Click here to go to document index



# 4.0 SITE 3 – AREA A DOWNSTREAM WATERCOURSES/OBDA (OU3)

Site 3 under the Navy's IRP includes the Area A Downstream Watercourses and the OBDA. The soil OU associated with the OBDA was addressed through a non-time-critical removal action (NTCRA). The Action Memorandum for the OBDA was signed in July 1997. The soil and sediment OU (OU 3) associated with the Area A Downstream Watercourses was addressed through a remedial action. The ROD for the soil and sediment OU was signed in March 1998. This five-year review of Site 3 is being conducted as a matter of policy because hazardous substances, pollutants, or contaminants associated with the soil and sediment OUs have been removed from the site but a remedy for the groundwater OU has not been selected. The groundwater OU is still being investigated under CERCLA and the need for a remedial action for the groundwater OU will be determined in the future.

## 4.1 HISTORY AND SITE CHRONOLOGY

A list of important Site 3 historical events and relevant dates in the site chronology is shown below. The identified events are illustrative, not comprehensive.

| Event | Date |
|---|---|
| Pesticides used in waterbodies. | 1960s |
| Final IAS completed. | March 1983 |
| Phase I RI completed. | August 1992 |
| Draft FFS issued. | April 1994 |
| OBDA non-time critical removal action (NTCRA) began. | January 1997 |
| Phase II RI finalized. | March 1997 |
| OBDA NTCRA completed. | March 1997 |
| Proposed Plan for soil and sediment issued. | July 1997 |
| EE/CA for OBDA issued and Action Memorandum for OBDA signed. | July 1997 |
| Final Post Removal Report for OBDA issued. | July 1997 |
| Public Meeting | August 1997 |
| ROD for soil and sediment signed. | March 1998 |
| Remedial Design for soil and sediment began. | 1998 |
| Remedial Design for soil and sediment completed. | 1999 |
| Remedial Action for soil and sediment began. | July 1999 |
| Remedial Action for soil and sediment completed. | August 2000 |
| O&M began. | March 2001 |
| Draft Final Basewide Groundwater OU RI completed. | August 2001 |

## 4.2 BACKGROUND

### 4.2.1 Area A Downstream Watercourses

The Area A Downstream Watercourses receive surface water and groundwater recharge from the Area A Landfill, Area A Wetland, Torpedo Shops, OBDA, OBDANE, and surrounding areas and convey them to the Thames River. The Area A Downstream Watercourses include North Lake and several small ponds (Upper Pond, Lower Pond, and OBDA Pond) and interconnected streams (Streams 1 through 6). The general configuration of the Area A Downstream Watercourses and adjacent areas is shown on Figure 4-1. The location of this site relative to other IR sites at NSB-NLON is shown on Figure 1-2.

The primary water discharge point from the Area A Wetland to the Area A Downstream Watercourses is through four 24-inch-diameter metal culvert pipes located within the dike that separates the Area A Wetland from the Area A Downstream Watercourses. The discharge from these culverts forms a small stream (Stream 4) that flows westward for approximately 200 feet into Upper Pond. Upper Pond discharges to Stream 3, which flows northward and then westward toward Triton Avenue (past the OBDANE site) to the entrance of the Torpedo Shops. At this location, it meets the drainage channel from the Torpedo Shops and forms Stream 5. Stream 5 flows westward along Triton Avenue through the Small Arms Range and under Shark Boulevard and eventually discharges to the Thames River at the DRMO outfall. A second pond (Lower Pond), northwest of Upper Pond, is a natural depression and is recharged by groundwater inflow. The outlet of the pond forms Stream 2, which enters a storm sewer and flows to the west around North Lake.

Groundwater passing beneath the Area A Landfill/Wetland dike discharges to a small pond (the OBDA Pond) located at the base of the dike and the OBDA. Stream 1 flows from this pond westward toward North Lake, a recreational swimming area for Navy personnel. Under normal flow conditions, the stream enters a culvert that by-passes North Lake and discharges to a stream (Stream 6) below the outfall of the lake. Stream 6, which is formed by Stream 1, Stream 2, and the outflow of North Lake, flows westward under Shark Boulevard and through the golf course to the Thames River. North Lake is filled with potable water every year and drained at the end of the season. Surface water levels in North Lake do not appear to coincide with groundwater levels in adjacent monitoring wells, indicating little hydraulic connection between surface water of North Lake and the shallow groundwater.

Most of the area is within designated Explosive Safety Quantity Distance (ESQD) arcs of the Area A Weapons Center; therefore, further development is not planned for this area. Navy regulations prohibit construction of inhabited buildings or structures within these arcs and, although existing buildings operate under a waiver of these regulations, no further construction is planned.

The main cause of contamination at the Area A Downstream Watercourses was the application of pesticides. These pesticides were reportedly applied on the surface of water bodies to control mosquito proliferation adjacent to the nearby base recreational facilities (North Lake and golf course). Additional contaminants are the inorganic constituents of the river dredge spoil and Area A Landfill material that have been carried over from adjacent sites. Samples of surface soil and sediment showed the presence of mainly DDT, 1,1-dichloro-2,2-bis(4-chlorphenyl)ethane (DDD), 1,1-dichloro-2,2-bis(4-chlorphenyl) ethene (DDE) (collectively referred to as DDTR), and small amounts of other pesticides such as dieldrin. Samples of sediment also contained relatively high levels of several metals (such as arsenic, beryllium, cadmium, lead and zinc) compared to less contaminated reference areas outside the site.

A two-phase RI/FS was conducted to investigate and determine appropriate remedial alternatives for Site 3. The Phase I RI field investigation was conducted from 1990 to 1992 (Atlantic, 1992). This investigation consisted of test borings, monitoring well installation, and soil, surface water, sediment, and groundwater sampling. The RI concluded that several risk exposure scenarios exceeded acceptable regulatory levels and that an FS should be performed for the site. A draft FFS (Atlantic, 1994) was completed for the soil and sediments at the site. Additional soil and sediment samples were collected and analyzed during the FFS to further define the extent of contamination. The FFS concluded that off-site landfilling and on-site thermal desorption provide superior protection of the environment and that the landfilling alternative is more cost effective than the on-site thermal desorption alternative.

The Phase II RI field investigation was conducted from 1993 to 1995 (B&RE, 1997a). This investigation also included test borings, monitoring well installation, and soil, surface water, sediment, and groundwater sampling. A soil gas survey and an extensive ecological investigation were also completed during the Phase II RI. The Phase II RI concluded that VOCs were present in the groundwater at Site 3, the site poses noncarcinogenic risks to the site worker and older child trespasser, and notable concentrations of pesticides exist in site soil and sediments. The Phase II RI recommended that the FS for this site should be revisited to focus on pesticides in soil and sediment, more sampling is required to delineate pesticide contamination and determine the origin of VOCs in groundwater, and finally, the debris associated with the OBDA should be removed.

Following the Phase II RI, an FS was completed in 1997 for soil and sediment at Site 3 (B&RE, 1997g). An alternative that included dredging, on-site dewatering, off-site disposal of sediment and soil, restoration of wetlands and waterways, and monitoring was selected for the site, and the selected remedy was documented in a ROD that was signed in March 1998 (B&RE, 1998c). A Remedial Design was completed for the soil and sediment at Site 3 in 1998 and 1999 (Foster Wheeler, 2000). The Remedial Action for Site 3 soil and sediment was completed in 1999 and 2000 (Foster Wheeler, 2001a).

A previously unknown source of petroleum contamination was detected during the Remedial Action at Site 3. The source, found during the remediation of Stream 5, is located on the north side of the stream just east of the Small Arms Range. Petroleum product was discovered emanating from the north side of the excavation. Upon further investigation, a small disposal area (i.e., drums, cable, etc.) was discovered upgradient of the location where petroleum was discovered. No additional investigation or remedial actions have been taken at this new source area, but the Navy is currently pursing a removal action for the site.

Further investigation of the groundwater OU at Site 3 was completed during the Basewide Groundwater OU RI (TtNUS, 2001e). During the investigation, temporary monitoring wells were installed and sampled and existing permanent monitoring wells were sampled. The following recommendations were made in the RI for Site 3.

- The soil OU associated with the new source area north of Stream 5 should be investigated further and addressed independently from the Basewide Groundwater OU RI. It is likely that a removal action would be appropriate for this source area.

- The Navy should proceed with a NTCRA to address contaminated soil and rubble present at the OBDANE. The Navy subsequently completed this removal action in May 2001.

- Even though contaminant concentrations were generally low and risks are acceptable under the current land use scenario, it is recommended that an FS be prepared for the groundwater OU associated with Site 3. The FS should evaluate, at a minimum, land use controls and monitoring for the site.

