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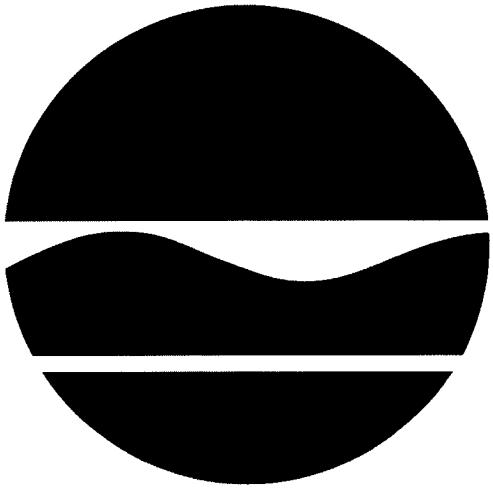
NORTHROP GRUMMAN AEROSPACE and the NAVAL WEAPONS INDUSTRIAL RESEARCH PLANT (NWIRP) SITES

GROUNDWATER FEASIBILITY STUDY

PROJECT REVIEW

TOWN OF OYSTER BAY, NASSAU COUNTY
Site No. 1-30-003 and 003A 002

MAY, 1999



SITE BACKROUND

Grumman

* Grumman Corporation established in the early 1930s at the Bethpage site.
* Naval aircraft were developed and manufactured at the site.
* Grumman also manufactured of naval amphibious craft and NASA satellites and space craft for NASA.
* From 1943-1949, Grumman disposed of their chromic acid wastes directly on the ground or in open seepage basins. In 1949, a chromic acid treatment system was put on-line at Plant 2 .
* Grumman consisted of numerous buildings with manufacturing processes that included machining, degreasing, chemical milling, descaling, coatings and assembly.

Some of the wastes generated by Grumman were taken to the NWIRP property for treatment or storage before being taken off site by private haulers. These wastes were primarily chlorine-solvents. There were several locations on the Grumman site where wastes were stored, treated, or disposed of. These areas were targeted for investigation during the RI/S that was conducted at the site.

In addition to the chromic acid treatment system located at Plant 2, systems for treating phenols, oils, and other organic compounds, and for recovering silver were also used at Plant 2.

TCE was stored in an above ground tank along the NE corner of Plant 2. A release of TCE from this tank or the associated piping system was discovered during the Grumman RI.

NWIRP

The NWIRP facility was established in 1933. The NWIRP facility was for the research, prototyping, testing, design engineering, fabrication, and primary assembly of military aircraft.

The facilities at NWIRP include four plants, Nos. 3, 5, and 20, used for assembly and prototype testing; and No. 10, which contains a group of QC labs, two warehouse complexes, a salvage storage area, water recharge basins, an industrial wastewater treatment plant, and several smaller support buildings.

Site 1 - Former Drum Marshalling Area

From the early 1950's to 1978, drums containing liquid wastes were stored on a cinder covered area over a cesspool leach field. This leach field may have been used to discharge process wastewater. In 1978, the drum storage area was moved a few yards to the south to a 100- by 100-foot concrete pad. This pad did was covered nor were there any berms around it. In 1982, the drum storage area was moved to Site 3.

Various solvents were stored at Site 1. Cadmium and cyanide wastes were at one time stored in this area. Approximately 200 to 300 drums were stored at these locations at any given time. Reportedly, all drums of waste which were stored at these areas were taken offsite by contractors for treatment and disposal.

Site 2 - Recharge Basin Area

Prior to 1984, some Plant 3 production-line rinse waters were discharged in the three on-site recharge basins. These waters were directly exposed to chemicals used in the industrial processes (rinsing of manufactured parts). Only non-contact cooling water has been discharged into these basins since 1984. The source of this non-contact cooling water has been on-site production wells.

On at least one occasion (1956), hexavalent chromium was detected in the water in the recharge basins at

concentrations in excess of allowable limits. This matter was discovered and handled by the Nassau County Department of Health.

Adjacent to and west of the recharge basins are the former sludge drying beds. Sludge from the Plant 2 Industrial Waste Treatment Plant was dewatered in these beds before being disposed of off site.

Site 3 - Salvage Storage Area

The NWIRP salvage storage area is located at this site which is located to the west of Site 2. This area has been used for the storage of fixtures, tools, and metallic wastes such as aluminum and titanium scraps, since the early-1950's.

In addition to salvage storage, a 100- by 100-foot area within this site was used for the storage of drummed wastes. This area was reportedly covered with coal ash cinders. Halogenated and non-halogenated waste solvents were stored in this area from the early-1950's through 1969. The exact location of this drum storage area is not known. Since 1969, drums have been stored on a covered concrete, bermed pad.

Enforcement History

* Grumman entered into an RI/FS Consent Order with the NYSDEC for the Bethpage Facility site in 1990.

* The United States Navy has undertaken their environmental studies pursuant to the Navy's Installation Restoration Program. The State of New York provided oversight of the work conducted by the Navy pursuant to a Memorandum of Agreement between the State and the Department of Defense.

Summary of the Remedial Investigations

RI's were conducted to determine the nature and extent of the contamination risks posed by the sites.

The following tasks were included in the RI:

- Soil gas surveys were conducted in order to locate potential areas which could be sources of groundwater contamination.

- Soil samples were collected to confirm the results of the soil gas surveys and to indentify source areas that could not initially be located using soil gas surveys.

- Groundwater samples were collected from monitoring wells that were installed as part of the two Remedial Investigations and by other organizations (such as the United States Geological Survey).

Groundwater Contamination

The primary groundwater contaminants are chlorinated VOCs which were either used and disposed of at the sites or are biological breakdown products of chemicals used and disposed of. These compounds are:

- perchloroethene (PCE)
- trichloroethene (TCE)
- dichloroethenes (DCE)
- vinyl chloride (OXY/Hooker Ruco)
- 1,1,1-trichloroethane

In addition, metals, specifically arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver, were detected in groundwater samples that were collected at the sites. However, only arsenic, cadmium, and chromium were detected at concentrations greater than the corresponding standards, and only in a small number of on-site monitoring wells.

Extent of Groundwater Contamination

By current estimates, the groundwater plumes emanating from the three sites total 2,000 acres in area and are over 500 feet deep in places.

On-Site Groundwater Plume

* The highest concentrations of VOCs in groundwater were detected in on-site wells.
* The most contaminated on-site well was HN-24I with TCE at 58,000 ug/l.
* High concentrations at 1,000 ug/l have been detected in some of Grumman and the Navy supply wells.
* High concentrations of VOCs have been detected at GP-1, and a stripper was installed in 1989 to treat the water that pumped from that well.

Off-Site Groundwater Plume

* The plume(s) emanating from the sites have impacted or threaten three public water supplies operated by the Bethpage Water District. As a result, nine (9) outpost or sentry wells were installed upgradient of the water supplies. **These wells have been sampled on a quarterly basis since March 1995.**

There are treatment systems in place at each of the three impacted or threatened water supplies.

