PROPOSED REMEDIAL ACTION PLAN

Northrop Grumman - Bethpage Facility
Operable Unit Number: 03
State Superfund Project
Bethpage, Nassau County
Site No. 130003A
May 2012

Prepared by
Division of Environmental Remediation
New York State Department of Environmental Conservation

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SECTION 1: SUMMARY AND PURPOSE OF THE PROPOSED PLAN

The New York State Department of Environmental Conservation (the Department), in consultation with the New York State Department of Health (NYSDOH), is proposing a remedy for the above referenced site. The disposal of hazardous wastes at the site has resulted in threats to public health and the environment that would be addressed by the remedy proposed by this Proposed Remedial Action Plan (PRAP). The disposal of hazardous wastes at this site, as more fully described in Section 6 of this document, has contaminated various environmental media. The proposed remedy is intended to attain the remedial action objectives identified for this site for the protection of public health and the environment. This PRAP identifies the preferred remedy, summarizes the other alternatives considered, and discusses the reasons for the preferred remedy.

The New York State Inactive Hazardous Waste Disposal Site Remedial Program (also known as the State Superfund Program) is an enforcement program, the mission of which is to identify and characterize suspected inactive hazardous waste disposal sites and to investigate and remediate those sites found to pose a significant threat to public health and environment.

The Department has issued this document in accordance with the requirements of New York State Environmental Conservation Law and Title 6 of the Official Compilation of Codes, Rules and Regulations of the State of New York; (6 NYCRR) Part 375. This document is a summary of the information that can be found in the site-related reports and documents in the document repository identified below.

SECTION 2: CITIZEN PARTICIPATION

The Department seeks input from the community on all PRAPs. This is an opportunity for public participation in the remedy selection process. The public is encouraged to review the reports and documents, which are available at the following repository:

Bethpage Public Library
Attn: Ms. Lois Lovisolo
Powell Avenue
Bethpage, NY 11714
Phone: 516) 931-3907

A public comment period has been set from: 06/1/2012 to 06/30/2012

A public meeting is scheduled for the following date: 06/12/2012 at 7:00pm

Public meeting location: Bethpage Senior High School

In addition, the NYSDEC will also be holding two public availability sessions on:

06/12/2012 from 2:30 to 4:00pm, and

06/11/2012 from 7:00 to 9:00pm

Availability Session Location: Bethpage Community Center- 103 Grumman Road West

At the public meeting, the findings of the remedial investigation (RI) and the feasibility study (FS) will be presented along with a summary of the proposed remedy. After the presentation the public will have the opportunity to provide verbal or written comments on the PRAP.

At the public availability sessions a summary of the proposed remedy will be presented and staff will be available to answer questions.

Written comments may also be sent through 06/30/2012 to:

Steven Scharf
NYS Department of Environmental Conservation
Division of Environmental Remediation
625 Broadway
Albany, NY 12233- 7015
sxscharf@gw.dec.state.ny.us

The Department may modify the proposed remedy or select another of the alternatives presented in this PRAP based on new information or public comments. Therefore, the public is encouraged to review and comment on the proposed remedy identified herein. Comments will be summarized and addressed in the responsiveness summary section of the Record of Decision (ROD). The ROD is the Department's final selection of the remedy for this site.

Receive Site Citizen Participation Information By Email

Please note that the Department's Division of Environmental Remediation (DER) is "going paperless" relative to citizen participation information. The ultimate goal is to distribute citizen participation information about contaminated sites electronically by way of county email listservs. Information will be distributed for all sites that are being investigated and cleaned up in a particular county under the State Superfund Program, Environmental Restoration Program, Brownfield Cleanup Program, Voluntary Cleanup Program, and Resource Conservation and Recovery Act Program. We encourage the public to sign up for one or more county listserves at www.dec.ny.gov/chemical/61092.html.

SECTION 3: SITE DESCRIPTION AND HISTORY

Location: The Northrop Grumman - Bethpage Facility is a part of the former Grumman Aerospace complex. It is located on Hicksville Road in an urbanized area of Bethpage. Operable Unit 3 (OU3) is off-site from the Northrop Grumman-Bethpage Facility Site (Site No.130003A) and includes the Former Grumman Settling Ponds and adjacent areas. Unless otherwise stated, the term "site" in this document will refer to OU3. The Former Grumman Settling Ponds represent approximately 3.75 acres located within the 12 acre Bethpage Community Park (the Park). The Park is located at the intersection of Stewart Avenue and Cherry Avenue, in Bethpage, New York. OU3 also includes the Grumman Access Road located south and west of the Park and some adjoining land.