### 4.2.2 OBDA

The OBDA was located on the slope of the dike below and adjacent to the Area A Landfill. It was located on the southwestern end of the dike where the angle of the slope approaches 45 degrees. A small wetland at the base of the dike has been designated as the OBDA Pond. The OBDA was used as a disposal site after the earthen dike was constructed in 1957. The IAS Report (NEESA, 1983) indicated that the material had been there for many years. The IAS Report also indicated that the materials were not covered and included 30 partially covered 200-gallon metal fuel tanks and scrap lumber. The site was inspected in 1998 and it was observed that the tanks were still present at the site and old creosote telephone poles, several empty unlabeled 55-gallon drums, and rolls of wire were present at the site. Orange iron floc was observed in the sediments in the area where water was discharging from the base of the dike embankment.

As discussed above, the OBDA Pond, located downgradient of the OBDA, was investigated as part of the Area A Downstream Watercourses during the Phase I and II RIs and the FFS and FS for the site. No investigative activities were completed within the limits of the disposal area. All the debris from the OBDA area was removed and disposed off site as part of a NTCRA in 1997. This removal action was completed during the Area A Landfill IRA because the sites are located adjacent to one another. An Engineering Evaluation/Cost Analysis (EE/CA) and Action Memorandum were prepared in 1997 to document the decision process for the NTCRA (Navy, 1997).

## 4.3 REMEDIAL ACTIONS

As discussed above, an Action Memorandum (Navy, 1997a) for the OBDA was signed in 1997. A NTCRA was completed at the site in 1997. In addition, a ROD (B&RE, 1998c) was signed for the soil and sediment OU at Site 3 and the selected remedial action was implemented at the site. The following sections describe the removal action and remedial action that were completed at Site 3.

The groundwater OU at Site 3 is still being investigated under CERCLA. Appropriate remedial actions for the groundwater OU will be determined when the RI/FS process has been completed, so the groundwater OU is not discussed below.

### 4.3.1 Remedy Selection

#### 4.3.1.1 Area A Downstream Watercourses

Following the Phase II RI, an FS for soil and sediment at Site 3 was completed (B&RE, 1997g). No additional samples were collected during the study. Four remedial alternatives were evaluated during the FS. Although groundwater was not the focus of the FS, the cross-medium impact from contaminated soil and sediment was considered during the evaluation of alternatives. Based on site information such as types of contaminants, environmental media of concern, and potential exposure pathways, RAOs were developed to aid in the development of alternatives. These RAOs were developed to mitigate existing and future potential threats to public health and the environment. The following RAOs were selected for the soil and sediment OU:

- Protection of potential human receptors by preventing incidental ingestion of contaminated soil and sediment containing DDT, DDD, and dieldrin at concentrations exceeding 27 mg/kg, 38 mg/kg, and 0.57 mg/kg, respectively.

- Protection of potential human receptors by preventing incidental ingestion of sediment containing arsenic and beryllium at concentrations exceeding 6.1 mg/kg and 2.1 mg/kg, respectively.

- Protection of ecological receptors by preventing contaminated soil (containing DDTR concentrations exceeding 5.6 mg/kg, rounded down to 5.0 mg/kg to be conservative) and contaminated sediment (containing DDTR concentrations exceeding 2.0 mg/kg and dieldrin concentrations exceeding 0.045 mg/kg to 0.195 mg/kg) from entering the food chain.

- Protection of ecological receptors from potential toxicity of sediment containing cadmium, lead, and zinc at concentrations exceeding their respective effects range-medium (ER-M) values of 9.6 mg/kg, 218 mg/kg, and 410 mg/kg.

The preferred alternative that was selected from the FS and documented in the ROD was excavation of the contaminated soil and sediment followed by onsite dewatering and disposal at an off-site landfill. The sequence of actions envisioned at a conceptual state were as follows: (1) removal, on-site treatment, and discharge of standing water from ponds and streams with appropriate stream flow diversions; (2) clearing/grubbing of contaminated soil areas; (3) dredging, on-site dewatering, and off-site disposal of contaminated sediment; (4) excavation, on-site dewatering, and off-site disposal of contaminated soil; (5) placement of clean soil backfill over the excavated soil areas with top soil cover and revegetation to replace altered wetland functions and values; and (6) placement of suitable borrow material over the dredged sediment areas (such as sand in ponds and gravel in streams) and restoration of aquatic habitats. It was assumed that fencing and security measures would be present and continued to be instituted during the remedial action.

The remedial goals selected for the remedial action are summarized in Table 4-1. The arsenic and beryllium remedial goals were derived for protection of human receptors and the remaining remedial goals were derived for protection of ecological receptors of concern. The ecological remedial goals are sufficiently low to be protective of human receptors of concern. The human health remedial goals are contaminant concentrations that would reduce the potential health risks to the receptors of concern (i.e., the older child trespasser and construction workers) to acceptable levels. The following bullets discuss the basis for the ecological remedial goals:

- The soil remedial goal for DDTR was based on potential impacts to the short-tail shrew via ingestion of soil and contaminated prey items. The no-observed-adverse effects level (NOAEL) used for the shrew was 0.8 mg/kg-day (Opresko et al., 1994). The soil to earthworm bioaccumulation factor (BAF) was determined based on a site-specific bioaccumulation study. Finally, the exposure parameters in the food-chain model (i.e., ingestion rates) were obtained from the Wildlife Exposure Factors Handbook (USEPA, 1993b).

- The sediment remedial goals for the metals were based on the Effects Range-Median (ER-M) value from Long et al. (1995).

- The sediment remedial goal for DDTR is based on empirical relationships between effects to benthic macroinvertebrates and DDTR concentrations.

- The sediment remedial goal for dieldrin is based on equilibrium partitioning using the site-specific total organic carbon (TOC) concentrations, the chemical-specific organic carbon partition coefficient (Koc) value, and the water-quality screening value (WQSV) for dieldrin. The WQSV for dieldrin was obtained from the draft Sediment Quality Criteria for the Protection of Benthic Organisms: Dieldrin (USEPA, 1993a). The WQSV from that document (0.062 µg/L) was used because it is based on risks to aquatic organisms.

The cost associated with the selected remedy was estimated to be $8,125,000. The cost for wetland restoration and O&M for years 0 through 5 was estimated at $50,000 per year.

The Remedial Design for the soil and sediment OU began in 1998 and was completed in 1999. Additional sampling was conducted in the fall and winter of 1998 to further delineate the extent of contamination. The focus of the design was to develop a Work Plan and construction drawings that showed the details for excavating and disposing of the contaminated soil and sediment. The Work Plan and drawings that were developed described and showed construction sequencing, equipment lay-down areas, stream and pond dewatering details, dewatering pads, site restoration details, final grading plans, erosion and sediment control details, etc. for the remedial action. A verification sampling plan was also included in the Work Plan. The goal of the plan was to verify that the remedial action met the remedial goals defined above.

#### 4.3.1.2 OBDA

The decision process for selecting the NTCRA for OBDA was documented in the Action Memorandum for the OBDA (Navy, 1997a). The NTCRA was completed to eliminate the potential threat to human and ecological receptors caused by the migration of contamination from potentially leaking tanks, drums, or other containers. It was determined that the most effective way to address this threat was to perform a NTCRA and dispose the material off site. Other actions that were considered included institutional controls and containment. The ARARs/TBCs for the NTCRA were CTDEP Pollutant Mobility Criteria, CTDEP Direct Exposure Criteria for soil, and the FFDC action tolerance level. The estimated cost of the NTCRA was $500,000.

### 4.3.2 Remedy Implementation

#### 4.3.2.1 Area A Downstream Watercourses

The remedial action for the Area A Downstream Watercourses/OBDA soil and sediment OU was completed during July 1999 and August 2000. The details of the remedial action were documented in the Remedial Action Completion Report for Area A Downstream/OBDA Remediation (Foster Wheeler, 2001a). The actual cost of remediation was approximately $6,000,000. This cost does not include O&M costs.

Remediation and restoration of the site was done in phases (i.e., Phases I through VI). The waterbodies addressed in each phase are summarized below.

- Phase I – Stream 4
- Phase II – Stream 3
- Phase III – Stream 5
- Phase IV – Upper Pond
- Phase V – Lower Pond/Stream 2
- Phase VI – OBDA Pond/Stream 1/Base of OBDA Slope/Discharge Channel Structure

Although conditions varied between watercourses, the following general tasks were completed during each phase:

- Dewater and treat water, if necessary.
- Properties sampling for match to fill material prior to excavation.
- Excavate soil/sediment and load directly to front-end loader.
- Transfer soil/sediment to material-handling pad.
- Sample excavated soil and sediment for waste characterization purposes prior to stabilization.
- Sample excavation sidewalls/base at the frequency specified in the Sampling and Analysis Plan.
- Perform field immunoassay screening in conjunction with off-site laboratory analysis for pesticides and metals.
- Backfill or continue excavation based on field screening and laboratory analysis.
- Mix contaminated sediment on material handling pad with stabilizing agent.
- Load stabilized material onto dump trucks and transport to disposal/recycling facility.

