DEPARTMENT OF THE NAVY
ENGINEERING FIELD ACTIVITY, NORTHWEST
NAVAL FACILITIES ENGINEERING COMMAND
3505 NW ANDERSON HILL ROAD
SILVERDALE, WA 98383-9130

5090/SUBASE
09EO2CD/5159
11 JUN 1994

Mr. Jeff Rodin
U.S. Environmental Protection Agency (HW-074)
1200 Sixth Avenue
Seattle, WA 98101

Mr. Craig Thompson
Washington State Dept. of Ecology
P.O. Box 47600
Lacey, WA 98504-7600

Dear Sirs:

Enclosed are copies of the Revised Final *Explanation of Significant Difference (ESD)* for Site A for Naval Submarine Base, Bangor (2 and 3 copies, respectively).

Your written concurrence is requested. If you have any questions, please contact me at (206) 396-5984.

Sincerely,

CHRIS M. DRURY, P.E.
Remedial Project Manager
By direction of the
Commanding Officer

Copy to:
SUBASE Bangor, Code 851 (2 copies)
Hart Crowser, T. Flynn (w/o encl)

bcc: (w/encl)
AR 4.4 SUBASE OU 1
SF 5.0 SUBASE OU 1
EFA NW (Code 09EO2GR)

EXPLANATION OF SIGNIFICANT DIFFERENCES (ESD)
FOR SOIL AND GROUNDWATER REMEDIATION CHANGES
SITE A
SUBASE, BANGOR
BANGOR, WASHINGTON

Introduction

Bangor Ordnance Disposal Site A at the Naval Submarine Base, Bangor (SUBASE, Bangor) is located at the north end of SUBASE, Bangor. SUBASE, Bangor is located in Kitsap County, Washington, on Hood Canal approximately 10 miles north of Bremerton. The lead agency for this National Priorities List (NPL) site is the U.S. Navy. The U.S. Environmental Protection Agency (EPA) and the Washington State Department of Ecology (Ecology) have provided support and oversight on the preliminary studies, site investigations, remedial action alternative selection, remedial design, and remedial action for Site A.

This ESD is prepared in accordance with Section 117(c) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and Section 300.435(c)(2)(i) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). It addresses the following changes/clarifications to Site A soil and groundwater remediation requirements as described in the Site A Record of Decision (ROD):

- Contaminated soil in the leach basin will be amended with clean sand, and calcium chloride will be added to the wash water to enhance leaching of ordnance compounds from the soil;

- Granular activated carbon (GAC) technology will replace ultraviolet/oxidation (UV/Ox) technology for soil leachate treatment;

- The small volume (60 to 130 cubic yards) of surface soils in Debris Area 2 containing lead concentrations which exceed the cleanup standard will be left in place to minimize potential impacts to human health and the environment associated with soil disturbance;

- A leachate management plan will be developed and implemented to assure that leachate releases from the closed leach basin will be protective of groundwater and surface water quality; and

- Groundwater treatment will commence no later than July 1, 1996. (This deadline assures that groundwater treatment will not be delayed in the event that soil remediation takes longer than anticipated.)

Soil treatability studies demonstrated that leaching performance improves markedly when the leach basin soil is amended with sand and calcium chloride is added to the wash water. As a result of these studies, the recommended leachate recirculation flow rate increased from 50 gpm (assumed in the FS) to 300 gpm. In addition, new information became available regarding the cost and implementability of GAC treatment. A reevaluation of GAC versus UV/Ox technologies concluded that GAC treatment of the leachate is equally implementable, equally effective, and substantially less expensive than UV/Ox treatment.

Debris Area 2 surface soils containing up to 660 mg/kg lead (versus a cleanup standard of 250 mg/kg) are located in a steeply sloping, heavily wooded area. The extent of soils exceeding the cleanup standard is very limited and represents a small volume (60 to 130 cubic yards). Further evaluation of the potential risks associated with excavating this soil has determined that excavation presents a greater risk to human health and the environment than leaving this soil in place.

