with decommissioning the pump and treat system either before or at completion of treatment.

Implementability (Balancing)

Alternative 2 is the most easily implemented alternative because it requires only groundwater monitoring after removing the pump and treat system, which is common to all alternatives. The challenges in Alternative 2 are the inability to make adjustments, if needed, and the long timeframe of 58 years.

Alternative 4 is the next most easily implemented alternative by continuing the existing pump and treat system, while performing injections in the perched zone, which has easy access because of its shallow depth. Repeated injections in wells would require strategies to lessen the chance for biofouling that can result from aquifer stimulation. Alternative 4 requires continuing to operate the pump and treat system, but the challenges of maintaining the aging system are reduced since the timeframe is only 7 years, while increased clogging from biofouling in later years could cause difficulties.

Alternative 1 can be implemented following current pump and treat system operations. The main challenges are related to maintaining the aging system components to operate another 28 years and handling difficulties that arise from biofouling and well siltation. Alternative 1 is ranked as more difficult to implement than Alternative 4 because of expected challenges of maintaining the aging system over the long period of operation.

Alternative 3 can be implemented following current pump and treat system operations but presents a few more challenges than Alternative 1 due to the need for expanding the system by adding perched zone extraction and increasing shallow aquifer extraction. The potential problems from adding many extraction wells are because of the increased opportunity for biofouling and well siltation. These potential problems may be less compared to Alternative 1 because of the shorter operational period of 18 years.

Alternative 5 relies only on injections where the two principal challenges are completing enough distribution of injectate in the shallow aquifer that doesn't easily transmit fluids, and avoiding biomass clogging the aquifer near injection wells. Additionally, repeated injections in wells would require strategies to lessen the potential for biofouling from aquifer stimulation. Uncertainties in injectate distributions to the shallow aquifer in Alternative 5 make it the lowest rank for implementability.

Cost (Balancing)

Cost evaluations consider both net present value and inflation value estimates but prioritize the estimate for inflation value due to the long timeframes of several alternatives. Results of the cost estimate show Alternative 4 as the least costly alternative based on combined net present value and inflation value, which is only slightly better than Alternative 5. Alternative 2 is next in cost due to low net present value

and the fact that no capital investment is needed for the monitoring, even though the extended period of 58 years of O&M raises the inflation value. The cost for Alternative 3 is higher because of capital expenses for expanding and operating the pump and treat system. Alternative 1 is the most expensive due to 28 years of O&M costs for active pump and treat operations. Table 4 summarizes the costs for each alternative and Appendix C of the FFS provides a detailed cost estimates for each alternative.

Summary

Alternative 2 ranks highest for green and sustainable remediation (GSR) metrics, followed in by Alternative 5, Alternative 4, Alternative 3, and Alternative 1. The five alternatives were compared using a ranking analysis based on the seven criteria in the FFS report. Alternative 4 ranked the highest. Table 5 summarizes the evaluation of remedial alternatives for Site A groundwater cleanup.

PREFERRED ALTERNATIVE

The Navy supports implementation of Alternative 4 (biostimulation in the perched zone) as the preferred alternative for reducing the principal threat of residual MC in groundwater at Site A. Alternative 4 provides the most cost-effective means of reliably protecting human health and the environment in the long term and has the second shortest restoration timeframe. Figure 5 illustrates the preferred alternative at the site.

Alternative 4: Biostimulation in the Perched Zone

In accordance with the USEPA *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA,* Alternative 4 was selected as the preferred alternative due to the best score as shown in Table 5. This alternative applies biostimulation to the perched zone to remove RDX and other ordnance compounds at their source, while also improving conditions in the shallow aquifer using the existing pump and treat system as shown in Figure 5. Injections of a carbon substrate will be completed annually along with groundwater monitoring to examine the progress and determine when injections have met their goal. The approach will build on the successful biostimulation pilot tests to degrade RDX in the perched zone. Alternative 4 will accelerate the existing pump and treat remedy by removing RDX in the perched zone, thereby eliminating RDX in percolating water that helps sustain concentrations in the shallow aquifer. The existing pump and treat system will continue to operate, reducing RDX in the shallow aquifer through mass removal until the source area in the perched zone meets cleanup levels. Monitoring will allow assessment of the cleanup action's effectiveness and changes in COC concentrations throughout the source area.