Development of a Computer Groundwater Model

A groundwater computer model was developed for developing and evaluating remedial alternatives for addressing the groundwater contamination. The study area that is encompassed in the model is 24.1 square miles. The model simulates groundwater flow throughout the entire thickness of the Upper Glacial and Magothy aquifers.

Interim Remedial Measures

Interim remedial measures (IRMs) are conducted at sites when a source of contamination or exposure pathway can be effectively addressed before the completion of the RI/FS. Two IRMs have been implemented as part of the groundwater feasibility study.

1. Protection of the Bethpage Water District Supply Wells

Treatment systems have been installed at the three impacted or threatened public supply wells operated by the Bethpage Water District (BWD). BWD Plants 4 and 6 were funded by Grumman and BWD Plant 5 was funded by the U.S. Navy as specified in the May 1995 Record of Decision for the NWIRP-Bethpage site.

2. On-Site Containment IRM: GP-1, ONCT-1, ONCT-2, and ONCT-3

* The groundwater IRM is containment of the plume still below the sites.
* The groundwater IRM system went on-line full time in July, 1998.
* The IRM consists of four extraction wells; one existing and three that were installed in 1996-97.
* The bulk of the contaminant removal is predicted to occur in wells ONCT-1 and GP-1 with lesser amounts of contaminants extracted from wells ONCT-2 and ONCT-3.
* The combined pumping rate for GP-1, ONCT-1, ONCT-2, and ONCT-3 is 3375 gpm.

RECORD OF DECISION FOR SITE SOILS

A Record of Decision for the Northrop Grumman and NWIRP Sites was executed on July 5, 1995. The selected remedies for addressing the contamination in the unsaturated zones of site soils., These are source control remedies for the were outline in the Record of Decision.

GROUNDWATER FS

Alternative 1: Continuation of Existing Treatment, which includes On-Site Plume Containment, Treatment, and Discharge to On-Site Recharge Basins (via the IRM); Treatment of Off-site Public Supply Wells; and Groundwater Monitoring (including Monitored Natural Attenuation).

Alternative 2: On-Site Plume Containment, Treatment, and Discharge to On-Site Recharge Basins (via the IRM); HN-24 Area Treatment; Treatment of Off-site Public Supply Wells; and Groundwater Monitoring (including Monitored Natural Attenuation).

Alternative 3: On-Site Plume Containment, Treatment, and Discharge to On-Site Recharge Basins (via the IRM); GM-38D2 Area Treatment and Discharge to an Off-Site Storm Sewer; Treatment of Off-site Public Supply Wells; and Groundwater Monitoring (including Monitored Natural Attenuation).

Alternative 4: On-Site Plume Containment, Treatment, and Discharge to On-Site Recharge Basins (via the IRM; HN-24 Area Treatment; GM-38D2 Area Treatment and Discharge to an Off-Site Storm Sewer; Treatment of Off-site Public Supply Wells; and Groundwater Monitoring (including Monitored Natural Attenuation).

Alternative 5: On-Site Plume Containment, Treatment, and Discharge to On-Site Recharge Basins (via the IRM; Treatment of Off-site Public Supply Wells; Off-Site Plume Containment, Treatment, and Discharge to Off-Site Storm Sewers; and Groundwater Monitoring (including Monitored Natural Attenuation).

Alternative 6: On-Site Plume Containment, Treatment, and Discharge to On-Site Recharge Basins (via the ERM); HN-24 Area Treatment; Treatment of Off-site Public Supply Wells; Off-Site Plume Containment, Treatment, and Discharge to Off-Site Storm Sewers; and Groundwater Monitoring (including Monitored Natural Attenuation).

Alternative 7: On-Site Plume Containment, Treatment, and Discharge to On-Site Recharge Basins (via the IRM); GM-38D2 Area Treatment and Discharge to an Off-Site Storm Sewer; Treatment of Off-site Public Supply Wells; Off-Site Plume Containment, Treatment, and Discharge to Off-Site Storm Sewers; and Groundwater Monitoring (including Monitored Natural Attenuation).

Alternative 8: On-Site Plume Containment, Treatment, and Discharge to On-Site Recharge Basins (via the IRM); HN-24 Area Treatment; GM-38D2 Area Treatment and Discharge to an Off-Site Storm Sewer; Treatment of Off-site Public Supply Wells; Off-Site Plume Containment, Treatment, and Discharge to Off-Site Storm Sewers; and Groundwater Monitoring (including Monitored Natural Attenuation).

Alternative	Total Gallons Pumped (billions)	Total Mass Removal	Capital Cost	Annual O&M ($/year)	Present Worth O&M (30 years)	Grand Total
Alterntive 1	53.22	73,800	3,670,000	1,480,000	23,040,000	26,700,000
Altemative 2	53.22	76,200	4,900,000	1,606,000	23,300,000	28,200,000
Altemative 3	61.10	79,100	8,060,000	1,700,000	25,510,000	33,600,000
Altemative 4	61.10	81,500	9,290,000	1,826,000	25,720,000	35,000,000
Altemative 5	110.53	81,900	21,390,000	2,600,000	41,390,000	62,800,000
Altemative 6	110.53	84,400	22,620,000	2,726,000	41,480,000	64,100,000
Altemative 7	118.42	82,000	21,860,000	2,606,000	41,470,000	63,300,000
Altemative 8	118.42	84,500	23,090,000	2,732,000	41,560,000	64,700,000