This ESD will clarify the Site A ROD regarding requirements for leachate management after completion of soil treatment. A leachate management plan will be developed and implemented to assure that leachate releases from the closed leach basin will be protective of groundwater and surface water quality. The plan will be developed prior to completion of soil treatment, as part of the detailed design for leach basin closure.

Finally, the ROD states that groundwater treatment will be implemented to achieve RAOs, and specifies that groundwater treatment will not begin until soil remediation is completed. However, the time required to complete soil remediation is uncertain. Therefore, a deadline (July 1, 1996) is now provided for implementation of groundwater treatment. Periodic groundwater monitoring will be conducted prior to this deadline, at a minimum frequency of semi-annually.

Public notice of this ESD will be published in a major local newspaper. The ESD will be available for review in the information repositories located at the following Kitsap regional libraries:

Central Kitsap Library (206) 377-7601
1301 Sylvan Way
Bremerton, Washington 98310

Bangor Branch (206) 779-9724
Naval Submarine Base, Bangor
Silverdale, Washington 98315-5000

The ESD will also become part of the Administrative Record File in accordance with NCP 300.825(a)(2). The Administrative Record for Site A is available between the hours of 0800 and 1600 at:

Engineering Field Activity, Northwest
Naval Facilities Engineering Command
1040 Hostmark Street
Poulsbo, WA 98370
(206) 396-5984

Summary of Site History, Contamination Problems, and Selected Remedy

A vicinity map of Site A is shown on Figure 1. The site consists of a Burn Area, two Debris Areas, and a Stormwater Discharge Area. The Burn Area was used to detonate and incinerate various ordnance materials, including trinitrotoluene (TNT), flares, fuses, primers, smoke pots, smokeless powder, and black powder. The majority of these activities occurred between 1962 and 1975, followed by more limited disposal and testing through 1986. Inert solid waste materials (e.g., metal casings) from the Burn Area operations were deposited at the two adjacent Debris Areas. The Stormwater Discharge Area has received surface water runoff from the Burn Area since a diversion structure was completed in 1983. As a result of these activities, soil, surface water, and groundwater within various areas of Site A have received different types and quantities of releases of ordnance compounds, ordnance breakdown products, and metals.

In 1978, evaluation of SUBASE, Bangor waste disposal sites (including Site A) began under the Navy Assessment and Control of Installation Pollutants (NACIP) program. Work at Site A continued in 1981 as part of an Initial Assessment Study (IAS) and in 1986 as part of a Characterization Study, both under the NACIP program. With the enactment of the Superfund Amendments and Reauthorization Act (SARA) in 1986, the Navy suspended further NACIP program activities and phased into the EPA Remedial Investigation/Feasibility Study (RI/FS) program. In July 1987, EPA included Site A on the NPL of hazardous waste sites.

The Site A ROD was signed on December 10, 1991. The selected remedy contained in the ROD has two parts, which address contaminated soil and groundwater, respectively. The selected soil remedy consists of the following:

- Excavate approximately 7,000 cubic yards of ordnance-contaminated surface soil from the Burn Area and approximately 100 cubic yards of ordnance- and/or lead-contaminated surface soil from Debris Area 2;

- Modify excavated soils as necessary to enhance leaching, and place modified soils in a lined leach basin constructed in the Burn Area. Place lead-contaminated soil (from Debris Area 2) in a segregated cell within the leach basin;

- Leach ordnance contaminants from the excavated soils in the basin using a Soil Washing system, and treat the circulating leachate with UV/Ox technologies until ordnance cleanup levels are achieved in both the soil and the leachate; and

- Remove lead-contaminated Debris Area 2 soils from the leach basin and dispose of them at an off-site landfill.

