



5 August 2002

Mr. Brian Helland
Engineering Field Activity Northeast
Naval Facilities Engineering Command
10 Industrial Highway, Mail Stop 82
Lester, Pennsylvania 19113

RE: Preliminary Summary of the First *In Situ* Chemical Oxidation Injection Event
and Recommended Follow-up Actions at the Navy Exchange Service Station
(Building 538), Naval Air Station, Brunswick, Maine
Contract D62472-92-D-1296, Contract Task Order No. 0035
EA Project No. 29600.35

Dear Mr. Helland:

EA Engineering, Science, and Technology is pleased to provide this preliminary summary of site conditions at the Navy Exchange (NEX) Service Station (Building 538), Naval Air Station, Brunswick, Maine, following the first *in situ* chemical oxidation injection (ISCO) event (completed during 22 April through 2 May 2002). This letter provides a brief preliminary summary of the most significant findings and recommendations based on data collected during baseline ground-water and saturated zone soil sampling activities conducted during 11-12 March and 20 March 2002, respectively, prior to the first ISCO event; as well as data collected during two post-ISCO direct-push investigations completed during 22-24 May and 17-20 June 2002.

SUMMARY OF BASELINE AND POST-ISCO SAMPLING EVENTS

During the baseline sampling program conducted in March 2002, ground-water samples were collected from existing site monitoring wells, and saturated zone soil samples were collected from 8 direct-push soil boring locations (identified as BDP-1 through BDP-8) installed throughout the area targeted for ISCO injections. These data were collected to provide an assessment of baseline site conditions prior to the first ISCO injection event for subsequent evaluation of the ISCO remedial effectiveness. Preliminary baseline ground-water and saturated zone soil analytical data are summarized in Figures 1 and 2, respectively. The final analytical data, as well as laboratory chain-of-custody and Form Is, will be submitted under separate cover.

During the 22 April through 2 May 2002 ISCO injection event, approximately 17,000 gal of 12 percent hydrogen peroxide solution were injected into the saturated zone at the NEX Service Station through 47 direct-push ISCO injection points. Injection point locations were based on the ISCO Remediation Plan prepared for the NEX Service Station (EA 2002¹). At each ISCO injection

1. EA Engineering, Science, and Technology. 2002. Final *In Situ* Chemical Oxidation Remediation Plan, Navy Exchange Service Station, Naval Air Station, Brunswick, Maine. April.

location, separate shallow (i.e., approximately 5-9 ft below ground surface [bgs]) and deep (approximately 12-16 ft bgs) screened intervals were used to direct hydrogen peroxide and iron catalyst solution throughout the vertical extent of the saturated zone (i.e., approximately 5-16 ft bgs).

Following a 20-day period to allow re-equilibration of the subsurface, post-ISCO direct-push ground-water and soil samples were collected from 23 direct-push borings (identified as DP-1 through DP-23 in Figure 3) installed during 22-24 May 2002.

Review of the analytical data collected from the 22-24 May 2002 direct-push soil borings indicated the presence of two residual source areas that exhibited elevated concentrations of sorbed-phase petroleum hydrocarbon contamination. Additionally, based on increased dissolved-phase hydrocarbon concentrations reported throughout the remedial target area, it was apparent that the ISCO injection process had mobilized previously sorbed hydrocarbons.

To delineate the extent of the residual sorbed-phase hydrocarbon source areas and to further assess the effects of the first ISCO injection event, ground-water and saturated zone soil samples were collected from 14 supplemental direct-push borings (identified as SDP-1 through SDP-14 in Figure 3) and from 8 existing monitoring wells (MW-NASB-24, MW-NASB-25, MW-NASB-26, MW-NASB-225, MW-NASB-226, MW-NASB-250, MW-NASB-251, and MW-NASB-252). These supplemental soil boring and monitoring well sampling activities were conducted from 17 to 20 June 2002.

The preliminary total petroleum hydrocarbon-gasoline range organic (TPH-GRO) analytical data reported for baseline and post-ISCO saturated zone soil samples are provided in Figure 3. The preliminary TPH-GRO analytical data reported for post-ISCO ground-water samples are provided in Figure 4. Interpreted TPH-GRO concentration isopleths have been provided to delineate sorbed-phase petroleum source areas and corresponding dissolved-phase plumes associated with the fueling islands and former underground storage tanks (USTs). The final analytical data, together with laboratory chain-of-custody and Form Is, will be submitted under separate cover.