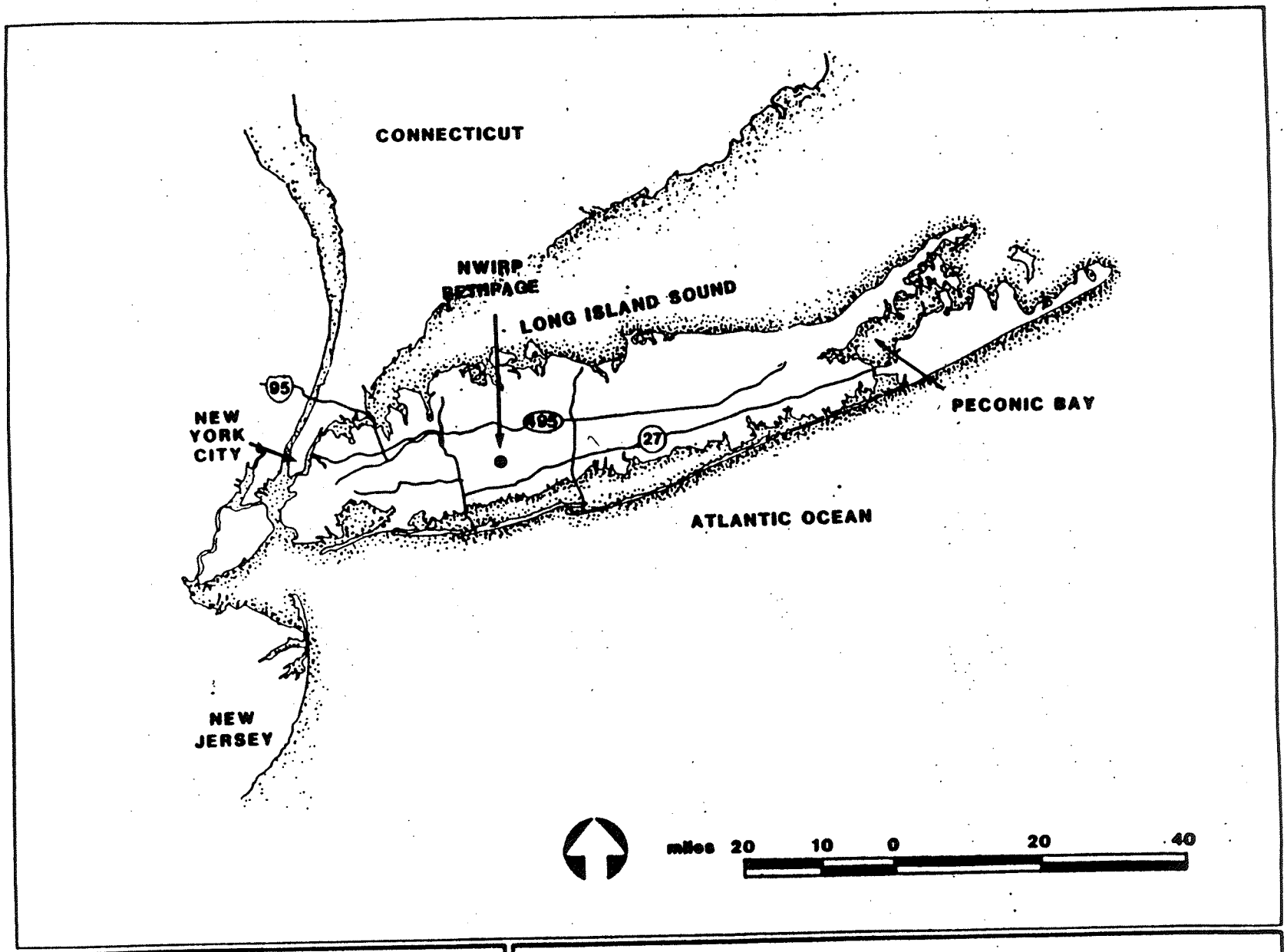
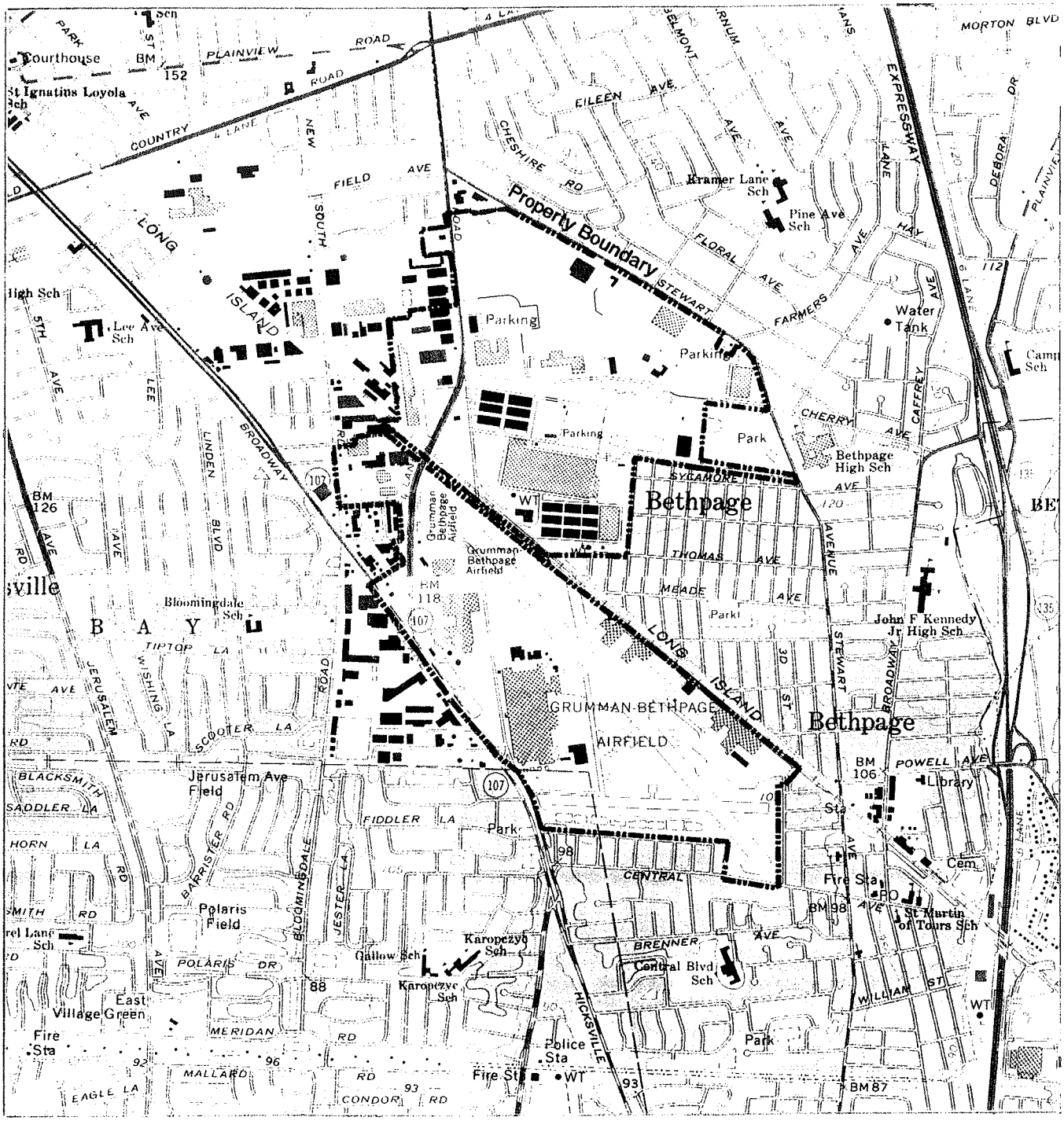


Figure 1–1

General Location Map,
NWIRP Bethpage, New York

Naval Weapons Industrial
Reserve Plant
Bethpage
Long Island, New York



From Amityville, Freeport, Hicksville, Huntington, New York USGS Quadrangles, 1979.

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NY

QUADRANGLE LOCATION

GERAGHTY & MILLER, INC.
Environmental Services

SITE LOCATION

GRUMMAN AEROSPACE COPRPORATION
BETHPAGE, NEW YORK

FIGURE
2-1

DWN: 5-17-94 | PRJCT NO.: NY00080.40 | FILE: 1695 | DRAWING: S. | CHECKED: J.S. | APPROVED: C.S.G. | DRAFTER: G.