The selected groundwater remedy consists of extracting groundwater from the Shallow Aquifer, treating it using UV/Ox technologies, and disposing of the treated water on base by reintroduction to the Shallow Aquifer.

Description of the Significant Differences and the Basis for those Differences

Add Sand Amendment to Leach Basin Soil and Calcium Chloride to Wash Water

The Site A ROD states that "the excavated soils will be modified as necessary by mechanical or chemical means to ensure that the subsequent treatment (washing) process will be effective and efficient." Soil treatability studies were performed by the Navy after the ROD was signed to tailor the use of soil washing technology for leaching of ordnance compounds from Site A soils. Slow diffusion of wash water through the low-permeability soil at Site A, limited the effectiveness of the passive soil leaching process. However, addition of more permeable sand to the Site A soil matrix in a 1:1 volume ratio achieves breakup of agglomerated silt and clay, resulting in reduced channeling and increased hydraulic conductivity. Addition of low concentrations of calcium chloride to the wash water (up to 40 mg/L) also increases the hydraulic conductivity, enhancing system operation. The treatability studies demonstrated that sand amendment and calcium chloride addition are necessary in order to optimize the passive leaching of ordnance contaminants from Site A soils.

Treat Leachate Using GAC Instead of UV/Ox Technology

The ROD stipulates that, pending successful completion of water treatability studies, UV/Ox technologies will be used to treat leachate from the passive soil leaching process. The water treatability studies, which were conducted using ordnance-contaminated groundwater from SUBASE, Bangor Site F, demonstrated that UV/Ox treatment is capable of destroying dissolved ordnance compounds to below cleanup criteria. However, GAC was reevaluated for leachate treatment when the anticipated leachate recirculation flow rate increased to 300 gpm (based on soil treatability study results) and new information became available regarding the cost and implementability of GAC technology.

The original decision to use UV/Ox instead of GAC resulted from the Feasibility Study's consideration of EPA's nine basic criteria for evaluating remedial alternatives. UV/Ox was judged to offer advantages in terms of implementability and cost. However, the basis for characterizing GAC technologies as relatively less implementable than UV/Ox was the limited availability of facilities capable of regenerating or disposing of spent (ordnance-laden) GAC. In addition, for the leachate concentrations assumed in the RI/FS, the estimated cost of leachate treatment was lower for UV/Ox than for GAC.

Based on current information, the implementability of GAC is no longer a problem. The carbon manufacturer/supplier selected by the Navy's Remedial Action Contractor (RAC) for the Interim Remedial Action at SUBASE, Bangor, Site F, is now capable and willing to accept ordnance-laden GAC at their carbon regeneration facility. The previous reluctance to handle the spent GAC, which was based on the concern regarding regeneration, can now be effectively addressed by limiting ordnance loading on the GAC. Accordingly, GAC is now equally as implementable as UV/Ox technology. Since adsorbed ordnance compounds are thermally destroyed in the regeneration process, this treatment technology also satisfies the statutory preference for permanent treatment to reduce toxicity, mobility, and volume.

Current cost estimates for Site A soil remediation using GAC versus UV/Ox technology are presented in Table 1. Since the signing of the ROD, the estimated costs for treating Site A leachate using UV/Ox have roughly doubled. This is mainly due to the much higher leachate design flow rate currently envisioned (300 gpm versus 50 gpm assumed in the FS) with the sand-amended soil. Current cost estimates for GAC treatment are only marginally higher than previous estimates. In this case, the higher costs associated with the 6-fold increase in leachate flow rate are largely offset by the much lower carbon replacement cost that can now be achieved through GAC regeneration.

Based on the data now available, GAC is proposed for use in place of UV/Ox for treating Site A leach basin leachate. The total soil remediation cost associated with this system is estimated at $1,700,000, which is about 20 percent higher than the selected soil remedy as presented in the ROD.