Approximately 18,050 tons of soil and sediment were excavated and disposed off-site during the remedial action. Post-excavation confirmatory sampling and analysis was performed to confirm that remedial goals

at each excavation had been met prior to closing the excavation. Field sampling and screening for DDTR was used as the decision-making tool regarding excavation depth and area. Once field-screening results indicated that the remedial goals in an area had been met for DDTR, samples were collected and submitted to the laboratory for confirmatory analysis. A minimum of 10% of the soil and sediment samples were analyzed for metals (arsenic, beryllium, cadmium, lead, and zinc) to confirm that levels were below their respective remedial goals or the CTDEP Residential Direct Exposure Criteria. Each sample was comprised of a minimum of four aliquots collected from each watercourse area. These composite samples were representative of the nature of each watercourse area. When the laboratory results confirmed that remedial goals were met, excavations were backfilled and restored in accordance with the 100% Design. Piezometers were installed for hydrologic monitoring, and all impacted wetlands and upland areas were restored with topsoil and planted with the selected herbaceous seed mixes. The initial phase of restoration was completed in August 2000. The next phase of restoration involved planting the woody material; which was initiated in April 2001 in accordance with the 100% Design - Wetlands Restoration Plan.

Several changes were made to the Remedial Design during the remedial action. The most significant change occurred during the remediation of Stream 4. Abandoned pipes were uncovered during the excavation of soil and sediment at the headwaters of the stream. Stream 4 is formed by the discharge from the Area A Wetland. These abandoned pipes were below the existing outlet structure for the Area A Wetland. It was felt that excavation and removal of the pipes would compromise the integrity of the Area A Wetland dike. Analytical results for a soil sample collected from around the pipes showed a concentration of DDTR of approximately 33 mg/kg, which is above the soil remediation goal of 5 mg/kg. To address the problem, the area around the piping was isolated and encapsulated using a cement/bentonite grout. A small form was erected around the area and the grout was placed to form a small monolithic structure. Large stone and cobbles were placed around the rim of the excavation, adjacent to the exposed portion of the berm and beneath the Area A Wetland outfall. The height of the rock was matched with the existing slope of the berm. Filter fabric was installed between the berm and the rock, and a sand and gravel material was placed to fill the void. Additional fill material was placed and graded to mimic the existing slope of the berm. Erosion control fabric was placed over the newly placed material and anchored to the existing slope of the berm. In order to minimize erosion immediately beneath the Area A Wetland outfall structure, concrete was placed to form an apron and anchor the rock structure in part of the excavation.

To meet the land use control requirements in the ROD, the U.S. Navy has prepared and implemented an instruction [i.e., SOPA (ADMIN) New London Instruction 5090.18, (Navy, 2000b)] to restrict use at IR sites at NSB-NLON. The instruction defines the Navy's policy regarding ground surface disturbance of soils or any subsurface disturbance of soils and/or groundwater in IR sites.

Other components of the remedial action, including long-term monitoring and O&M, are discussed below in Section 4.3.3.

#### 4.3.2.2 OBDA

The NTCRA for the OBDA was completed during January 1997 and March 1997. The details of the NTCRA were documented in the Final Post Removal Action Report for Over-Bank Disposal Area (Foster Wheeler, 1997b). Tanks, large metal items, timbers, and miscellaneous construction debris resting on or protruding through the existing ground surface were removed from the OBDA during the NTCRA. Material removed from the site was decontaminated, if necessary, stockpiled, and subsequently transported off-site for disposal. Potentially contaminated debris was wipe sampled and analyzed for DDT. Soil was also sampled and analyzed for DDT. DDT was not detected in either sample. After excavation, rock was placed in the excavation to stabilize it and then the excavation area was restored with topsoil and hydroseeded.

### 4.3.3 System Operations/Operation and Maintenance

As a result of soil and sediment excavation and removal during the Area A Downstream/OBDA remedial action, 2.90 acres of palustrine wetlands were disturbed. Compensatory mitigation for this impact required the restoration of 2.43 acres of palustrine wetlands and 0.47 acres of open water. All areas excavated during the Area A Downstream/OBDA remedial action have been restored and re-seeded in accordance with Wetland Restoration Plan in the 100% Design. This activity was considered Stage 1 of restoration activities. Vegetation, hydrologic conditions, and fish and wildlife use in the Area A Downstream/OBDA were monitored weekly between August 14, 2000 through October 26, 2000. A baseline benthic survey was also conducted in October 2000 in conjunction with the post-construction monitoring. The results of the monitoring are documented in the Post-Construction Monitoring Report, Area A Downstream/OBDA (Foster Wheeler, 2001b). In general, all monitoring results were positive and indicated that restoration activities were successful.

Planting of the woody species (i.e. shrubs and trees) in the Area A Downstream/OBDA was completed between April 2001 and May 2001. This activity was considered as Stage 2 of the restoration activities. Additional tasks to be completed in accordance with the Wetland Restoration Plan in the 100% Design include the following:

- *Phragmites* management
- Long-term monitoring for sediment, soil, surface water, hydrology, vegetation, benthic community
- Wetland delineation in accordance with Army Corps of Engineers (ACOE) methods.

As detailed in the final Long Term Wetland Monitoring Plan (Foster Wheeler, 2001c), long-term monitoring will consist of four components: vegetation, soils, hydrology, and functions and values. Long-term monitoring will commence upon the completion of the Stage 2 plantings. Monitoring will be initially conducted for three years based on the contingency that all the performance standards are met and successful restoration of disturbed wetlands is clearly demonstrated. If at the end of the third year of monitoring, the above performance standards are not achieved, two additional years of monitoring will be conducted and appropriate adjustments recommended (i.e., additional plantings). The performance standards for the monitoring are summarized below.

**Vegetation**

- A minimum of 80% areal cover, excluding planned open water areas, by noninvasive hydrophytic species for all seeded areas;

- Greater than 50% of dominant plant species that have a wetland indicator status of facultative (FAC), facultative wetland (FACW), or obligate wetland (OBL) with no more than 50% of FAC species;

- For planted woody species, a minimum of 80% survival based on stem count;

- A 20% increase in tree height and diameter at breast height.

**Soils**

- Trend towards hydric condition within upper 18 inches of soil profile.

**Hydrology**

- Emergent zone hydrology that consists of soil saturated to the surface, water on the surface or a combination of surface water and saturated soils for at least 10 consecutive days during the growing season,

- Scrub/shrub and forested zone hydrology that consists of soil that is saturated to the surface, or the groundwater table that is within 10 inches of the surface, for at least 10 consecutive days of the growing season.

**Functions and Values**

- All streams and ponds show a trend toward greater biological diversity in the benthic invertebrate community;

- Post-remedial functions and values equal to or greater than pre-remedial functions and values;

- Predicted potential habitat for 27% (16) of all wetland-dependent amphibians, reptiles, and mammals evaluated by the WEThings Method; and

- Restoration of 1.26 acres of emergent wetland, 1.17 acres of scrub/shrub/forested wetland, and 0.47 acres open water.

Preliminary assessments of the woody plantings at the Area A Downstream site indicate steadily progressing extensive, severe deer browse damage, especially to certain woody sapling species. The first biannual vegetation monitoring, scheduled for the fall of 2001, will include a thorough assessment of deer browse damage to all woody plantings at the site. The subsequent monitoring report will quantify deer browse damage on a species specific level and make recommendations for deer browse damage control and replanting in the spring of 2002. Based on the amount and severity of the browse damage, recommendations may be made to either replant heavily damaged species and protect those plantings with deer repellants, caging or site perimeter fencing, replant heavily damaged species with larger specimens to discourage deer browse, or shift the species composition mix from heavily damaged species to lightly damaged species through the replanting of those species observed to have incurred little or no deer damage.

The results of the additional monitoring tasks will be documented in the Second Five-Year Review Report.

## 4.4 FIVE-YEAR REVIEW FINDINGS

### 4.4.1 Site Inspection

A site inspection was conducted at Site 3 on April 10, 2001. Weather conditions during the inspection were favorable, with mild temperatures and no precipitation. Representatives from the U.S. Navy, USEPA, CTDEP, TtNUS, and Foster Wheeler participated in the inspection.

The site inspection included visual observations of the remediated and restored water bodies within the Area A Downstream/OBDA site. At the time of the inspection, the RAC was planting the woody species

(i.e., shrubs and trees) in the Area A Downstream/OBDA. Appendix A contains photographs taken of the site during the site inspection. The following items were noted during the site inspection.

- Iron floc is still present in the OBDA pond.
- The protective cover for monitoring well 2DMW11S was missing.
- A small portion of the southern bank of Stream 5, just south of the Torpedo Shops, was eroded (see Figure 4-1).

The land use for the site has remained unchanged since the remedial action. The area is fenced and access is restricted. Most of the site is within designated ESQD arcs of the Area A Weapons Center; therefore, further development is not planned for this area. Navy regulations prohibit construction of inhabited buildings or structures within these arcs and no further construction is planned.