The following actions will occur under Alternative 4:

- Installation of up to eight perched zone wells drilled to approximately 16 feet below ground surface, for a total of 24 perched zone injection wells including the 16 wells planned for the 2023 pilot study.
- Injection of water with fructose and buffer once a year for 5 years in 24 perched zone wells and the existing injection trench immediately north of the leach basin.
- Continued pump and treat in the shallow aquifer using the existing seven extraction wells until biostimulation has achieved COC concentration-based performance metrics in the perched zone indicative of effective source treatment. At that time, the shallow aquifer pump and treat system will be discontinued and decommissioned.
- Conduct long-term monitoring for 7 years in the perched zone and shallow aquifer wells with analysis of ordnance COCs plus some indicators of biological activity.
- Perform four rounds of groundwater confirmation sampling over 2 years following treatment.

Meeting RDX cleanup level of 0.8 micrograms per liter throughout Site A is estimated to take 5 years of biostimulation (annual injections) and 7 years of continued pump and treat of the shallow aquifer, followed by two years of groundwater monitoring. As a contingency, additional years of biostimulation and pump and treat system operation may be added if cleanup levels are not reached within the anticipated period. ICs preventing the use of groundwater are needed until groundwater throughout the aquifer meets the cleanup level. Enhancing biodegradation through biostimulation and extraction of COCs by the pump and treat system from the source area will reduce the volume and mobility of the COCs in groundwater. Alternative 4 will protect human health and the environment by reducing COC concentrations in the perched zone and shallow aquifer beneath Site A.

The selected cleanup action will be documented in a ROD Amendment and reviewed every 5 years as long as COCs remain at the site above levels that allow for unlimited use and unrestricted exposure.

Table 5. Detailed Analysis Summary

Criteria	Alternative 1: Pump & Treat Rank	Alternative 2: Monitored Natural Attenuation Rank	Alternative 3: Expanded Pump & Treat Rank	PREFERRED Alternative 4: Perched Zone Biostimulation Rank	Alternative 5: Perched Zone & Shallow Aquifer Biostimulation Rank
Overall protection of the environment (threshold)	meets criterion	meets criterion	meets criterion	meets criterion	meets criterion
Compliance with ARARs (threshold)	meets criterion	meets criterion	meets criterion	meets criterion	meets criterion
Long-term effectiveness and permanence (balancing)	2	1	2	2	2
Reduction of toxicity, mobility, and volume through treatment (balancing)	4	5	3	1	1
Short-term effectiveness (balancing)	4 (28 years)	5 (58 years)	3 (18 years)	2 (7 years)	1 (5 years)
Implementability (balancing)	3	1	4	2	5
Cost (balancing)	5	3	4	1	2
Net present value	($4.25M)	($1.35M)	($3.95M)	($3.65M)	($4.24M)
Inflation value	($10.27M)	($5.02M)	($6.72M)	($4.39M)	($4.82M)

Rank - The values represent relative comparison of Criteria and each alternative. Values between 1 and 5 are assigned, ranging from excellent (1) to poor (5). Values are normalized to a scale between 1 and 5 except where differences are considered subtle such that values of either 1 or 2 are applied.