Regulations, which apply to transporting GAC to and from Site A, will be included as ARARs for the remedial action. Transport of this material will be conducted in accordance with all applicable local, state, and federal transportation regulations. Fresh GAC transported onto the site will not be a hazardous waste and standard shipping regulations will apply. The spent GAC is a K045 hazardous waste, and will be managed as such. (K045 is the hazardous waste number assigned under the Resource Conservation and Recovery Act [RCRA] for spent carbon from the treatment of wastewater containing explosives.) A limit of ten percent by weight explosives loading on the GAC to be sent off site is set in order to ensure that the GAC will not be a characteristic RCRA hazardous waste for reactivity. In addition, spent GAC will be evaluated to determine if it exhibits the toxicity hazardous waste characteristic (e.g., due to 2,4-DNT content). This evaluation will include testing if necessary. Spent GAC will be manifested and transported in accordance with all applicable regulations.

In order to ensure that the off-site thermal treatment does not contribute to present or future environmental problems, the selection of a thermal treatment facility will follow the procedures presented in Procedures for Planning and Implementing Off-Site Response Actions, 58 FR 49200, September 22, 1993.

Leave in Place Limited Volume of Lead-Contaminated Soils in Debris Area 2

Debris Area 2 is located in a steeply sloping, heavily wooded drainage area containing significant undergrowth. The slope incline is estimated to be 0.75 horizontal to 1.0 vertical. A stream at the bottom of the slope flows into Cattail Lake, which is located approximately 100 yards further down the drainage (Figure 1). The Cattail Lake basin supports sensitive flora and fauna habitats.

TNT and lead concentrations exceeding RAOs were detected in an estimated 100 cubic yards of Debris Area 2 soil during the RI/FS investigation. The ROD stipulates that this soil would be excavated and placed in an isolated cell within the leach basin. Following leaching of TNT, the lead-contaminated soil would be disposed of at a permitted off-site landfill.

In preparing to carry out the above plan, the Navy's RAC further evaluated Debris Area 2, producing the following additional information:

1) **Maximum Concentrations of TNT and Lead in Debris Area 2 Soil are Lower than Measured during the RI/FS Investigation.** The RAC conducted a more comprehensive sampling program than that

previously performed during the remedial investigation, to further define the extent of Debris Area 2 soil contamination. Their results are summarized in Table 2 along with the results collected during the Remedial Investigation (RI). Both sampling programs identified TNT and lead as compounds exceeding RAOs in site soils. However, maximum concentrations measured during the Remedial Action are lower than those measured during the RI. (As shown in Table 2, TNT and lead concentrations exceeded the RAOs in only a limited number of samples.) Concentration differences between the two sampling programs of the magnitude observed are not surprising, given the heterogeneity of the steeply sloping site. However, results of the RAC's sampling program suggest that the one sample collected during the RI which yielded TNT and lead exceedences may not have been representative of site soils.

Maximum TNT and lead concentrations of 53 and 660 mg/kg, respectively, were detected during the Remedial Action. These compare with RAOs for TNT and lead of 33 and 250 mg/kg, respectively (based on Washington State Model Toxics Control Act [MTCA] direct contact soil cleanup levels, assuming residential use). Only one of the 20 soil samples analyzed during Remedial Action (five percent of the sample pool) exceeds the RAO for TNT, and that exceedence (53 mg/kg) is less than twice the RAO of 33 mg/kg. Lead concentrations exceed the lead RAO in five of the 20 samples (25 percent of the sample pool). The highest concentration detected is less than three times the lead RAO.

The RAC now estimates the volume of lead-contaminated Debris Area 2 soils to be in the range of 60 to 130 cubic yards. This is consistent with the RI/FS preliminary estimate of 100 cubic yards, and represents less than two percent of the total volume of Site A soils exceeding cleanup criteria.