### 4.4.2 Document and Analytical Data Review

The documents that were reviewed for this five-year review are listed below, and key information obtained from the documents is summarized in the following paragraphs. No analytical data are being collected as part of the post-construction monitoring program for the site; therefore, no data are reviewed in this section.

- Action Memorandum for Overbank Disposal Area
- Final Post Removal Report for Overbank Disposal Area
- FS for Soil and Sediment Area A Downstream/OBDA (Site 3)
- ROD for Soil and Sediment Area A Downstream Watercourses/Overbank Disposal Area
- 100% Design for Area A/OBDA
- Final Remedial Action Completion Report for Area A Downstream/OBDA Remediation
- Draft Post Construction Monitoring Report for Area A Downstream/OBDA
- Final Long Term Wetland Monitoring Plan for Area A Downstream/OBDA
- SOPA (ADMIN) New London Instruction 5090.18

A review of the Action Memorandum provided the RAOs, ARARs, and a summary of the remedial alternatives evaluated for the OBDA. The review also provided the cost estimate for the NTCRA.

A review of the post-removal report for OBDA provided the details of the NTCRA. The time-frame for the removal action, types of material removed, confirmation sampling results, and the amount of material removed are all documented in the report.

A review of the FS for Area A Downstream/OBDA soil and sediment provided RAOs, ARARs, and a summary of the remedial alternatives evaluated for the site. The review also provided the cost estimates for the remedial alternatives evaluated in the FS.

A review of the ROD for Area A Downstream/OBDA soil and sediment provided a description of the selected remedy. The selected remedy consisted of excavation of the contaminated soil and sediment, followed by on-site dewatering and off-site disposal, and site restoration. The contaminant-specific remediation goals were also documented in the ROD.

A review of the 100% Design for Area A/OBDA provided the details of the design of the remedial action for the soil and sediment. The design included a Work Plan and construction drawings that showed the details for excavating and disposing of the contaminated soil and sediment and site restoration. A verification sampling plan was also included in the design documents.

A review of the Remedial Action Completion Report for Area Downstream/OBDA provided the details of the remedial action. The time-frame for the remedial action, sequence of remedial actions, volume of material removed, confirmation sampling results, site restoration activities, and deviations from the remedial design are all documented in the report.

A review of the draft Post-Construction Monitoring Report provided the results of the monitoring program for vegetation, hydrologic conditions, and fish and wildlife use in the Area A Downstream/OBDA. The results of the baseline benthic survey were also provided in the report.

A review of the final Long Term Wetland Monitoring Plan provided the approach for re-establishment of wetlands disturbed during site remediation. The plan provides performance standards and monitoring components for determining the success of the restoration activities.

A review of New London Instruction 5090.18 provided the approach to be used for land use controls at NSB-NLON. The instruction details the restrictions on ground surface disturbance of soils or any subsurface disturbance of soils and/or groundwater at IR sites at NSB-NLON.

### 4.4.3 ARAR and Site-Specific Action Level Changes

The proposed remedy for soil and sediment at the Area A Downstream was excavation and off-site disposal of the material. A listing of the ARARs/TBCs considered during preparation of the ROD are presented on Tables 4-2, 4-3, and 4-4. These ARARs/TBCs were generally met during implementation of the Remedial Action. No new human health ARARs have been promulgated that would call into question the protectiveness of the remedy for soil and sediment.

Remedial action goals for arsenic and beryllium were based on potential impacts to older child trespassers exposed by incidental ingestion of soil/sediment. The remedial goal of 2.1 mg/kg for beryllium was based on carcinogenic health effects. In April 1998 USEPA withdrew the carcinogenic toxicity criteria for oral exposures to beryllium. The remedial goal for potential exposures to beryllium in soil/sediment by a older child trespasser based on noncarcinogenic effects would be 2,600 mg/kg. Since the revised remedial goal for beryllium is higher and therefore less stringent than the remedial goal presented in the feasibility study, the revised remedial goal for beryllium does not call into question the effectiveness of the remedy.

The groundwater OU was not addressed during the remedial action. There have been no changes in ARARs or site-specific action levels for groundwater since the draft final Basewide Groundwater OU RI was issued.

The soil remedial goal of 5.0 for DDTR was based on potential impacts to the short-tail shrew via ingestion of soil and contaminated prey items. The toxicity data used to develop this value has not changed in the last five years. A site-specific soil-to-earthworm bioaccumulation factor (BAF) was determined so this value does not change in the five-year review. Finally, the exposure parameters in the food-chain model not changed in the last five years. Therefore, the effectiveness of the remedy has not changed in the last five years.

The sediment remedial goal for the metals were based on the Effects Range-Median (ER-M) value from Long et al. (1995), which have not changed or been updated in the last five years. Also, because the sediment remedial goal for DDTR is based on site-specific empirical relationships between effects to benthic macroinvertebrates and DDTR concentrations, no changes can be made to this remedial goal. Therefore, the effectiveness of these remedy have not changed in the last five years.

The sediment remedial goal for dieldrin is based on equilibrium partitioning using the site-specific total organic carbon (TOC) concentrations, the chemical-specific organic carbon partition coefficient (Koc) value, and the water-quality screening value (WQSV) for dieldrin. The only update to the parameters used in this equation was the WQSV, which was decreased from 0.062 µg/L in USEPA, 1993a to 0.056 µg/L in USEPA, 1999a. This would produce a slightly lower sediment action level. Dieldrin was only detected in one post-removal sediment sample at an estimated concentration of 0.0022 J mg/kg. This value was well below the sediment action level of 0.045 mg/kg, and would only decrease slightly using the updated WQSV. Therefore, the revised WQSV for dieldrin does not call into question the effectiveness of the remedy.

## 4.5 ASSESSMENT

The following conclusions support the determination that the remedy for the Site 3 soil and sediment OU is expected to be protective of human health and the environment upon completion.

***Question 1. Is the remedy functioning as intended by the decision documents?***

- ***HASP/Contingency Plan:*** A HASP was prepared and followed during the implementation of the Remedial Design. Site restoration activities are being monitored as part of the post-construction monitoring program. Problems discovered during the monitoring program are addressed in accordance with the Wetland Restoration Plan.

- ***Implementation of Institutional Controls and Other Measures:*** Institutional controls associated with Site 3 are discussed in the New London Instruction 5090.18. The area is fenced and access is restricted. Most of the site is within designated ESQD arcs of the Area A Weapons Center; therefore, further development is not planned for this area.

- ***Remedial Action Performance:*** All contaminated soil and sediment in excess of remediation goals were excavated and disposed off site. The only exception was a small area in Stream 4, which was capped in place. The effectiveness of the remedial action and site restoration activities are being monitored as part of the post-construction monitoring program. The components of the monitoring program and the performance standards are summarized in Section 4.3.3. Initial results of the monitoring show that restoration activities are successful. One exception has been the survival of the woody species. Deer browse has been the major problem with the survival of woody species.

- ***System Operations/O&M:*** Any issues noted during the post-construction monitoring program are being addressed by the Navy's RAC. For example, areas where initial seeding was not successful have been re-seeded as necessary. Steps are being taken to minimize deer browse on the woody species. Re-planting of the woody species will also be completed.

- ***Cost of Operations/O&M:*** Not available at this time.

- ***Opportunities for Optimization:*** No opportunities for optimization can be discussed at this time.

- ***Early Indicators of Potential Remedy Failure:*** There are no indicators of potential remedy failure.

***Question 2. Are the assumptions used at the time of the remedy selection still valid?***

- **Changes in Standards and To Be Considereds**: There have been no changes in Standards or TBCs which that call into question the protectiveness of the remedy. As presented in Section 4.4.3, the water quality screening value for dieldrin decreased from 0.062 µg/L to 0.056 µg/L. None of the other standards/TBCs have changed since the ERA was conducted.

- **Changes in Exposure Pathways:** Because all contaminated soil and sediment above remediation goals was either excavated and disposed off-site or capped in place, the direct exposure pathway for human or ecological receptors to come into contact with the soil and sediment has been eliminated. This change was planned as part of the remedial action.

- ***Changes in Toxicity and Other Contaminant Characteristics:*** In April 1998 the USEPA withdrew the oral cancer slope factor for beryllium. In addition the oral reference dose for beryllium was lowered from 0.005 mg/kg/day to 0.002 mg/kg/day. As discussed in Section 4.4.3, the changes in the toxicity criteria for beryllium do not call into question the effectiveness of the remedy. None of the ecological toxicity data have changed since the ERA was conducted.

- ***Changes in Risk Assessment Methodologies:*** As discussed in Section 1.4, there have been no major changes in human health risk assessment methodologies since the signing of the ROD. Similarly, as presented in Section 1.4, no significant changes have occurred in the ecological risk assessment methodology since the ERA was conducted and the ROD was signed.