Short-term effectiveness is based upon restoration timeframe (treatment time in years until short-term remedial action objectives are met)

Cost ($M, million dollars) ranking considers both net present value and inflation value

ARARs - applicable or relevant and appropriate requirements

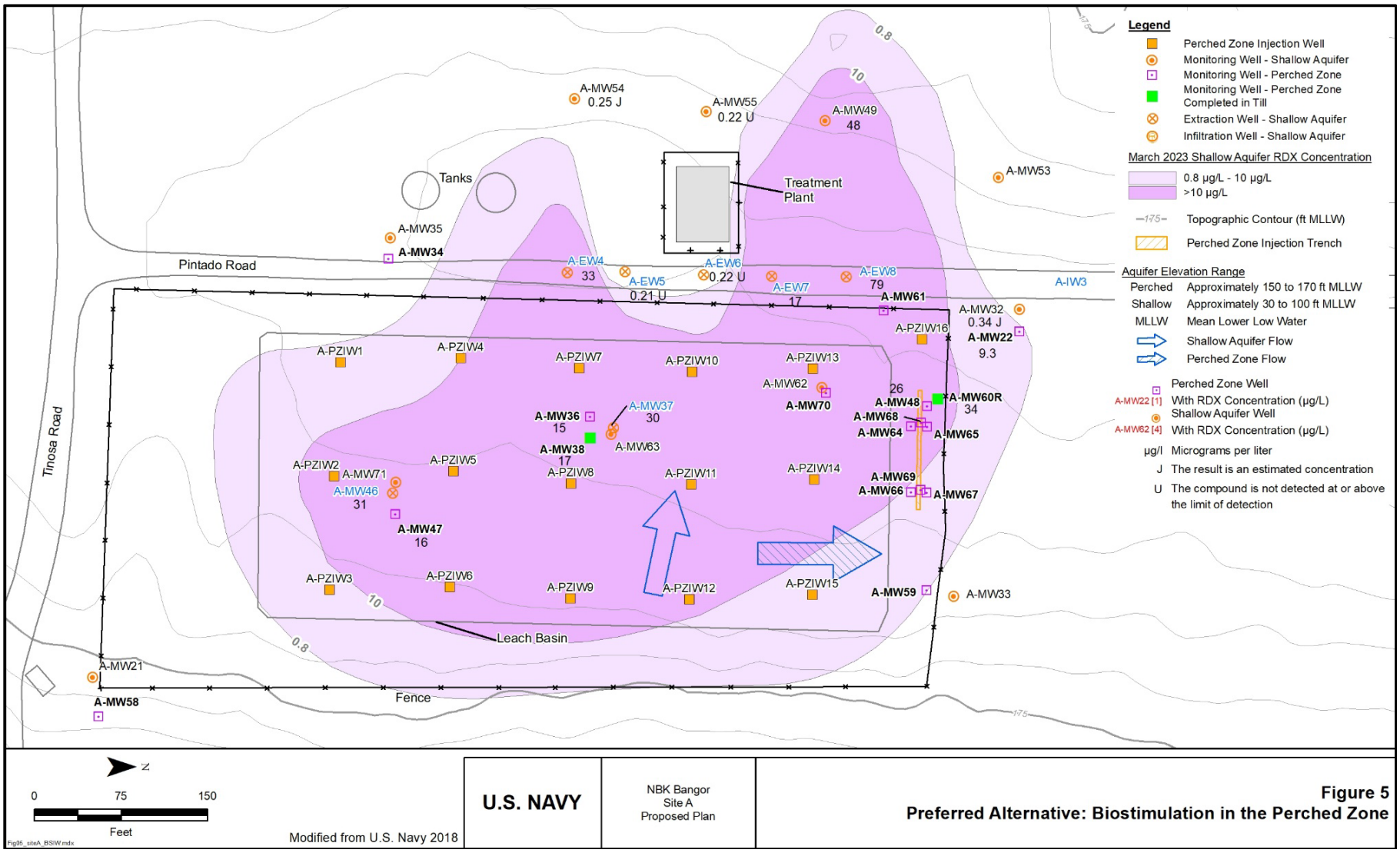


Figure 5
Preferred Alternative: Biostimulation in the Perched Zone

Input from the public will be evaluated in the final selection of the preferred alternative; therefore, the preferred alternative may change in response to public comment or new information.