2) **Soil Excavation on the Steeply Sloping Site May Impact Sensitive Habitats in the Cattail Lake Basin.** The Navy's RAC evaluated a range of strategies and technologies for excavating soil from Debris Area 2. All excavation strategies would require the removal of trees and undergrowth, which aid in stabilizing the slope, and considerable overexcavation for site access and equipment operation. The RAC concluded that these activities may cause destabilization of the slope, resulting in significant soil erosion both during the remedial activities and following such activities, until the slope restabilizes through revegetation. Soil erosion would likely impact sensitive habitats in the Cattail Lake basin.

Based on the above information, it is now proposed that the lead-contaminated soil at Debris Area 2 be left in place. Potential damage to sensitive habitat in the Cattail Lake basin may result due to soil erosion if soil excavation occurs. The volume of contaminated soil is relatively small, and the maximum contaminant (lead) concentration detected in that soil exceeds the cleanup standard by less than a factor of three. The contaminant is effectively bound to the soil, and therefore presents no significant risk to groundwater. The overall risk to human health and the environment associated with excavating the soil is judged to be greater than the risk associated with leaving the soil in place.

Institutional controls will be implemented to restrict future access to the Debris Area 2 slope. These controls will include a combination of barriers (e.g., fences, blackberry bushes, etc.) and warning signs. In addition, the SUBASE, Bangor, Master Plan will be revised to restrict future residential development in the vicinity of Debris Area 2.

Develop and Implement Leachate Management Plan for Closed Leach Basin

The Site A ROD may be unclear in its requirements for ordnance concentrations in basin leachate upon completion of soil treatment. Page ii of the ROD states that "Soil washing will continue until . . .leachate concentrations are below state groundwater protection (drinking water use) levels." However, page 28 states that "Treatment will be considered completed. . .when the RDX concentration in the treated leachate is less than. . .0.8 ug/L."

To assure that leachate releases from the closed leach basin will be protective of groundwater and surface water quality, a leachate management plan will be developed and implemented. The plan will be developed prior to completion of soil treatment, as part of the detailed design for leach basin closure. Closure design components (such as whether or not the leach basin liner will be perforated) and post-closure leachate management requirements will depend on leachate concentrations measured at the time of detailed closure design. If concentrations are below the groundwater cleanup levels specified in Table 1 of the ROD, then post-closure leachate may be discharged to either groundwater (via infiltration) or surface water.

If leachate concentrations measured at the time of closure design exceed one or more of the ROD (Table 1) **groundwater** cleanup levels but are below **surface water** cleanup levels, then the closure design will include steps to ensure that groundwater will be protected from future leachate releases caused by stormwater. These steps may include leaving the existing leach basin liner in place, and discharge of stormwater and leachate from the basin to surface water (e.g., to the Stormwater Discharge Area).

If leachate concentrations measured at the time of closure design exceed one or more of the ROD (Table 1) **surface water** cleanup levels, then the closure design will include treatment of leachate caused by stormwater to ensure protection of groundwater and surface water.

If leachate concentrations measured at the time of closure exceed either groundwater or surface water cleanup levels, the design will also include a compliance monitoring plan, addressing groundwater and surface water monitoring elements as appropriate.

Begin Treating Groundwater by July 1, 1996

Groundwater flows relatively slowly through the Shallow Aquifer beneath the Burn Area, where limited ordnance contamination has been detected. The ROD states that groundwater treatment will be implemented to achieve RAOs once soil remediation is completed. Soil remediation using passive soil leaching is currently estimated to require less than 2 years of leach basin operation. However, due to uncertainties associated with the leaching process, it is possible that more than 2 years of basin operation may be required.

In order to limit the migration of contaminants in the Shallow Aquifer, a deadline of July 1, 1996, is proposed for implementation of groundwater treatment at Site A. This deadline ensures that initiation of groundwater treatment will not be postponed due to unforeseen delays in the soil remediation schedule.

Periodic groundwater monitoring will be conducted in both the Perched Groundwater Zone and in the Shallow Aquifer during the period preceding the above deadline, at a minimum frequency of semi-annually.