***Question 3. Has any other information come to light that could call into question the protectiveness of the remedy?***

A new source area was discovered during the remediation of Stream 5. This area was not addressed during the remedial action and new contaminants and routes of exposure may be applicable to this site. Sampling and analysis conducted during the remedial action and the Basewide Groundwater OU RI indicate that the contaminants of concern for the new source area may include petroleum products and chlorinated solvents. The Navy plans to complete a removal action to address this new source area. Planning documents are currently being prepared for the removal action.

## 4.6 DEFICIENCIES

The only significant deficiency with the remedial action was that it did not address the new source area discovered north of Stream 5. The Navy plans to complete a removal action to address this new source area.

Other deficiencies noted during the site inspection included the following:

| Deficiency | Effects Protectiveness | |
|---|---|---|
| | Current | Future |
| Lack of monitoring well maintenance | N | N |
| Proper stabilization of the southern bank of Stream 5 | N | N |

### 4.7 RECOMMENDATIONS AND REQUIRED ACTIONS

Based on the results of the site inspection and review, the following recommendations and actions are required for Site 3.

- Continue post-construction/long-term monitoring and restoration program.
- Address erosion of Stream 5.
- Complete planning documents and conduct the removal action for the new source area.
- Maintain the existing monitoring well network and/or properly abandon unnecessary monitoring wells.
- Continue the RI/FS process and develop and implement an appropriate remedial alternative for the groundwater OU.
- Enforce the New London Instruction 5090.18.

### 4.8 PROTECTIVENESS STATEMENT

The remedy implemented for the soil and sediment at Site 3 is generally protective of human health and the environment. One limitation of the remedy is that it did not address the new source area discovered north of Stream 5. It is anticipated that, when the soil OU associated with the new source area is addressed by a removal action, the remedial actions completed for the soil and sediment OU will be completely protective of human health and the environment.

The groundwater OU for Site 3 is still being investigated. There are no immediate threats to human health or the environment from the OU (i.e., groundwater is not currently used as a drinking water source). An appropriate remedial action will be conducted for the OU in the future. The protectiveness of the remedial action will be evaluated during the Second Five-Year Review.

Click here to go to document index

**TABLE 4-1**

**SUMMARY OF REMEDIATION GOALS PROTECTIVE OF HUMAN AND ECOLOGICAL RECEPTORS OF CONCERN AREA A DOWNSTREAM/OBDA NSB-NLON GROTON, CONNECTICUT**

| Contaminant of Concern | Medium of Concern | |
|---|---|---|
| | Soil | Sediment |
| DDTR | 5.0 mg/kg | 2.0 mg/kg |
| Dieldrin | Not a COC | 0.045 mg/kg |
| Arsenic | Not a COC | 6.1 mg/kg |
| Beryllium | Not a COC | 2.1 mg/kg |
| Cadmium | Not a COC | 9.6 mg/kg |
| Lead | Not a COC | 218 mg/kg |
| Zinc | Not a COC | 410 mg/kg |

Click here to go to document index

**TABLE 4-2**

**CHEMICAL-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, ADVISORIES, AND GUIDANCE**
**SITE 3 – AREA A DOWNSTREAM WATERCOURSES/OBDA**
**NAVAL SUBMARINE BASE NEW LONDON**
**GROTON, CONNECTICUT**


**FEDERAL**

| Requirement | Citation | Synopsis of Requirement | Current Status / Applicability |
|---|---|---|---|
| Water Quality Criteria for DDT and Metabolites (EPA 440-80-038), 1980 | | Provides criteria for assessing toxicity of DDT and metabolics to aquatic organisms. | DDTR contaminated soil/sediment was either excavated, removed, and replaced with uncontaminated material or capped. Remaining soil/sediment provides no source of contamination to surface waters and poses no hazard to potential aquatic receptors; therefore, this remedy attains water quality criteria in the wetland surface water. |
| Technical Basis for deriving Sediment Quality Criteria for Non-Ionic Organic Contaminants for Protection of Benthic organisms by Using Equilibrium Partitioning (EPA-822-R-93-011), 1993 | | Guidance for estimating cleanup goals for sediment contamination. | Contaminated sediment was either excavated, removed, and replaced with uncontaminated material or capped. Remaining sediment poses no hazard to potential receptors. Removal of contaminated sediment achieved protection of receptors of concern; therefore, this requirement is no longer applicable. |
| National Oceanographic and Atmospheric Administration (NOAA) Incidence of Adverse Biological Effects within Ranges of Chemical Concentration in Marine and Estuarine Sediments (Long et. al., 1995) | | Guidance on concentration ranges of contaminants in sediment that would rarely or more likely to have adverse effects. Findings comparable with fresh-water sediments. | Contaminated sediment was either excavated, removed, and replaced with uncontaminated material or capped. Remaining sediment poses no hazard to potential receptors. Remedial actions achieved protection of receptors of concern; therefore, this requirement is no longer applicable. |
| Cancer Slope Factors (CSF). | | These are guidance values used to evaluate the potential carcinogenic or non-carcinogenic hazard caused by exposure to contaminants. | Contaminated sediment was either excavated, removed, and replaced with uncontaminated material or capped Remaining sediment poses no hazard to potential receptors. Remedial actions achieved protection of receptors of concern; therefore, this requirement is no longer applicable. |
| Reference Dose (RfD) | | These are guidance values used to evaluate the potential carcinogenic or non-carcinogenic hazard caused by exposure to contaminants. | Contaminated soil/sediment was either excavated, removed, and replaced with uncontaminated material or capped. Remaining soil/sediment poses no hazard to potential receptors; therefore, this requirement is no longer applicable. |

## TABLE 4-2

## CHEMICAL-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, ADVISORIES, AND GUIDANCE
## SITE 3 – AREA A DOWNSTREAM WATERCOURSES/OBDA
## NAVAL SUBMARINE BASE NEW LONDON
## GROTON, CONNECTICUT
## PAGE 2 OF 2

**STATE OF CONNECTICUT**

| Requirement | Citation | Synopsis of Requirement | Action to Be Taken to Attain ARAR |
|---|---|---|---|
| Soil Remediation Standards | RCSA § 22a-133k-1 thru 2 | Regulations specify remediation standards for direct exposure to soil and sediments. Regulations also specify groundwater protection standards for contaminated soil in areas with a state groundwater classification of GB. | Contaminated soil/sediment was either excavated, removed, and replaced with uncontaminated material or capped. Because these remedial actions prevent direct exposure, this requirement is no longer applicable. The groundwater aquifer is expected to meet the standards for the groundwater classification after the completion of the groundwater OU activities |

Click here to go to document index

**TABLE 4-3**

**LOCATION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, ADVISORIES, AND GUIDANCE**
**SITE 3 – AREA A DOWNSTREAM WATERCOURSES/OBDA**
**NAVAL SUBMARINE BASE NEW LONDON**
**GROTON, CONNECTICUT**


**FEDERAL**

| Requirement | Citation | Synopsis of Requirement | Current Status / Applicability |
|---|---|---|---|
| Clean Water Act, Section 404 | 33 USC 1344; 40 CFR Part 230 and 33 CFR Parts 320-323 | These rules regulate the discharge of dredge and fill materials in wetlands and navigable waters. Such discharges are not allowed if practicable alternatives are available. | Remedial action included dredging of soil and sediment from the contaminated wetlands and replacement/restoration with uncontaminated material. Measures were taken to minimize adverse effects and to replace or restore protected wetland functions and values. Now that the dredging and filling has been completed, this requirement is no longer applicable. |
| Executive Order 11990<br>RE: Protection of Wetlands | Executive Order 11990, 40 CFR Part 6, Appendix A | This Order requires Federal agencies to take action to avoid adversely impacting wetlands wherever possible, to minimize wetlands destruction and to preserve the values of wetlands, and to prescribe procedures to implement the policies and procedures of this Executive Order. | Remedial action included dredging of soil and sediment from the contaminated wetlands and replacement/restoration with uncontaminated material. Measures were taken to minimize adverse effects and to replace or restore protected wetland functions and values. Wetlands restoration is proceeding according to the Wetlands Restoration Plan. The substantive requirements of the wetlands ARARs will be met once the plan is fully implemented. Changes in remedial goals for soil and sediment as related to wildlife and benthic organisms are presented in Section 4.4.3. |
| Fish and Wildlife Coordination Act | 16 USC Part 661 *et. seq.*, 40 CFR 122.49 | This order protects fish and wildlife when Federal actions result in control or structural modification of a natural stream or body of water. | Remedial action included dredging of soil and sediment from the contaminated wetlands and replacement/restoration with uncontaminated material. Measures were taken to minimize adverse effects on fish and wildlife. Changes in remedial goals for soil and sediment as related to wildlife and benthic organisms are presented in Section 4.4.3. |
| Coastal Zone Management Act | 16 USC Parts 1451 *et. seq*. | Requires that any actions must be conducted in a manner consistent with state approved management programs. | Dredging, filling, and regrading have been completed and restoration of vegetation is in progress; therefore, this requirement is no longer applicable. |