CONCLUSIONS

As indicated by the baseline and post-ISCO analytical data, there appears to be two separate and distinct saturated zone soil source areas (with corresponding dissolved-phase plumes) in the vicinity of the NEX Service Station. Conclusions based on previous site investigations (i.e., the August 1999² direct-push investigation and other historical soil and ground-water sampling studies) indicated that the source area for the NEX Service Station was limited to gasoline releases associated with the former UST and product piping systems, with petroleum-impacted soil remaining adjacent to the southwest side (i.e., downgradient) of the existing UST area, following replacement of the former UST system (1992-1993). Although the current saturated zone soil sampling data also indicate that there are significantly impacted saturated zone soils at this location (i.e., southwest of the UST area), both the saturated zone soil and ground-water analytical data support several new findings that are outlined below:

- The extent and concentration of petroleum-impacted saturated zone soils associated with the UST area are greater than previously reported, and extend across Burbank Avenue to the northern foundation wall of the Family Services Center (Building 27).

2. EA Engineering, Science, and Technology. 2000. Direct-Push Soil and Ground-Water Investigation at the Family Service Center (Building 27) and Navy Exchange Service Center (Building 538), Naval Air Station, Brunswick, Maine. April.

- A separate residual source area with significant petroleum-impacted saturated zone soil is located directly south of, and downgradient to, the existing fueling island area. Dissolved-phase hydrocarbons released from saturated zone soil and/or during fueling operations at this location are likely to migrate (albeit at reduced concentrations) to locations downgradient of the NEX Service Station area (potentially as far as Site 9).
- The estimated mass of petroleum hydrocarbons present in saturated zone soils associated with the above residual source areas may represent >90 percent of the total remaining hydrocarbon mass at the NEX Service Station site. The ISCO remedial program was not designed to address sorbed-phase petroleum hydrocarbons at the concentrations and volumes indicated by the recently collected soil boring data.
- Although there is evidence that the first ISCO event has successfully oxidized sorbed-phase hydrocarbons in the vicinity of the injection points, it has also been indicated that petroleum hydrocarbons have been mobilized from the sorbed-phase to the dissolved-phase, with associated increases in dissolved-phase concentrations up to several orders of magnitude relative to pre-ISCO conditions.
- Continuation of ISCO remedial operations is not recommended because: (1) it would be cost-prohibitive to oxidize the mass of sorbed-phase hydrocarbons, and (2) there is a significant potential for continued mobilization of petroleum hydrocarbons from saturated zone soils.

Currently, EA is developing a complete site evaluation report that will include the final analytical data from the baseline and post-ISCO ground-water and saturated soil sampling programs. In the interim, it is recommended that the Navy and EA work together with the Maine Department of Environmental Protection to develop a rapid-response remediation plan to address the large mass of petroleum hydrocarbon contamination (both sorbed-phase and dissolved-phase) now known to be located at the northwest corner of the Family Services Center (Building 27). Vapor-phase hydrocarbons may have the potential to migrate into the Family Services Center at this location, based on previous complaints registered by the building occupants.

If there are any questions, please do not hesitate to contact Al Easterday at 508-485-2982.