Backup Technologies

UV/Ox will be the back-up technology for the Passive Soil Wash leachate treatment, to be used in the unlikely event that thermal destruction of ordnance compounds adsorbed onto GAC proves impracticable.

If a specific batch of spent GAC is not accepted for thermal regeneration (due, for example, to an unacceptably high ordnance loading), it will either be used as a supplemental fuel in a cement kiln or, as a last resort, incinerated. In any case, only a facility permitted to accept K045 hazardous waste will be used.

As stipulated in the Site A ROD, it is intended to use UV/OX for treatment of extracted groundwater (at flow rates much lower than those required for the Passive Soil Wash leachate treatment). However, in the unlikely event that UV/Ox treatment fails to meet cleanup criteria, GAC will be the backup treatment technology.

Affirmation of the Statutory Determinations

Considering the new information that has been developed for Site A, the lead agency believes that the remedy as changed is protective of human health and the environment to the maximum extent possible, and is cost-effective. Federal and state requirements that were identified in the ROD as applicable or relevant and appropriate will be met, with one exception: a small volume (60 to 130 cubic yards) of soils with lead concentrations above cleanup standards will be left in place on the steep slope of Debris Area 2. The risk to human health and the environment associated with excavating this soil is judged to be greater than the risk associated with leaving the soil in place.

The revised remedy utilizes permanent solutions. GAC was considered as an alternative treatment technology during development and selection of the original remedy. It is now considered to be equivalent to UV/Ox in terms of effectiveness and implementability. The deadline for implementation of groundwater remediation enhances protection of human health and the environment.

Public Participation Activities

Public notice of this ESD will be published in a major local newspaper. Notice has been issued previously that the contents of the Administrative Record File are available for public review and comment. The GAC treatment technology has been discussed and presented to the public at previous meetings conducted to explain the remedial action alternatives and selected remedies for Site A and for an Interim Action for the treatment of ordnance contaminated groundwater at Site F. A fact sheet will be issued explaining this ESD.

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Attachments:

Table 1 - Site A Soil Remediation Cost Estimates
Table 2 - Summary of Debris Area 2 Soil Sampling Results
Figure 1 - Site A Vicinity Map

Table 1 - Site A Soil Remediation Cost Estimates

	Soil Remediation Cost Estimates[1]	
Leachate Treatment Technology	Total Cost in Millions of Dollars	Unit Cost in Dollars per Ton
UV/Ox	2.7	250
GAC	1.7	160

1 Estimates are based on purchasing a 300 gpm UV/ozone system for leachate treatment versus leasing a 300 gpm GAC system. (UV/ozone systems of this size are not available for lease.) Estimates include costs for final design, construction, operation and maintenance, monitoring and analytical, and post-remediation requirements. Groundwater treatment costs are not included.

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Table 2 - Summary of Debris Area 2 Soil Sampling Results

	Remedial Investigation	Remedial Action
Dates of Sampling	1988-1990	May 1993
No. of Discrete Soil Samples Analyzed	5	20
Compounds Detected Above RAOs[1]	TNT/Lead	TNT/Lead
No. of Exceedences[2] ► TNT ► Lead	1 (20%) 1 (20%)	1 (5%) 5 (25%)
Maximum Concentration Detected in mg/kg ► TNT ► Lead	72 940/2,400	53 660
Estimated Volume of Soil Exceeding RAOs in Cubic Yards	100	60 to 130

1 The remedial action objectives (RAOs) for TNT and lead in soil are 33 and 250 mg/kg, respectively. These are based on Washington State Model Toxics Control Act (MTCA) direct contact soil cleanup levels, assuming residential use.

2 The limited sampling conducted during the Remedial Investigation indicated that both TNT and lead contamination were limited to the upper half of the Debris Area 2 slope. The more comprehensive sampling program conducted during the Remedial Action confirmed this conclusion.