**TABLE 4-3**

**LOCATION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, ADVISORIES, AND GUIDANCE**
**SITE 3 – AREA A DOWNSTREAM WATERCOURSES/OBDA**
**NAVAL SUBMARINE BASE NEW LONDON**
**GROTON, CONNECTICUT**


**FEDERAL (Continued)**

| | | | |
|---|---|---|---|
| Executive Order 11988<br>RE: Floodplain Management | Executive Order 11988 | This order requires Federal agencies to evaluate the potential effects of actions it may take within a designated 100-year floodplain of a waterway to avoid adversely impacting floodplains whenever possible. | Dredging, filling, and regrading have been completed and restoration of vegetation is in progress; therefore, this requirement is no longer applicable. |

**STATE OF CONNECTICUT**

| Requirement | Citation | Synopsis of Requirement | Current Status / Applicability |
|---|---|---|---|
| Inland Wetlands and Watercourses | CGS § 22a-37 thru 45, RCSA § 22a-39-1 through 15 | These rules regulate all activities in wetlands and watercourses. | Contaminated soil and sediment were dredged from wetlands and watercourses, which were restored using uncontaminated material. Wetlands restoration is proceeding acording to the Wetlands Restoration Plan. The substantive requirements of the wetlands ARARs will be met once the plan is fully implemented. Changes in remedial goals for soil and sediment as related to wildlife and benthic organisms are presented in Section 4.4.3. |
| Coastal Management | CGS §§22a-92 and 94 | Federal facilities are required to file a coastal zone consistency determination under these rules, which includes the goal that development, preservation, or use of land and water resources of a coastal area proceed without significantly disrupting the natural environment. | Contaminated soil and sediment were removed from areas within the coastal zone, which were restored using uncontaminated material. The substantive requirements of the CT standards were met to address the alteration of the coastal zone. Restoration of vegetation is in progress; therefore, this requirement is no longer applicable. |
| CT Endangered Species Act | CGS § 26-303 thru 314 | Regulates activities affecting state-listed endangered or threatened species or their critical habitat. | Dredging, filling, and regrading have been completed and restoration of vegetation is in progress; therefore, this requirement is no longer applicable. |

Click here to go to document index

**TABLE 4-4**

**ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, ADVISORIES, AND GUIDANCE**
**SITE 3 – AREA A DOWNSTREAM WATERCOURSES/OBDA**
**NAVAL SUBMARINE BASE NEW LONDON**
**GROTON, CONNECTICUT**


**FEDERAL**

| Requirement | Citation | Synopsis of Requirement | Current Status / Applicability |
|---|---|---|---|
| Clean Water Act, Section 402, National Pollution Discharge Elimination System (NPDES) | 33 USC 1342; 40 CFR 122 through 125 | These standards govern the discharge of water into surface waters. | Surface water removed prior to dredging, along with water from the sediment/soil dewatering process, was treated by filtration and carbon adsorption to meet discharge criteria according to substantive requirements of NPDES. Now that dredging and water discharge has been completed, this regulation is no longer applicable. |

**STATE OF CONNECTICUT**

| | | | |
|---|---|---|---|
| Water Pollution Control | RCSA § 22a-430-1 through 8 | These rules regulate water discharge to surface water. | Surface water removed prior to dredging, along with water from the sediment/soil dewatering process, was treated by filtration and carbon adsorption in compliance with these regulations. Now that dredging and water discharge has been completed, this regulation is no longer applicable. |
| Water Quality Standards | CGS 22a-426 | Connecticut's Water Quality Standards establish specific numeric criteria, designated uses, and anti-degradation policies for groundwater and surface water. | Surface water removed prior to dredging, along with water from the sediment/soil dewatering process, was treated by filtration and carbon adsorption in a manner which is consistent with the antidegradation policy in the Water Quality Standards. Now that dredging and water discharge has been completed, this regulation is no longer applicable. |
| Hazardous Waste Management: Generator and Handler Requirements, Listing and Identification | RCSA § 22a-449(c) 100-101 | CT is delegated to administrate the federal RCRA statute through its state regulations. These sections establish standards for listing and identification of hazardous waste. The standards of 40 CFR 260-261 are incorporated by reference. | Hazardous waste determinations were performed on all contaminated soils/sediments excavated to determine that that levels of regulated constituents do not exceed applicable limits. Also, wastes produced from surface water and dewatering treatment were tested to determine whether levels of certain regulated constituents (lead, mercury, heptachlor, etc.) exceed TCLP limits. Any contaminated soils/sediments which exceed applicable limits were managed in accordance with requirements of these regulations. Now that excavation and disposal operations have been completed, this regulation is no longer applicable. |

## TABLE 4-4

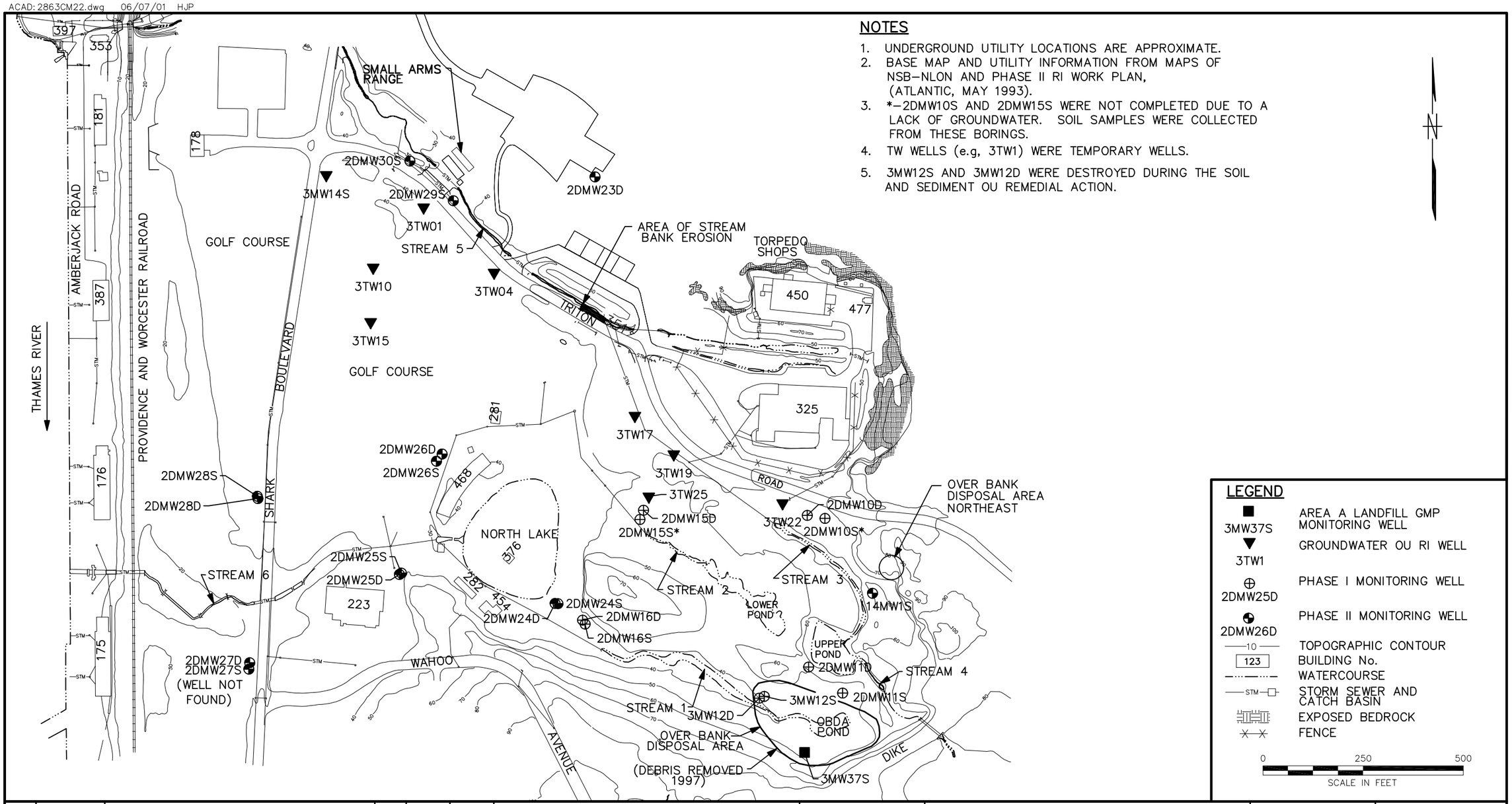
## ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, ADVISORIES, AND GUIDANCE
## SITE 3 – AREA A DOWNSTREAM WATERCOURSES/OBDA
## NAVAL SUBMARINE BASE NEW LONDON
## GROTON, CONNECTICUT
## PAGE 2 OF 2