Based on the information currently available, the Navy believes the preferred alternative (Alternative 4: Biostimulation in the Perched Zone) meets the threshold criteria and provides the best balance of any of the alternatives with respect to the balancing and modifying criteria.

The Navy expects the preferred alternative to satisfy the following statutory requirements of CERCLA 121(b):

1. Be protective of human health and the environment;
2. Comply with regulations;
3. Be cost effective;
4. Utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and
5. Satisfy the preference for treatment as a principal element.

The Navy believes that the preferred alternative provides the best protection of human health and the environment and is the most cost effective. The EPA is supportive of the preferred alternative.

NEXT STEPS: IMPLEMENTATION OF THE REMEDIAL ACTION AND PERIODIC REVIEWS

After reviewing and considering the community comments made on this Proposed Plan, the Navy and EPA will prepare the final revised remedial action plan to cleanup Site A groundwater. The preferred alternative may be modified based on public comments to this Proposed Plan or new information. The final cleanup decision will be recorded in an amendment to the existing OU 1 ROD. The ROD Amendment will include a Responsiveness Summary, which is a record of written responses to public comments on this Proposed Plan.

After completing the ROD Amendment, detailed engineering drawings and monitoring plans will be developed in the cleanup design. Cleanup design is followed by remedial action, where the revised cleanup will be implemented. Once the cleanup action is implemented, ongoing operation, maintenance, and monitoring will be performed to ensure that the cleanup action functions as expected and to record that the action is meeting the cleanup objectives. Any issues that are identified during operation, maintenance, and monitoring will be addressed as they occur.

In addition to ongoing operation, maintenance, and monitoring, CERCLA requires reviews of cleanup actions to be conducted at least once every 5 years at sites where contaminants have been left above levels that allow for unlimited use and unrestricted exposure. The purpose of these five-year reviews (FYRs) as they are called is to make sure that the cleanup actions chosen for a site are functioning properly and continue to protect human health and the environment. If the FYR process identifies any problem related to the cleanup actions, recommendations for corrective measures are developed and implemented by the Navy. The revised cleanup action carried out at Site A will be reviewed during each FYR. If the FYR process finds that the revised cleanup action is not meeting the cleanup objectives, the Navy and EPA will consider changes to the cleanup action.

COMMUNITY PARTICIPATION

PUBLIC COMMENT PERIOD:

May 13 to June 12, 2024

We encourage you to comment on this Proposed Plan during the 30-day public comment period. You may submit written comments by mail, postmarked no later than June 12, 2024, to:

Sarah Lincoln
Public Affairs Officer
NAVFAC NW
1101 Tautog Circle, Suite 203
Silverdale, WA 98315-1101

Jaclyn Satira
EPA Region 10
1200 Sixth Avenue, Suite 155
Seattle, WA 98101

Christopher Maurer
Washington State Department of Ecology
2399 Desmond Drive SW
Lacey, WA 98503

Comments may be emailed to Ms. Lincoln at navfacnwpao@us.navy.mil, Ms. Satira at satira.jaclyn@epa.gov, or Mr. Maurer at cmau461@ECY.WA.GOV. Public comments received during this period will be included in the Responsiveness Summary section of the ROD Amendment and considered in the final cleanup action decisions for Site A. A public meeting is scheduled for Wednesday May 15, 2024, from 5:00 to 7:00 pm at the Landings Community Center located at 2785 Cascades Pass Blvd, Bremerton, WA 98312.

LOCATION OF THE ADMINISTRATIVE RECORD:

The Administrative Record, containing all documents pertaining to the project, is maintained at Naval Base Kitsap Bangor, 1101 Tautog Circle (Building 1101, 2nd floor), Silverdale, Washington. Members of the public can review these items by contacting the NAVFAC NW Public Affairs Officer at (360) 340-5592. Publicly available documents can also be found online at: https://administrative-records.navfac.navy.mil/?JL74OU3G4WLHG7LKJ.