Sincerely yours,



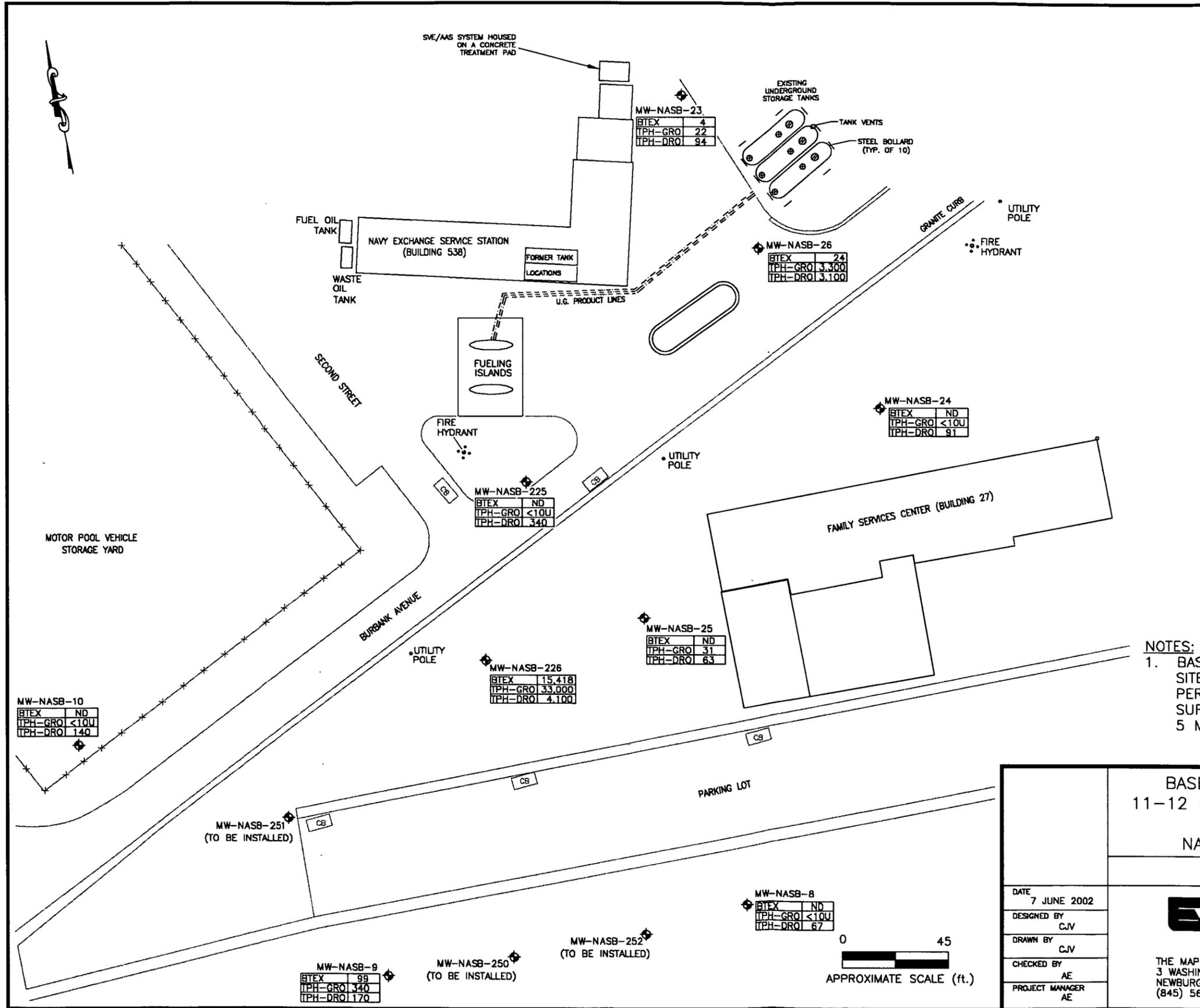
Alexander C. Easterday, P.G.
CTO Manager



Curtis J. Varner, P.E.
Project Engineer

ACE/caw

cc: C. Sait, MEDEP (2 copies)
A. Williams, NAS Brunswick (1 copy)



LEGEND

MW-NASB-023 MONITORING WELL

BTEX	4
TPH-GRO	22
TPH-DRO	94

DISSOLVED-PHASE ANALYTICAL DATA (ALL UNITS IN UG/L)