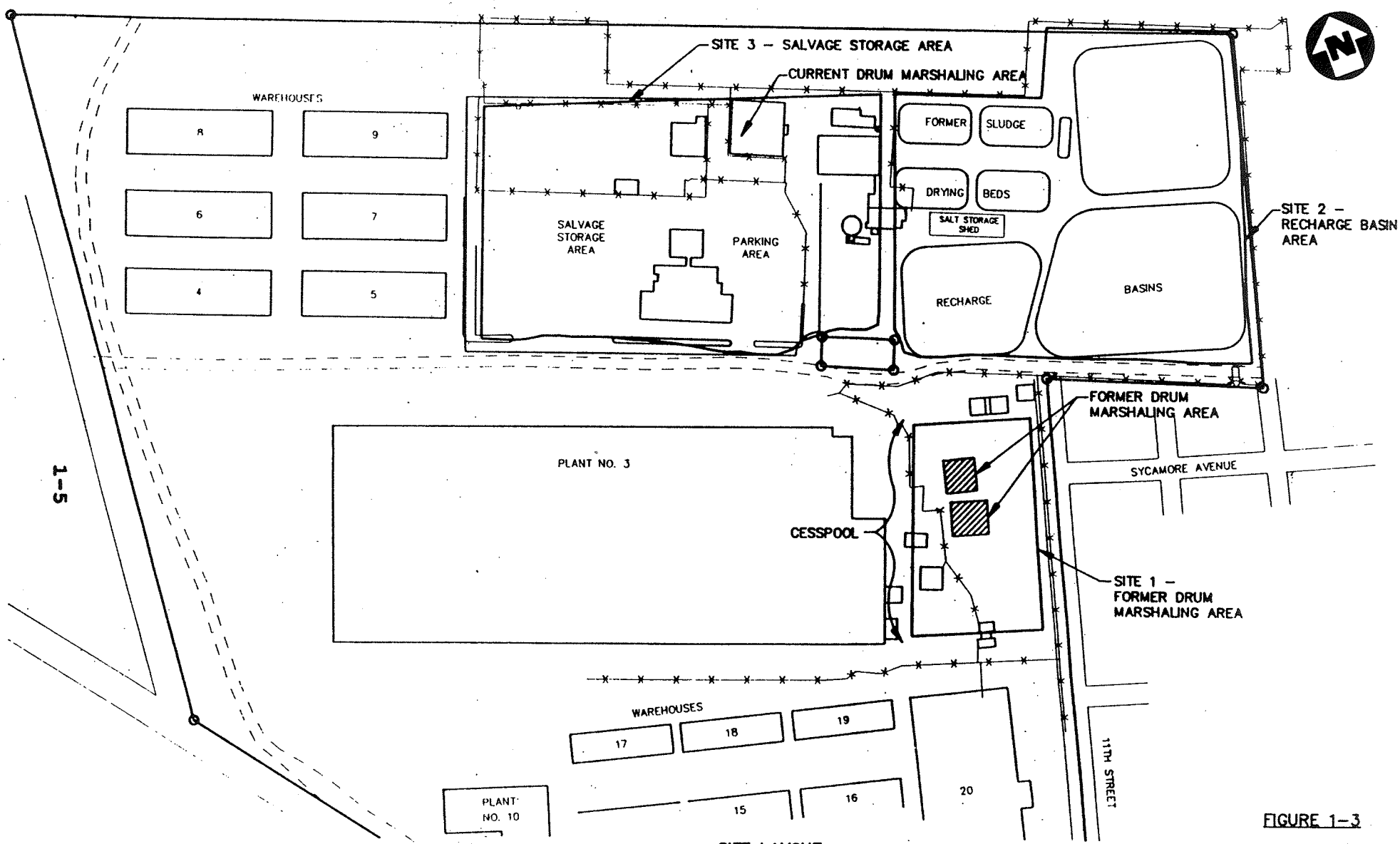

FIGURE 1-3

SITE LAYOUT
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NEW YORK

HALLIBURTON NUS
Environmental Corporation

5026
10555
9920
MW-51D 1 255 04/30/96 <10 150 130 576
MW-51D 2 365 04/30/96 <1 <1 0.7 J 15.70
9932
GM-5S 68 08/24/93 <10 <10 <10 0
GM-5I 129.1 08/24/93 <10 <10 20 20
GM-1S 73 08/25/93 <10 <10 <10 0
GM-1I 125 08/25/93 <10 <10 <10 0
GM-2S 76 08/25/93 <10 <10 <10 0
GM-4S 70 08/24/93 <10 <10 18 18
GM-4I 130 08/24/93 <10 2 9 15
GM-1S
GM-1I
GM-2S
GM-2I 115 08/25/93 <10 <10 <10 0
3147
3428
3142
2066
1232
GM-6S 77.7 08/23/93 <10 <10 <10 0
GM-6I 143 08/23/93 <10 <10 <10 3
GM-7S 59 08/26/93 <10 <10 <10 0
GM-7I 105 08/26/93 <10 21 2 27
GM-7D 220 08/26/93 <10 16 3 22
RUCO
GLYMER
SITE
GM-2I
PLANT 111
10591
AVENUE
6775
GM-3S
GM-31S 76 09/01/93 <10 <10 <10 18
GM-3I
B1
B2
7004
A1
A2
MW-54
GM-4S
GM-4I
GP-16
PLANT 35
FARMERS
6078
8767
8767 640 01/01/97 <0.5 <0.5 <0.5 0
4146
4063
8768
MW-55
R1
5390
M1
N1
C1
C2
G1
G2
5368
Q1
PLANT 37
GM-5S
GM-5I
MW-57I
MW-57S
3450
H1
H2
D1
D2
P1
1461
E1
E2
I1
I2
MW50D1
MW-50D2
MW-51D1
MW-51D2
08/01/95 <20 170 240 1022
HN-25S
HN-25I
HN-25D
GM-8S 58 08/25/93 <10 <10 2 2
GM-8I 115 08/27/93 <10 <10 <10 0
8768 678 01/01/97 <0.5 <0.5 <0.5 0
GM-8I
GM-8S
4175
J-1S
J-2I
F1
F2
GM-9S
10593
GM-9I
4708
GP-8
GP-15
HN-27I 153 08/25/93 <10 4 <10 4
HN-8D
U.S. NAVY SITE
GP-10
GP-9
HN-26S
HN-26I
HN-27S
10592
959
MW-52D
MW-52I
MW-52S
HN-43I
GP-11