**STATE OF CONNECTICUT (Continued)**

| Requirement | Citation | Synopsis of Requirement | Current Status / Applicability |
|---|---|---|---|
| Hazardous Waste Management: Generator Standards | RCSA § 22a-449(c)-102 | This section establishes standards for various classes of generators. The standards of 40 CFR 262 are incorporated by reference. | Surface water treatment residues (spent filtration media and activated carbon) were tested for hazardous characteristics during remediation. Now that dredging and the associated water treatment have been completed, this regulation is no longer applicable. |
| Hazardous Waste Management: TSDF Standards | RCSA § 22a-449 (c) 104 | This section establishes standards for treatment, storage, and disposal facilities. The standards of 40 CFR 264 are incorporated by reference. | Now that excavation and disposal operations have been completed, this regulation is no longer applicable. |
| Air Pollution Control | RCSA § 22a-174 1-20 | These regulations require permits to construct and to operate specified types of emission sources and contain emission standards that must be met prior to issuance of a permit. Pollutant abatement controls may be required. Specific standards pertain to fugitive dust (18b), and control of odors (23) . | Emission standards for fugitive dust from excavation and restoration operations were met with dust control measures. Odors/emissions from the dewatering piles were managed to comply with these standards. Now that excavation and disposal operations have been completed, this regulation is no longer applicable. |
| Water Diversion Policy Act | RCSA § 22a-377(b) | These rules regulate a wide variety of water diversions. | Surface water diversions during remediation were conducted using best management practices. Now that dredging, excavation, filling, and site regrading have been completed, this regulation is no longer applicable. |
| Connecticut Guidelines for Soil Erosion and Sediment Control | CT Council on Soil and Water Conservation | Technical and administrative guidance for development, adoption and implementation of erosion and sediment control program. | Guidelines were followed during remediation. Dredging, filling, and regrading have been completed and restoration of vegetation is in progress; therefore, this requirement is no longer applicable. |

Click here to go to document index

ACAD: 2863CM22.dwg 06/07/01 HJP




## NOTES

1. UNDERGROUND UTILITY LOCATIONS ARE APPROXIMATE.
2. BASE MAP AND UTILITY INFORMATION FROM MAPS OF NSB–NLON AND PHASE II RI WORK PLAN, (ATLANTIC, MAY 1993).
3. *–2DMW10S AND 2DMW15S WERE NOT COMPLETED DUE TO A LACK OF GROUNDWATER. SOIL SAMPLES WERE COLLECTED FROM THESE BORINGS.
4. TW WELLS (e.g, 3TW1) WERE TEMPORARY WELLS.
5. 3MW12S AND 3MW12D WERE DESTROYED DURING THE SOIL AND SEDIMENT OU REMEDIAL ACTION.

## LEGEND

- 3MW37S — AREA A LANDFILL GMP MONITORING WELL
- 3TW1 — GROUNDWATER OU RI WELL
- 2DMW25D — PHASE I MONITORING WELL
- 2DMW26D — PHASE II MONITORING WELL
- 10 — TOPOGRAPHIC CONTOUR
- 123 — BUILDING No.
- WATERCOURSE
- STM — STORM SEWER AND CATCH BASIN
- EXPOSED BEDROCK
- FENCE

0 250 500
SCALE IN FEET

| NO. | DATE | REVISIONS | BY | CHKD | APPD | REFERENCES |
|---|---|---|---|---|---|---|
| | | | | | | |

DRAWN BY HJP DATE 5/30/01
CHECKED BY DATE
COST/SCHED–AREA
SCALE AS NOTED

**Tetra Tech NUS, Inc.**

**SITE MAP**
**SITE 3–AREA A DOWNSTREAM WATERCOURSES/OBDA**
**NSB–NLON, GROTON, CONNECTICUT**

CONTRACT NO. 2863 | OWNER NO. 0816
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 4–1 | REV. 0

FORM CADD NO. TtNUS_BH.DGN – REV 0 – 1/20/98

Click here to go to document index



# 5.0 SITE 4 – RUBBLE FILL AREA AT BUNKER A-86 (OU 10)

This five-year review is being conducted for Site 4 as a matter of policy since a removal action was completed for the site's soil OU and no hazardous substances remain on site that would limit use or restrict exposure. Groundwater at Site 4 is under investigation as part of the Site 2 groundwater monitoring program and the Basewide Groundwater OU.

## 5.1 HISTORY AND SITE CHRONOLOGY

A list of important Site 4 historical events and relevant dates in the site chronology is shown below. The identified events are illustrative, not comprehensive.

| Event | Date |
|---|---|
| Waste materials discarded at the site. | 1970s |
| Final IAS completed. | March 1983 |
| Verification Study completed. | 1988 |
| Phase I RI completed. | August 1992 |
| Phase II RI completed. | March 1997 |
| Time Critical Removal Action for Site 4 soil completed. | May 1997 |
| Action Memorandum completed. | September 1997 |
| Proposed Plan issued. | April 1998 |
| Public Meeting conducted. | May 1998 |
| Final NFA ROD for Site 4 soil. | June 1998 |

## 5.2 BACKGROUND

Site 4, the Rubble Fill Area, was a 25-foot by 60-foot plot located in the north-central section of NSB-NLON, approximately 80 feet west of Bunker A-86 and just south of the Area A landfill. The site map is included as Figure 5-1. The previous site location with respect to other IR sites at NSB-NLON is shown on Figure 1-2. According to the Initial Assessment Study Report (Envirodyne, 1982), waste materials, including an electric motor, concrete, asphalt, tar buckets, wood, and gravel, were discarded at the site in the early 1970s (NEESA, 1983). In addition to wood and concrete construction debris, previous investigations located an empty 5-gallon container of monothanolanine (labeled as a corrosive), an empty 5-gallon container of thorite (labeled as nonshrinking compound for patching concrete), and a 55-gallon drum of lube oil that was approximately 10 percent full at the site (Atlantic, 1992).

During the RI, the report noted that, after pooling in a small drainage swale located immediately west of the fill area, excess surface runoff from this site flows north-northeast toward the Area A Landfill and the Area A

Wetland. Groundwater also flows to the north-northeast toward the Area A Landfill and Area A Wetland (B&RE, 1997a).

In 1997, a low-permeability cover system was installed over the Area A Landfill. In conjunction with the construction of this cover system, an interception trench was constructed into the hillside between the Area A Landfill and Site 4. Grading required for the construction of the interception trench involved excavating the soil at Site 4 and the hillside between Site 4 and the Area A Landfill to a depth of approximately 8 feet. An Action Memorandum was written for this site in September 1997 (Navy, 1997b). This excavation constituted a time-critical removal action for Site 4.

## 5.3 REMEDIAL ACTIONS

### 5.3.1 Remedy Selection

As discussed above, the Navy decided to complete a time-critical removal action to address the soil and construction debris associated with Site 4. The rationale for completing the removal action was documented in the Action Memorandum (Navy, 1997b). All soil and debris were removed from the site during the action and only exposed bedrock remained after the action was completed. The cost of the removal action was approximately $500,000. The Navy prepared a risk evaluation memorandum to document negligible remaining risks associated with the site. Based on the negligible risks, a NFA ROD for the site's soil OU was signed in 1998.

Groundwater at Site 4 will be addressed as part of the Basewide Groundwater OU for the NSB-NLON and in a separate ROD.

### 5.3.2 Remedy Implementation

During the removal action, the excavated soil and construction debris were incorporated into the Area A Landfill subgrade, except wood debris, which was sampled and disposed off site (Foster Wheeler, 1997a). Following the excavation, verification sampling was conducted in an area of about 17,000 square feet to determine the extent of residual contamination (B&RE, 1997b). The Verification Sampling Report (B&RE, 1997b) concluded that, if the human health risk assessment conducted for the Phase II RI were revised using the verification sampling data, the cumulative incremental cancer risk would be expected to exceed the upper limit of the USEPA target risk range (i.e., $1x\ 10^{-4}$). The remaining soil at Site 4 was subsequently removed, leaving only exposed bedrock. The Navy prepared a risk evaluation memorandum in March 1998 to document the negligible remaining risks associated with the site. A NFA Proposed Remedial Action Plan (PRAP) (Navy, 1998b) and ROD (Navy, 1998c) were prepared for this

site. The groundwater in this area is being monitored in conjunction with the Area A Landfill Groundwater Monitoring Plan and is being further evaluated as part of the Basewide Groundwater OU RI.

## 5.4 FIVE-YEAR REVIEW FINDINGS

### 5.4.1 Site Inspection

A site inspection conducted at Site 4 included visual observations of the former location of the Rubble Fill Area. Conditions during the inspection were favorable, with mild temperatures and no precipitation. Representatives from the U. S. Navy, USEPA, CTDEP, and TtNUS participated in the inspection. No significant observations were noted. The current site consists of a bedrock outcrop. Appendix A contains photographs taken of the site during the inspection.

The land use for the site has remained unchanged; the former location of Site 4 is not currently used by the Navy. NSB-NLON will continue to use the area surrounding the former Site 4 for storage.

### 5.4.2 Document and Analytical Data Review

The NFA Decision Document for soils at Site 4 was reviewed for this five-year review. A summary is presented below.