CATCH BASIN

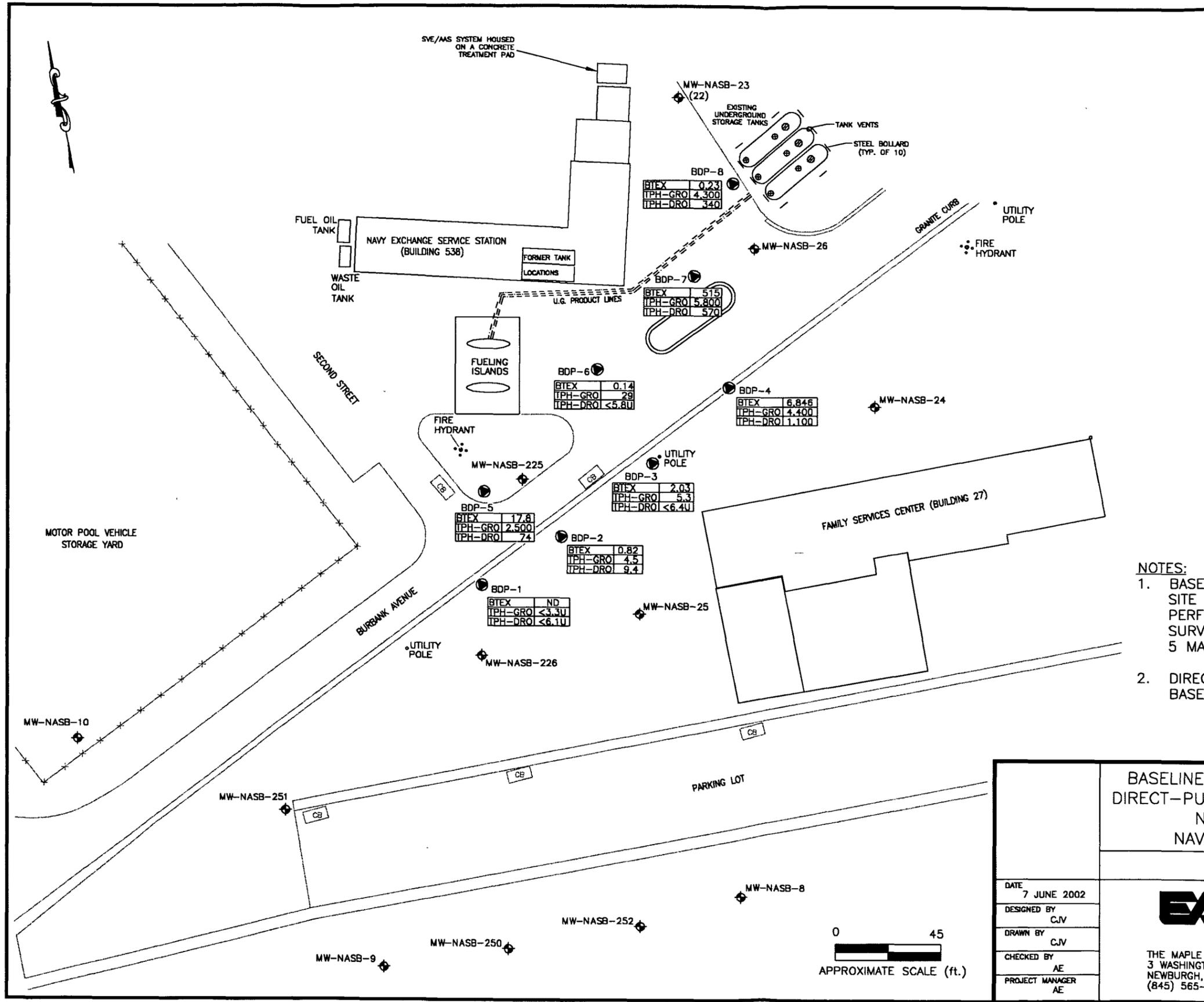
EXISTING CHAIN LINK FENCE

NOTES:

1. BASE MAP DEVELOPED FROM ERM-NEW ENGLAND, INC. SITE PLAN DATED 24 JUNE 1992 AND SURVEYS PERFORMED BY CORNERSTONE PROFESSIONAL LAND SURVEYING, INC., 20 MAY 1994, 19 JULY 1995, 5 MAY 1997, AND 7 NOVEMBER 2001.