HN-27S3 54.3 08/25/93 <10 141 637 922
HN-30S
HN-30I
10594
GP-14
GP-14 467 08/01/95 130 15 14 161
PLANT 3
1797
HN-27S2
HN-27I
HN-27I2
HN-27S3
HN-29S 49.3 08/25/93 <83 340 1400 2650
HN-29I 130.4 08/25/93 <10 17 <10 21
HN-29D 220 08/25/93 <10 13 26 39
HN-42I 107 08/25/93 <10 6 2 8
HN-42S 57 08/25/93 <10 <10 <10 0
GM-10S
GM-10I
GM-11S
HN-24S
HN-24I
HN-24I1
HN-24I2
HN-28I 155 08/25/93 <10 9 <10 9
9079
MW-53I
MW-53D1
MW-53D2
6620
6683
HN-24S 59 08/25/93 <10 16
HN-24I2 158 08/25/93 <1000 12000
HN-29S
HN-29I
HN-29D
HN-28S
HN-28I
10623
HN-42I
HN-42S
GM-12S 55 08/27/93 <10 20 <10 21
GM-12I 116 08/27/93 <100 1000 <100 1013
GP-6
GM-12I
GM-12S
GM-13D 210 08/27/93 <20 340 64 897
GM-13S 67 08/23/93 <50 140 600 1941
GM-13I 109 08/31/93 <10 28 87 173
GM-14S 67 08/26/93 <10 <10 2 2
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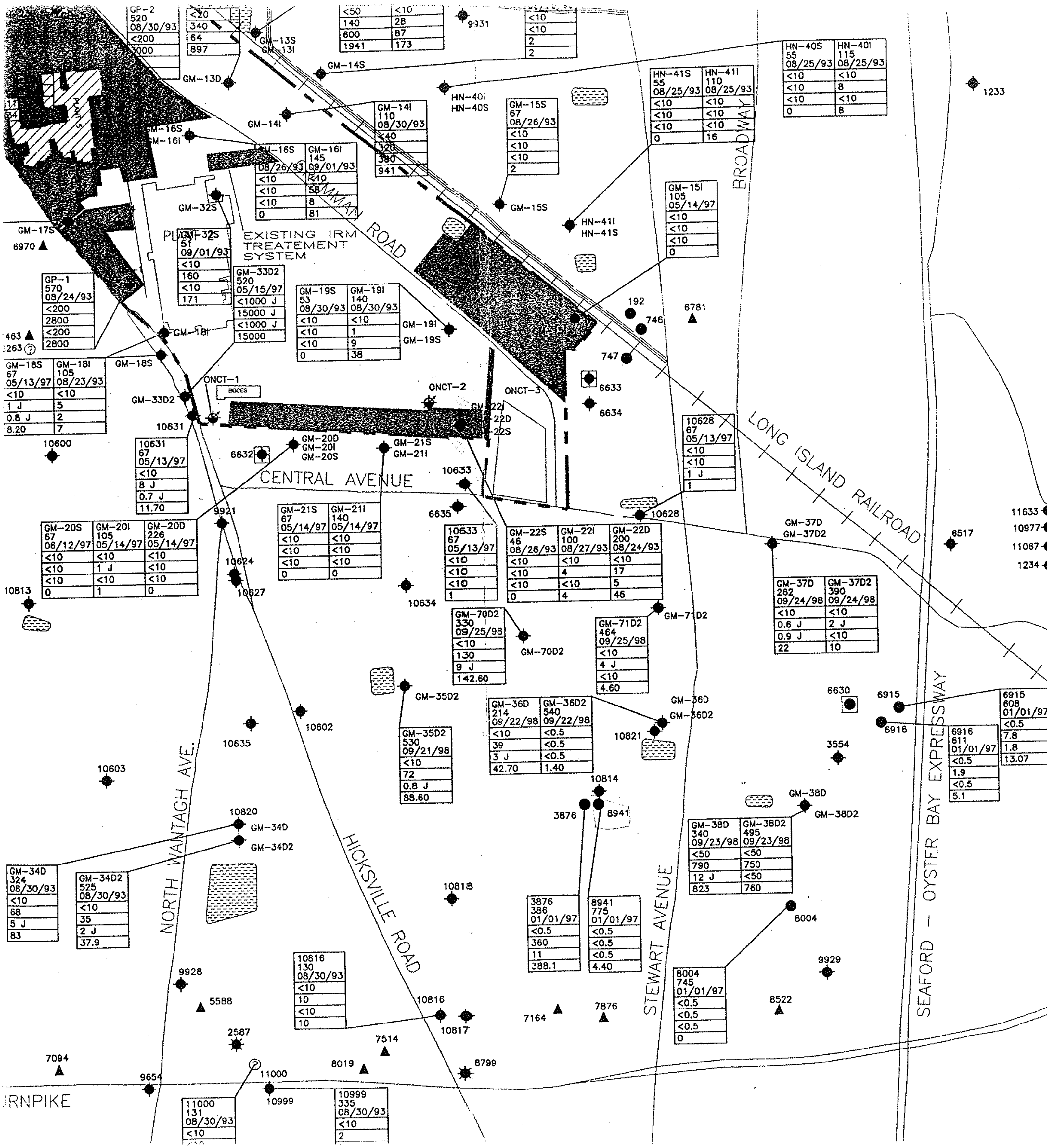
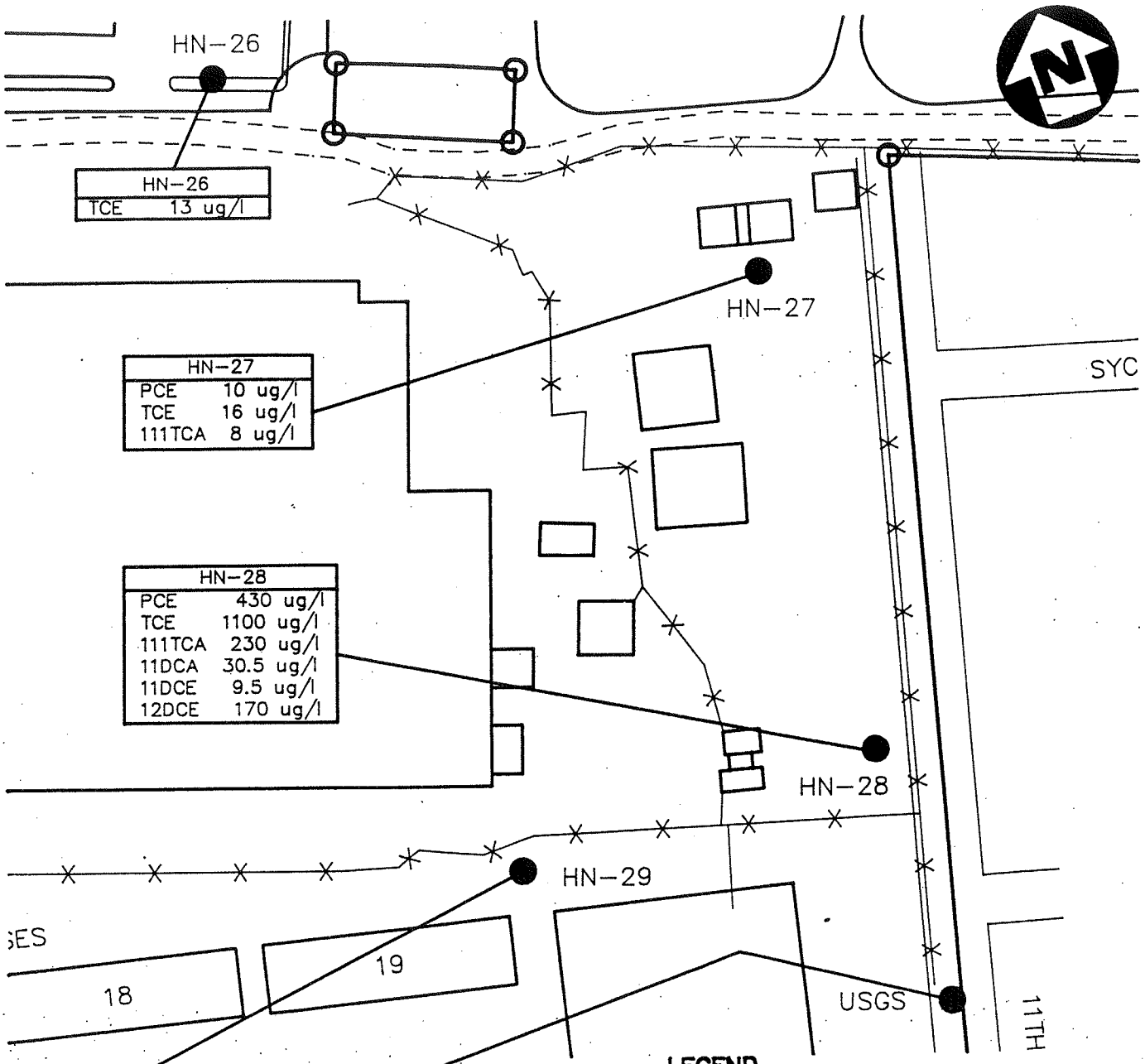
GP-2 520 08/30/93 <200 2000
GP-6 366 08/01/95 61 89 150 418.4
GM-13S
GM-13I
9931
GM-13D
GM-14S
2240
HN-40S 55 08/25/93 <10 <10 <10 0
HN-40I 115 08/25/93 <10 8 <10 8
HN-40I
HN-40S
HN-41S 55 08/25/93 <10 <10 <10 0
HN-41I 110 08/25/93 <10 <10 <10 16
PLANT 5
10630
GM-16S
GM-16I
GM-14I
GM-14I 110 08/30/93 <40 320 380 941
GM-15S 67 08/26/93 <10 <10 <10 2
10597
GM-23S 56 08/23/93 <10 <10 <10 0
GM-23I 120 08/24/93 <10 20 6 30
GM-16S 08/26/93 <10 <10 <10 0
GM-16I 145 09/01/93 <10 58 8 81
BROADWAY
GM-32S
GM-17S
GM-15I 105