A review of the NFA Decision Document indicates that a decision was made to conduct no further action for soils at Site 4 at NSB-NLON. This decision was made because all contaminated soil was removed and no unacceptable risks to human or ecological receptors remained. Groundwater at the site will be addressed as part of the Basewide Groundwater OU for NSB-NLON and decisions will be documented in a separate ROD.

### 5.4.3 ARAR and Site-Specific Action Level Changes

As discussed in the NFA Decision Document for the site (Navy, 1998c), all of the contaminated soil at Site 4 was removed and no contaminated soil remains at the site that could pose an unacceptable risk to potential human or ecological receptors because no exposure pathway exists. Therefore, any changes to previous ARARs or site-specific action levels would not impact the protectiveness of the remedy selected for this site.

## 5.5 ASSESSMENT

The following conclusions support the determination that the remedy at Site 4 is expected to be protective of human health and the environment upon completion.

***Question 1. Is the remedy functioning as intended by the decision documents?***

- ***HASP/Contingency Plan:*** A quarterly groundwater monitoring program is currently being implemented at Site 2. One groundwater monitoring well from Site 4 is included in the program as an upgradient monitoring well. It was recommended that the program be continued to gather data to evaluate long-term trends in contaminant concentrations. Should groundwater data indicate the need for additional remedial action evaluation at some point in the future, an FS should be performed at that time.

- ***Implementation of Institutional Controls and Other Measures:*** Even though the Navy has an IR Site Use Restriction Instruction in place as of October 2000 at NSB-NLON [SOPA (ADMIN) NLONINST 5090.18], all soil has been removed from the site, which eliminated any concerns with ground disturbance or exposure to contaminated media.

- ***Remedial Action Performance:*** All the contaminated soils were removed from Site 4. The groundwater monitoring plan developed and implemented for Site 2 monitors groundwater associated with Site 4. The results of the program are discussed in Section 3.0. The results of the program do not indicate any residual impacts from Site 4.

- ***System Operations/O&M:*** Not applicable.

- ***Cost of Operations/O&M:*** Not applicable.

- ***Opportunities for Optimization:*** This five-year review does not identify a need for optimization at this time.

- ***Early Indicators of Potential Remedy Failure:*** No early indicators of potential remedy failure were noted during the review or have been detected during the Site 2 groundwater monitoring program.

***Question 2. Are the assumptions used at the time of the remedy selection still valid?***

- ***Changes in Standards and To Be Considereds***: This five-year review has identified that CTDEP has issued additional RSR (Criteria for Additional Polluting Substances, April 30, 1999) since the NFA Decision Document was issued. The additional criteria do not call into question the protectiveness of the remedy.

- ***Changes in Exposure Pathways:*** Since the soil at Site 4 was consolidated under the Site 2 cap, there is currently no pathway of exposure for human or ecological receptors to come into contact with the soil related to Site 4.

- ***Changes in Toxicity and Other Contaminant Characteristics:*** There have been no changes in toxicity and other factors for contaminants of concern that would call into question the protectiveness of the remedy.

- ***Changes in Risk Assessment Methodologies:*** Changes in risk assessment methodologies since the time of the NFA Decision Document do not call into question the protectiveness of the remedy.

***Question 3. Has any other information come to light that could call into question the protectiveness of the remedy?***

No additional information has been identified that would call into question the protectiveness of the remedy.

### 5.6 DEFICIENCIES

No deficiencies were discovered during the five-year review for Site 4.

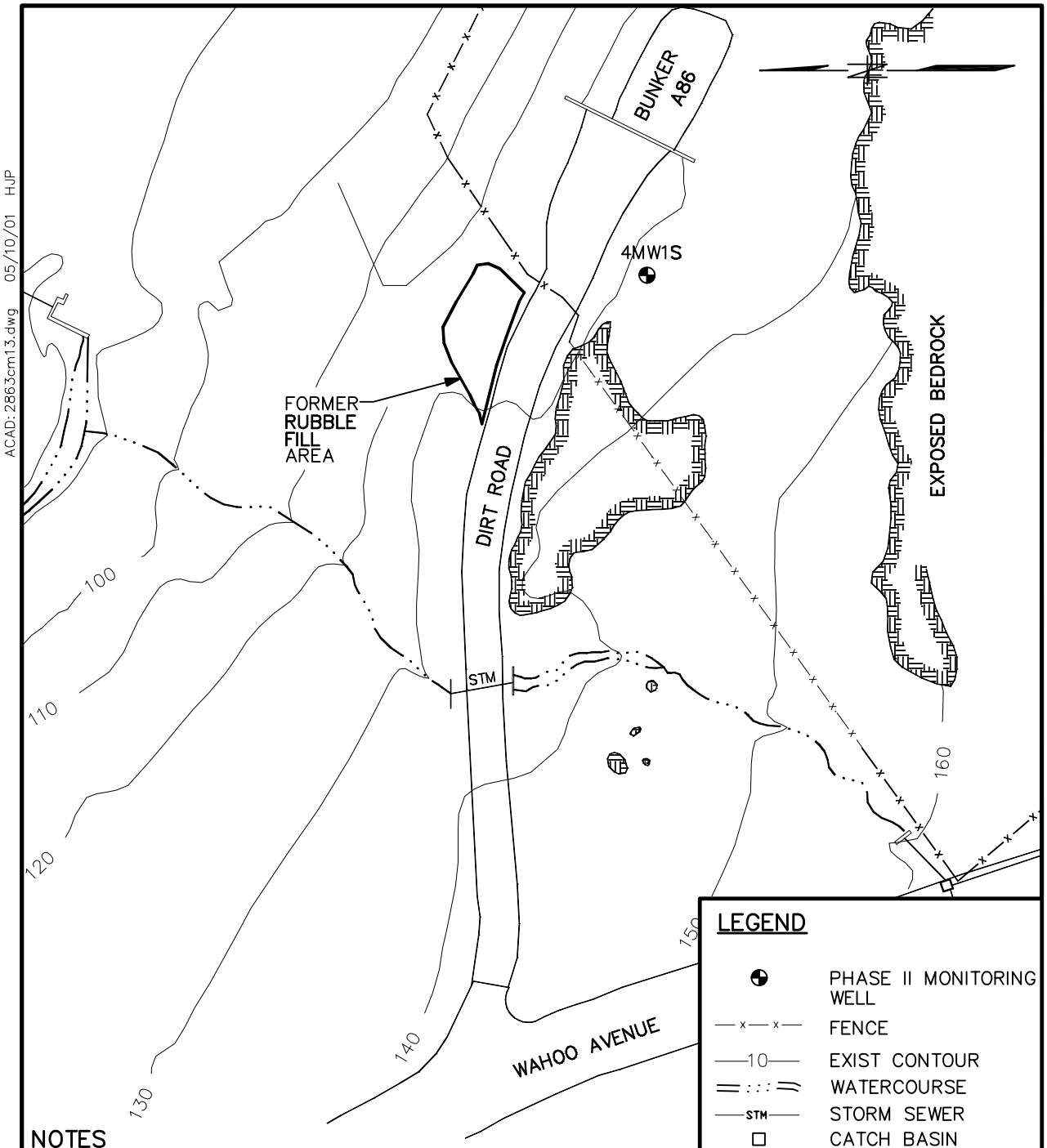
### 5.7 RECOMMENDATIONS AND REQUIRED ACTIONS

Based on the results of the site inspection and review, the only recommendation and further action required for Site 4 is completion of the investigation of the groundwater OU and preparation of an appropriate decision document.

### 5.8 PROTECTIVENESS STATEMENT

The remedy for the Site 4 soil OU is protective of human health and the environment. The source of contamination was completely removed. The remedy for the Site 4 groundwater OU has not been selected, and therefore the protectiveness of the remedy can not be determined at this time. There are no imminent threats related to the groundwater since it is not used as a drinking water source. In addition, the groundwater is currently being monitored under the Site 2 Groundwater Monitoring Program and the initial results do not indicate that groundwater poses any significant concern at this time.

Click here to go to document index




NOTES

1. UNDERGROUND UTILITY LOCATIONS AREA APPROXIMATE.
2. BASE MAP AND UTILITY INFORMATION FROM MAPS OF NSB–NLON AND PHASE II RI WORK PLAN.

| | | | |
|---|---|---|---|
| DRAWN BY HJP DATE 5/7/01 | Tetra Tech NUS, Inc. | CONTRACT NO. 2863 | OWNER NO. 0816 |
| CHECKED BY DATE | SITE MAP<br>SITE 4–RUBBLE FILL AREA AT BUNKER A86<br>NSB–NLON<br>GROTON, CONNECTICUT | APPROVED BY DATE | |
| COST/SCHED–AREA | | APPROVED BY DATE | |
| SCALE AS NOTED | | DRAWING NO. FIGURE 5–1 | REV. 0 |

FORM CADD NO. TtNUS_AV.DWG – REV 0 – 1/22/98

Click here to go to next section of document