DWG. FILE F:\FEDERAL\DDO\NAVY\2960035\NEX\ISCOMEMO\MARCH2002-BASELINE-GW.DWG

BASELINE GROUND-WATER ANALYTICAL DATA 11-12 MARCH 2002 QUARTERLY SAMPLING EVENT NAVY EXCHANGE SERVICE STATION NAVAL AIR STATION, BRUNSWICK, MAINE																	
FIGURE 1																	
DATE 7 JUNE 2002 DESIGNED BY CJV DRAWN BY CJV CHECKED BY AE PROJECT MANAGER AE	<table border="1"> <tr><td>PROJECT NUMBER</td><td>29600.35</td></tr> <tr><td>SCALE</td><td>AS SHOWN</td></tr> <tr><td>FILE NAME</td><td>MARCH2002-BASELINE-GW</td></tr> <tr><td>DRAWING NUMBER</td><td>-</td></tr> <tr><td>SHEET NUMBER</td><td>1 OF 1</td></tr> </table>	PROJECT NUMBER	29600.35	SCALE	AS SHOWN	FILE NAME	MARCH2002-BASELINE-GW	DRAWING NUMBER	-	SHEET NUMBER	1 OF 1						
PROJECT NUMBER	29600.35																
SCALE	AS SHOWN																
FILE NAME	MARCH2002-BASELINE-GW																
DRAWING NUMBER	-																
SHEET NUMBER	1 OF 1																
THE MAPLE BUILDING 3 WASHINGTON CENTER NEWBURGH, NY 12550 (845) 565-8100																	
<table border="0"> <tr> <td>ALASKA</td> <td>NEW JERSEY</td> </tr> <tr> <td>CALIFORNIA</td> <td>NEW YORK</td> </tr> <tr> <td>DELAWARE</td> <td>OREGON</td> </tr> <tr> <td>FLORIDA</td> <td>PENNSYLVANIA</td> </tr> <tr> <td>HAWAII</td> <td>RHODE ISLAND</td> </tr> <tr> <td>MARYLAND</td> <td>TENNESSEE</td> </tr> <tr> <td>MASSACHUSETTS</td> <td>TEXAS</td> </tr> <tr> <td>NEBRASKA</td> <td>WASHINGTON</td> </tr> </table>		ALASKA	NEW JERSEY	CALIFORNIA	NEW YORK	DELAWARE	OREGON	FLORIDA	PENNSYLVANIA	HAWAII	RHODE ISLAND	MARYLAND	TENNESSEE	MASSACHUSETTS	TEXAS	NEBRASKA	WASHINGTON
ALASKA	NEW JERSEY																
CALIFORNIA	NEW YORK																
DELAWARE	OREGON																
FLORIDA	PENNSYLVANIA																
HAWAII	RHODE ISLAND																
MARYLAND	TENNESSEE																
MASSACHUSETTS	TEXAS																
NEBRASKA	WASHINGTON																



LEGEND

- MW-NASB-023 MONITORING WELL
- CATCH BASIN
- EXISTING CHAIN LINK FENCE
- DIRECT-PUSH SAMPLING LOCATION

BTEX	ND
TPH-GRO	<3.3U
TPH-DRO	<6.1U

SATURATED-ZONE SOIL SAMPLE ANALYTICAL DATA (ALL UNITS IN MG/KG)

- NOTES:**
1. BASE MAP DEVELOPED FROM ERM-NEW ENGLAND, INC. SITE PLAN DATED 24 JUNE 1992 AND SURVEYS PERFORMED BY CORNERSTONE PROFESSIONAL LAND SURVEYING, INC., 20 MAY 1994, 19 JULY 1995, 5 MAY 1997, AND 7 NOVEMBER 2001.
 2. DIRECT-PUSH SAMPLING LOCATIONS APPROXIMATED BASED ON FIELD NOTES RELATIVE TO KNOWN POINTS.

DWG. FILE F:\FEDERAL\DDO\NAVY\2960035\NEX\SCOREMPLAN\MARCH2002-BASELINE.DWG

BASELINE SATURATED ZONE SOIL CONCENTRATIONS
 DIRECT-PUSH SAMPLES COLLECTED 20 MARCH 2002
 NAVY EXCHANGE SERVICE STATION
 NAVAL AIR STATION, BRUNSWICK, MAINE

FIGURE 2

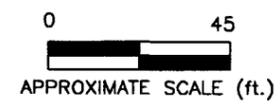
DATE	7 JUNE 2002
DESIGNED BY	CJV
DRAWN BY	CJV
CHECKED BY	AE
PROJECT MANAGER	AE



THE MAPLE BUILDING
 3 WASHINGTON CENTER
 NEWBURGH, NY 12550
 (845) 565-8100

- ALASKA
- CALIFORNIA
- DELAWARE
- FLORIDA
- HAWAII
- MARYLAND
- MASSACHUSETTS
- NEBRASKA
- NEW JERSEY
- NEW YORK
- OREGON
- PENNSYLVANIA
- RHODE ISLAND
- TENNESSEE
- TEXAS
- WASHINGTON