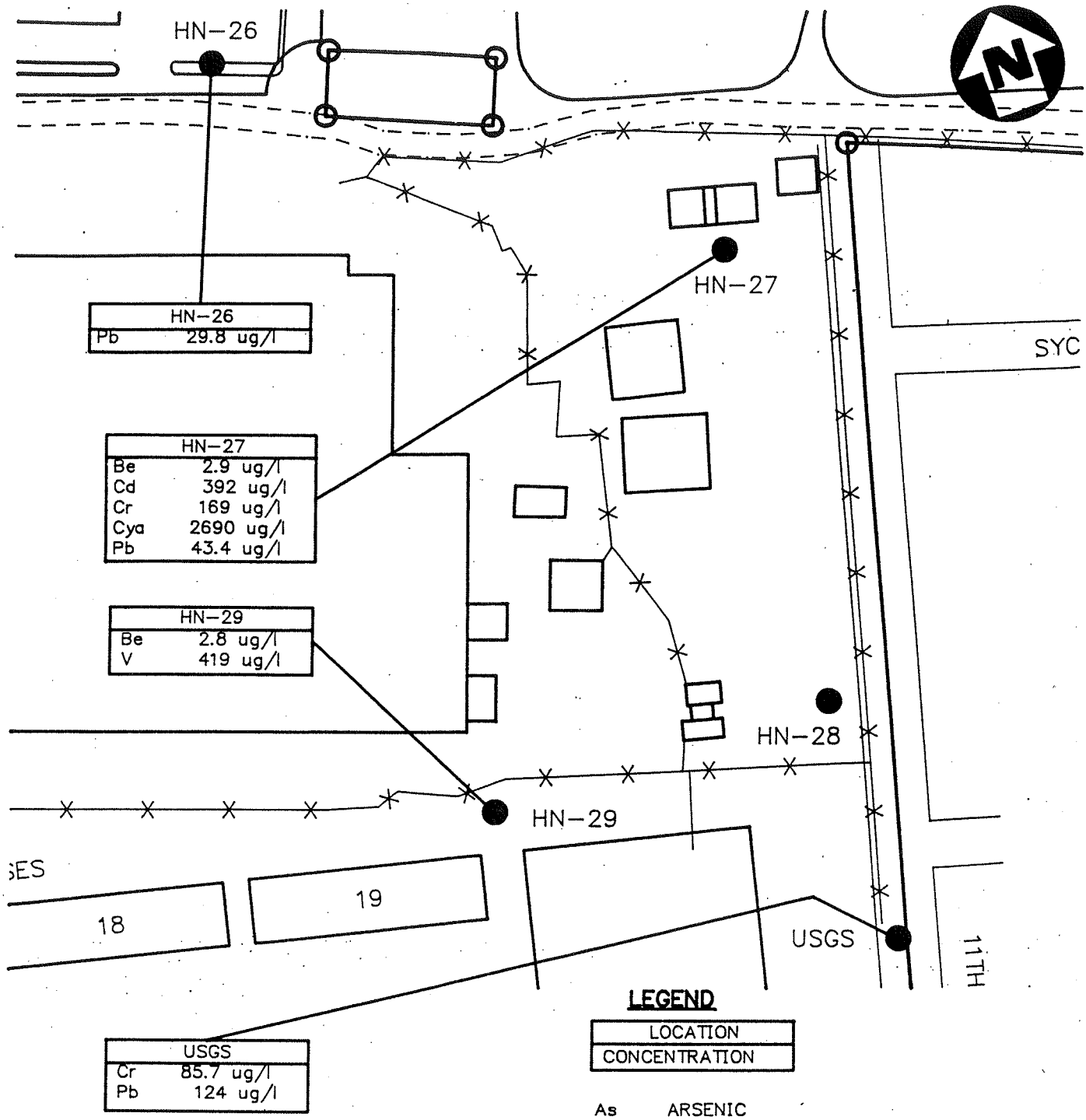
CENTRAL AVENUE
LONG ISLAND RAILROAD
BROADWAY
STEWART AVENUE
HICKSVILLE ROAD
NORTH WANTAGH AVE.
SEAFORD - OYSTER BAY EXPRESSWAY
IRNPIKE
EXISTING IRM TREATEMENT SYSTEM
BOCES
GP-2 520 08/30/93 <200 3000
<20 340 64 897
<50 <10 140 28 600 87 1941 173
<10 <10 2 2
HN-40S 55 08/25/93 <10 <10 <10 0
HN-40I 115 08/25/93 <10 8 <10 8
HN-41S 55 08/25/93 <10 <10 <10 0
HN-41I 110 08/25/93 <10 <10 <10 16
GM-14I 110 08/30/93 <40 320 380 941
GM-15S 67 08/26/93 <10 <10 <10 2
GM-16S 08/26/93 <10 <10 <10 0
GM-16I 145 09/01/93 <10 58 8 81
GM-15I 105 05/14/97 <10 <10 <10 0
GM-32S 51 09/01/93 <10 160 <10 171
GM-33D2 520 05/15/97 <1000 J 15000 J <1000 J 15000
GP-1 570 08/24/93 <200 2800 <200 2800
GM-19S 53 08/30/93 <10 <10 <10 0
GM-19I 140 08/30/93 <10 1 9 38
GM-18S 67 05/13/97 <10 1 J 0.8 J 8.20
GM-18I 105 08/23/93 <10 5 2 7
10631 67 05/13/97 <10 8 J 0.7 J 11.70
10628 67 05/13/97 <10 <10 1 J 1
GM-20S 67 06/12/97 <10 <10 <10 0
GM-20I 105 05/14/97 <10 1 J <10 1
GM-20D 226 05/14/97 <10 <10 <10 0
GM-21S 67 05/14/97 <10 <10 <10 0
GM-21I 140 05/14/97 <10 <10 <10 0
10633 67 05/13/97 <10 <10 <10 1
GM-22S 46 08/26/93 <10 <10 <10 0
GM-22I 100 08/27/93 <10 4 <10 4
GM-22D 200 08/24/93 <10 17 5 46
GM-37D 262 09/24/98 <10 0.6 J 0.9 J 22
GM-37D2 390 09/24/98 <10 2 J <10 10
GM-70D2 330 09/25/98 <10 130 9 J 142.60
GM-71D2 464 09/25/98 <10 4 J <10 4.60
GM-35D2 530 09/21/98 <10 72 0.8 J 88.60
GM-36D 214 09/22/98 <10 39 3 J 42.70
GM-36D2 540 09/22/98 <0.5 <0.5 <0.5 1.40
6915 608 01/01/97 <0.5 7.8 1.8 13.07
6916 611 01/01/97 <0.5 1.9 <0.5 5.1
GM-38D 340 09/23/98 <50 790 12 J 823
GM-38D2 495 09/23/98 <50 750 <50 760
GM-34D 324 08/30/93 <10 68 5 J 83
GM-34D2 525 08/30/93 <10 35 2 J 37.9
3876 386 01/01/97 <0.5 360 11 388.1
8941 775 01/01/97 <0.5 <0.5 <0.5 4.40
8004 745 01/01/97 <0.5 <0.5 <0.5 0
10816 130 08/30/93 <10 10 <10 10
11000 131 08/30/93 <10
10999 335 08/30/93 <10 2
GM-13S GM-13I GM-13D GM-14S GM-14I GM-16S GM-16I GM-17S GM-18I GM-18S GM-19I GM-19S GM-32S GM-33D2 GM-15S HN-40I HN-40S HN-41I HN-41S
ONCT-1 ONCT-2 ONCT-3 GM-22I GM-22D GM-22S GM-20D GM-20I GM-20S GM-21S GM-21I GM-37D GM-37D2 GM-71D2 GM-70D2 GM-35D2 GM-36D GM-36D2 GM-38D GM-38D2 GM-34D GM-34D2
9931 1233 6970 463 263 192 746 6781 747 6633 6634 10631 10600 6632 10633 6635 10628 9921 10624 10627 10813 10634 11633 10977 11067 1234 6517 6630 6915 6916 3554 10602 10635 10603 10821 10814 3876 8941 10820 10818 8004 9929 9928 5588 2587 10816 10817 7164 7876 8522 7094 9654 11000 10999 7514 8019 8799