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Site A Vicinity Map

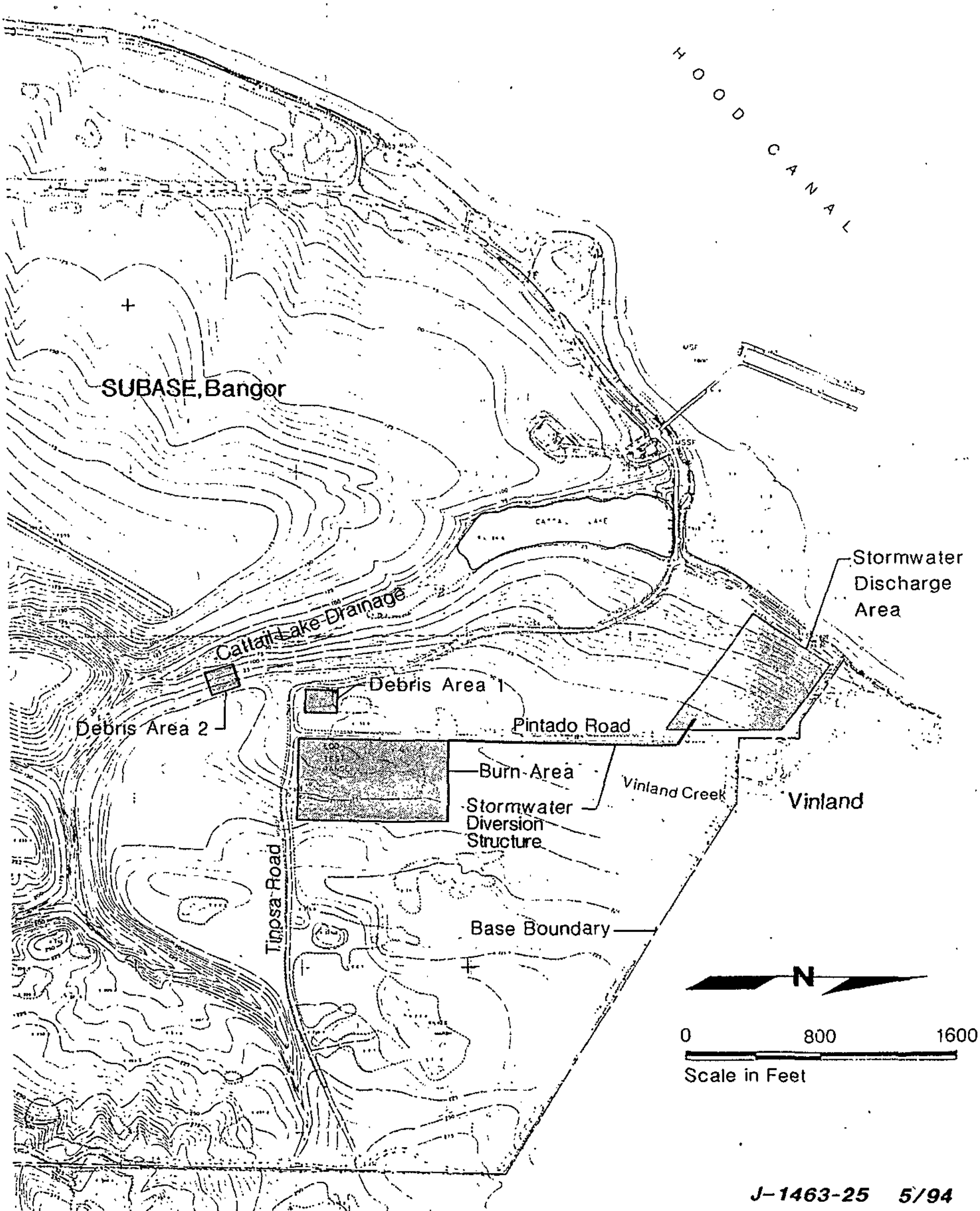

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Figure 1