PROJECT NUMBER	29600.35
SCALE	AS SHOWN
FILE NAME	MARCH2002-BASELINE
DRAWING NUMBER	-
SHEET NUMBER	1 OF 1



LEGEND

- MONITORING WELL
- BDP-1 (<3.3U) BASELINE DIRECT-PUSH LOCATION (TPH-GRO NOT DETECTED ABOVE LIMIT)
- DP-23 (3.79) POST-ISCO DIRECT-PUSH LOCATION (TPH-GRO CONC., MG/KG)
- DP-13 POST-ISCO DIRECT-PUSH LOCATION (COMPLETED AS MONITORING WELL)
- SDP-1 (<1.32U) SUPPLEMENTAL DIRECT-PUSH LOCATION (TPH-GRO NOT DETECTED ABOVE LIMIT)

FUEL OIL TANK
WASTE OIL TANK

NAVY EXCHANGE SERVICE STATION (BUILDING 538)

FORMER TANK LOCATIONS

U.G. PRODUCT LINES

FUELING ISLANDS

SECOND STREET

FIRE HYDRANT

SDP-13 (1.87)

SDP-12 (1,480)

SDP-14 (684)

MW-NASB-225

BDP-5 (2,500)

DP-11 (417)

SDP-15 (<1.4U)

DP-12 (632)

BURBANK AVENUE

UTILITY POLE

DP-23 (3.79)

MW-NASB-226

BDP-2 (4.5)

BDP-1 (<3.3U)

DP-22 (<1.18U)

MW-NASB-25

SDP-10 (<1.25U)

DP-20 (634)

SDP-7 (1.66)

DP-6 (103)

BDP-3 (5.3)

DP-7 (0.37U)

DP-5 (141)

DP-9 (2,230)

SDP-5 (2,760)

BDP-4 (4,400)

DP-19 (4,180)

SDP-8 (<1.56U)

SDP-9 (<1.37U)

SDP-6 (<1.21U)

MW-NASB-24

SDP-3 (<1.35U)

SDP-4 (<1.35U)

SDP-1 (<1.32U)

DP-14 (<1.33U)

SDP-2 (712)

DP-4 (<0.26U)

BDP-7 (5,800)

DP-3 (1,630)

DP-13 (3,280)

DP-15 (876)

DP-1 (1,600)

BDP-8 (4,300)

DP-15 (876)

DP-2 (802)

DP-13 (802)

DP-16 (1,460)

DP-8 (3,450)

DP-9 (2,230)

DP-18 (<1.35U)

DP-17 (<1.39U)

BDP-6 (28)

DP-10 (<1.475U)

DP-6 (103)

SDP-7 (1.66)