SHALLOW GROUNDWATER ORGANICS
ABOVE MCLS, ALS, RFD
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NEW YORK

FIGURE 4-12

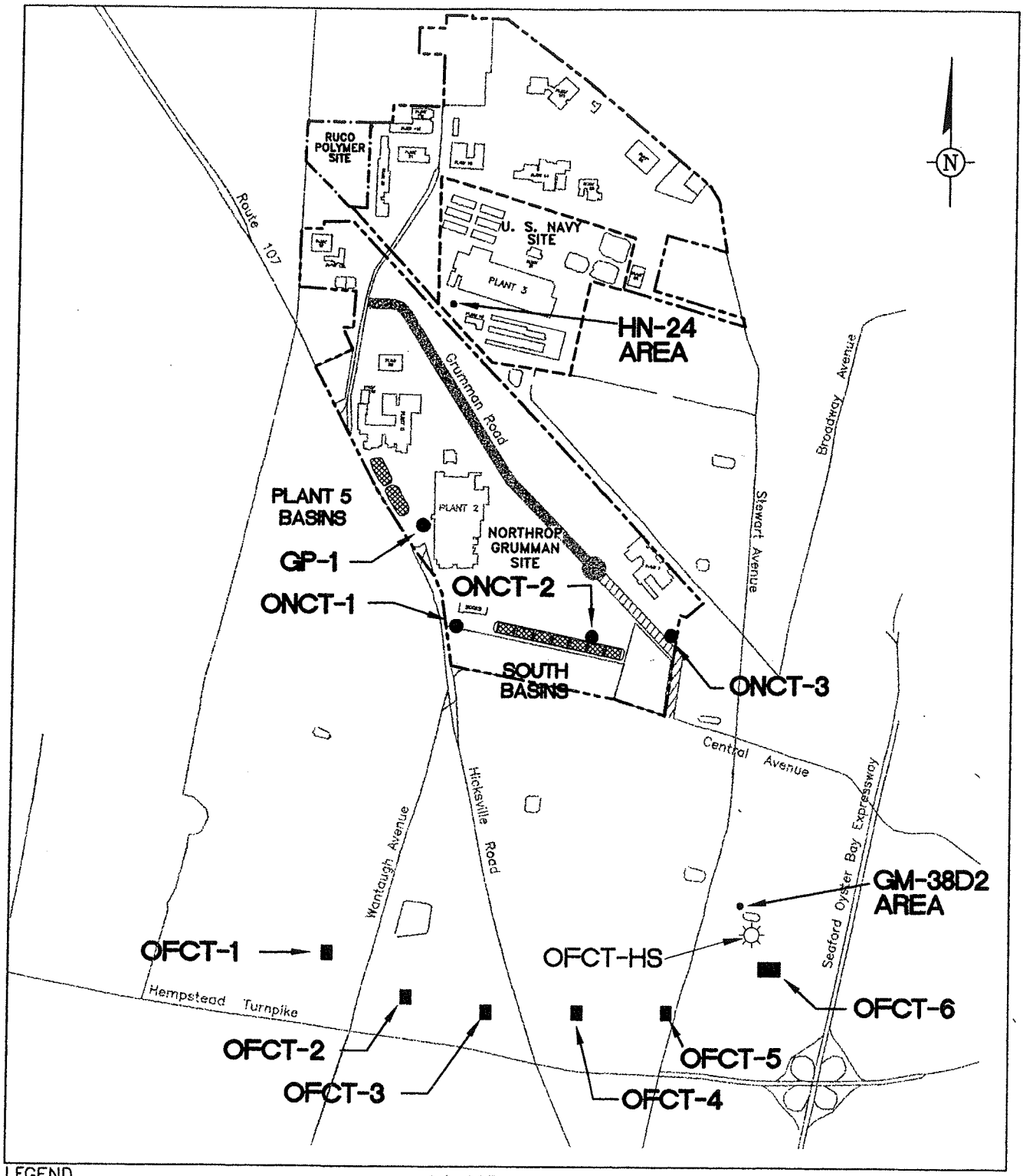
HALLIBURTON NUS
Environmental Corporation



GROUNDWATER SHALLOW INORGANICS
(UNFILTERED)
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NEW YORK

FIGURE 4-14

HALLIBURTON NUS
Environmental Corporation



LEGEND

OFCT-2 ■ LOCATION AND DESIGNATION OF OFF-SITE EXTRACTION WELL

OFCT-HS ☼ LOCATION AND DESIGNATION OF OFF-SITE GM-38D2 AREA EXTRACTION WELL

ONCT-3 ● LOCATION AND DESIGNATION OF ON-SITE EXTRACTION WELL

HN-24 AREA VICINITY OF HN-24 AREA

GM-38D2 AREA VICINITY OF GM-38D2 AREA

DRAFT

0 2000 FT

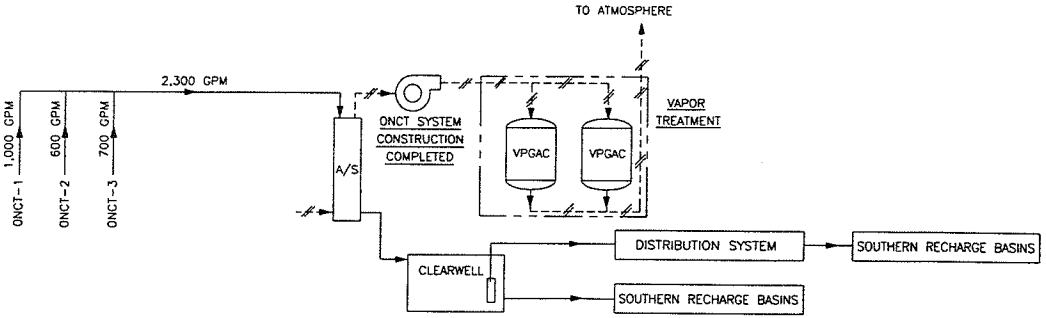
DWG G:\APROJECT\GRUMMAN\NY000008.0151\Task 7\Figures\3-1B.DWG

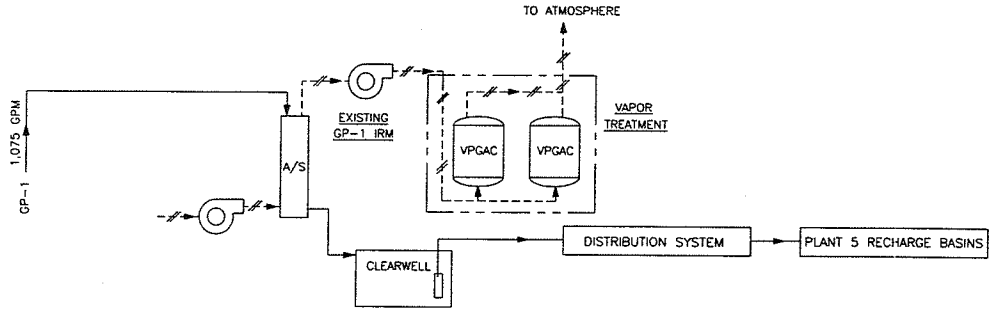
ARCADIS GERAGHTY & MILLER
88 Duryea Road
MELVILLE, NY 11747
Tel: 516/249-7600 Fax: 516/249-7610

LOCATIONS OF EXTRACTION WELLS, PRODUCTION WELL, AND RECHARGE BASINS

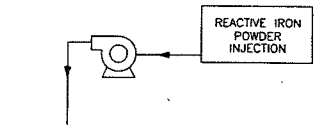
NORTHROP GRUMMAN CORPORATION
BETHPAGE, NEW YORK

FIGURE NO.
3-1

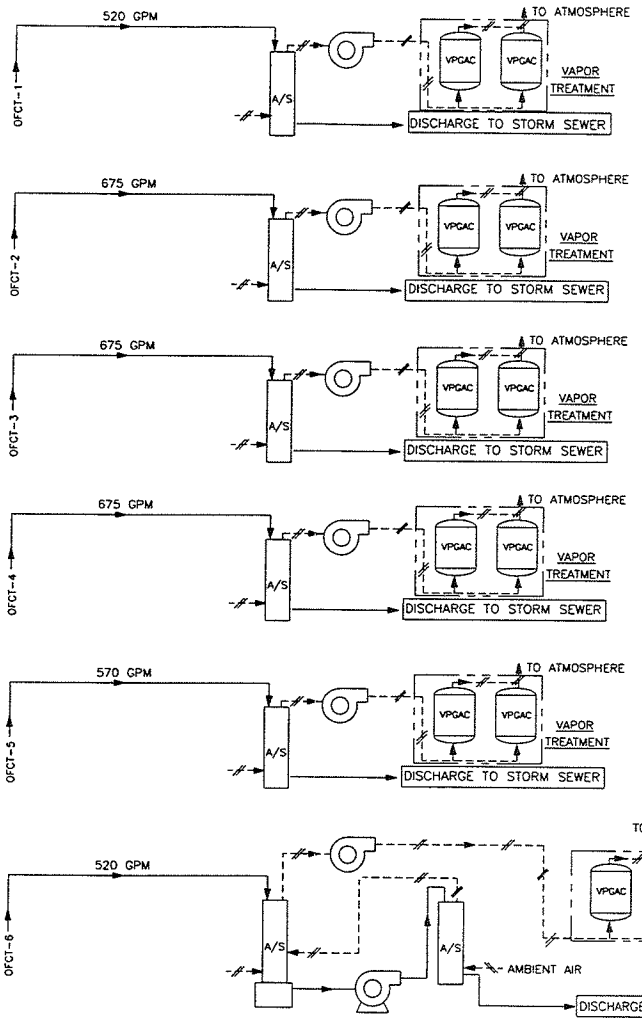




ON-SITE TREATMENT SYSTEM



HN-24 AREA TREATMENT



OFF-SITE TREATMENT SYSTEMS

LEGEND

VPGAC	VAPOR PHASE GRANULAR ACTIVATED CARBON
A/S	AIR STRIPPER
——→	LIQUID FLOW
-//--//-→	VAPOR FLOW

NO.	DATE	REVISION DESCRIPTION	BY CKD

ARCADIS GERAGHTY & MILLER
88 DURYEA ROAD
MELVILLE, NY 11747
Tel: 516/249-7600 Fax: 516/249-7610

ALTERNATIVE 6: ON-SITE PLUME CONTAINMENT, TREATMENT, AND DISCHARGE TO ON-SITE RECHARGE BASINS (VIA THE IRM); HN-24 AREA TREATMENT; TREATMENT OF OFF-SITE PUBLIC SUPPLY WELLS; OFF-SITE PLUME CONTAINMENT, TREATMENT, AND DISCHARGE TO STORM SEWERS; AND GROUNDWATER MONITORING (INCLUDING MONITORED NATURAL ATTENUATION)

NORTHROP GRUMMAN CORPORATION
BETHPAGE, NEW YORK

DRAWN	DATE	PROJECT MANAGER	DEPARTMENT MANAGER
MS	12/17/98	CS	TL
		LEAD DESIGN PROF. GN	CHECKED GN
DRAFT		PROJECT NUMBER NY000008.0151	DRAWING NUMBER 3-7