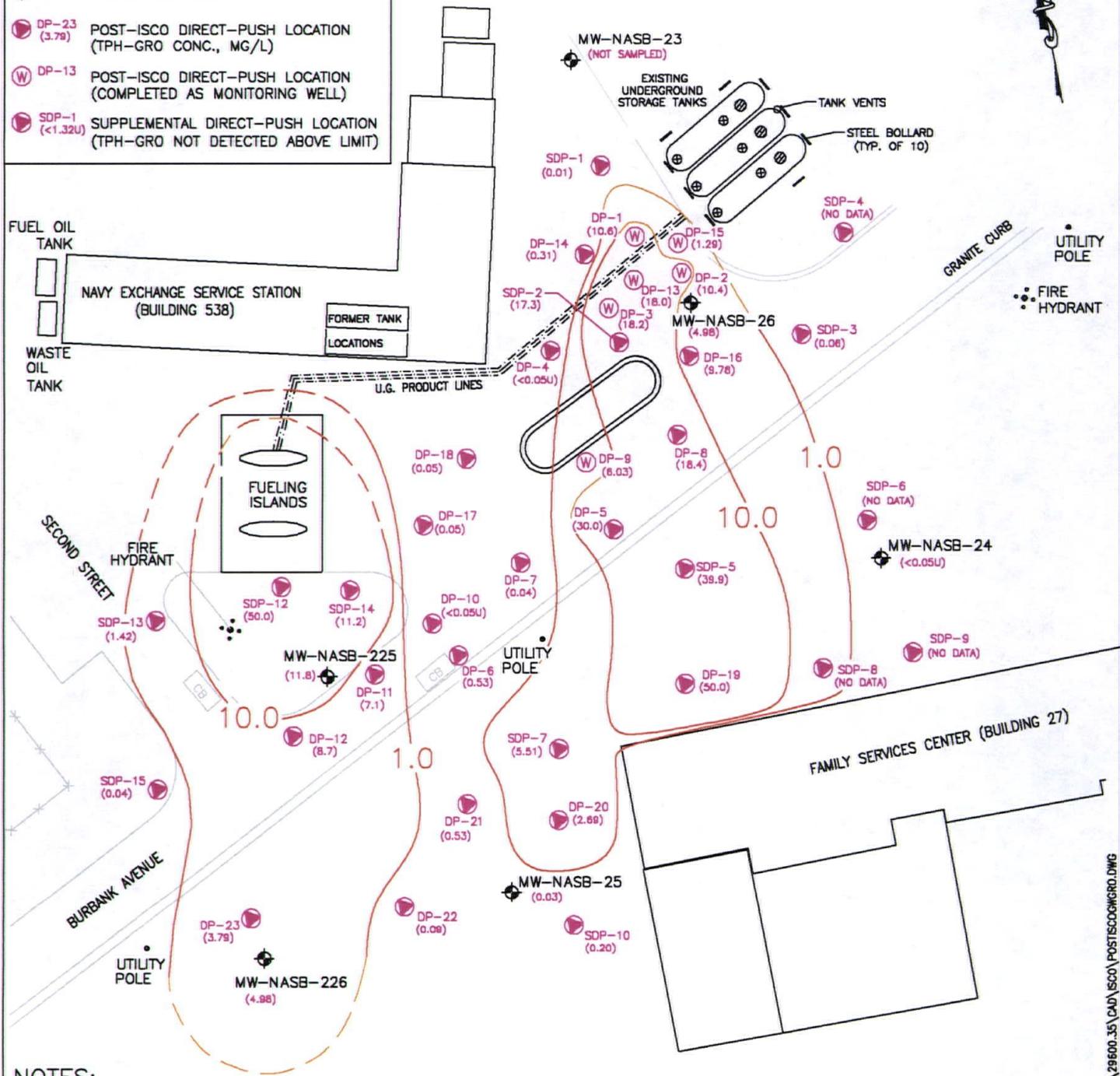
DP-21 (<1.48U)

DP-20 (634)

SDP-7 (1.66)

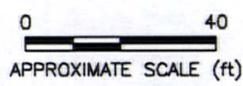
LEGEND

-  MONITORING WELL
-  DP-23 (3.79) POST-ISCO DIRECT-PUSH LOCATION (TPH-GRO CONC., MG/L)
-  DP-13 POST-ISCO DIRECT-PUSH LOCATION (COMPLETED AS MONITORING WELL)
-  SDP-1 (<1.32U) SUPPLEMENTAL DIRECT-PUSH LOCATION (TPH-GRO NOT DETECTED ABOVE LIMIT)



NOTES:

1. LOCATIONS OF BASELINE AND POST-ISCO DIRECT-PUSH POINTS ARE APPROXIMATED BASED ON FIELD NOTES.
2. INTERPRETED DISSOLVED PHASE TPH-GRO CONCENTRATION ISOPLETHS ARE BASED ON POST-ISCO GROUND-WATER SAMPLING DATA (MAY AND JUNE 2002).



EA ENGINEERING,
SCIENCE, AND
TECHNOLOGY

INTERPRETED DISSOLVED PHASE TPH-GRO
CONCENTRATION ISOPLETHS (MG/L)
NEX SERVICE STATION, NAVAL AIR STATION BRUNSWICK

FIGURE 4

PROJECT MGR ACE	DESIGNED BY CJV	DRAWN BY CJV	CHECKED BY ACE	SCALE AS SHOWN	DATE 16 JULY 2002	PROJECT NO 29600.35	TASK 6824
--------------------	--------------------	-----------------	-------------------	-------------------	----------------------	------------------------	--------------

FILE: F:\FEDERAL\DOOP\WAVY\29600.35\CAU\ISCO\POSTISCO\GRO.DWG