Site Features: The Park was donated to the Town of Oyster Bay by Grumman Aircraft Engineering Corporation in October 1962. The Ball-field area of the Park is built over the location of the Former Grumman Settling Ponds. Northrop Grumman retains ownership of the Grumman Access Road which is a closed private road associated with the former plant. The remainder of the Park contains an active storm water recharge basin, a parking area, the Town Ice Skating Rink, and the Town Pool.

Current Zoning: Although zoned for light industrial use, the Town of Oyster Bay has utilized the Former Grumman Settling Ponds area as part of the Bethpage Community Park since the mid-1960s. The surrounding land use is a combination of industrial, commercial, residential, a school and recreational uses.

Historic Uses: From circa 1949 to 1962, the Former Grumman Settling Ponds area was used for dewatering of sludge, including neutralized chromic acid waste, from the waste water treatment facility which was located within the Grumman Aerospace Bethpage complex. This complex included both Grumman owned and operated plants, and government owned (United States Navy) and contractor (Grumman) operated plants. Grumman's operations started in 1930 and the Naval Weapons Industrial Reserve Plant (NWIRP) operations started in 1933. All manufacturing ceased at the Grumman and NWIRP facilities in 1996.

The then named Grumman Aerospace-Bethpage Facility Site (Site No.130003) consisting of some 600 acres was listed in the *Registry of Inactive Hazardous Waste Disposal Sites in New York State* in 1983. (Site No. 130003 as defined did not include the Bethpage Community Park.) Subsequently on March 10, 1993, the Grumman Aerospace-Bethpage Facility Site (130003) was divided into the Northrop Grumman-Bethpage Facility Site (130003A) and the Naval Weapons Industrial Reserve Plant Site (130003B) consisting of 105 acres. During the early 1990s many portions of the Northrop Grumman-Bethpage Facility Site (130003A) were delisted as the investigation of areas was completed. The Northrop Grumman-Bethpage Facility Site (130003A) was further divided on March 13, 2000 with 26 acres becoming the Northrop Grumman-Steel Los Plant 2 Site (130003C). Currently the Northrop Grumman-Bethpage Facility Site (130003A) is 9 acres. In June 2004, a portion of the Naval Weapons Industrial Reserve Plant Site (130003B) was delisted reducing the NWIRP site to 8.7 acres.

Several Records of Decision (RODs) have been issued by the NYSDEC for the Northrop Grumman-Bethpage Facility Site and the Naval Weapons Industrial Reserve Plant Site:

- 130003A, Operable Unit 1 on-site soils source area, March 1995
- 130003A and 130003B, Operable Unit 2 groundwater, March 2001
- 130003B, Operable Unit 1 on-site soils source areas, May 1995.

Operable Units: An operable unit represents a portion of a remedial program for a site that for technical or administrative reasons can be addressed separately to investigate, eliminate or mitigate a release, threat of release or exposure pathway resulting from the site contamination. The Grumman Aerospace Bethpage facility site is divided into 3 operable units. The former manufacturing plant area is designated as Operable Unit 1 (OU1) and Operable Unit 2 (OU2) consists of the groundwater contamination plume and is a joint operable unit for both the Grumman and NWIRP sites. Operable Unit 3 (OU3) consists of the Former Grumman Settling Ponds, the Grumman Access Road, some adjacent property and impacted groundwater which is not addressed by OU2. The Town of Oyster Bay also completed an Interim Remedial Measure (IRM) on an area within the Bethpage Community Park, which was originally but is not currently included in the OU3 area.

Site Geology and Hydrogeology: OU3 is located on the Long Island glacial sand deposits which have been designated as a sole source aquifer. Depth to groundwater (to the Upper Glacial aquifer) is 50 to 55 feet and flow is generally southward. The upper glacial aquifer is underlain by the Magothy aquifer which is the primary source of drinking water. Periodic lower permeability silty-sand and clay lenses exist throughout the area. Most of these confining layers are not continuous in the area of study.

A site location map is attached as Figure 1.

SECTION 4: LAND USE AND PHYSICAL SETTING

The Department may consider the current, intended, and reasonably anticipated future land use of the site and its surroundings when evaluating a remedy for soil remediation. For this site, alternatives (or an alternative) that restrict(s) the use of the site to restricted-residential use (which allows for commercial, industrial and active park recreation use) as described in Part 375-1.8(g) are/is being evaluated in addition to an alternative which would allow for unrestricted use of the site.

A comparison of the results of the investigation to the appropriate standards, criteria and guidance values (SCGs) for the identified land use and the unrestricted use SCGs for the site contaminants is included in the Tables for the media being evaluated in Exhibit A.

SECTION 5: ENFORCEMENT STATUS

Potentially Responsible Parties (PRPs) are those who may be legally liable for contamination at a site. This may include past or present owners and operators, waste generators, and haulers.

The PRPs for the site, documented to date, include:

Northrop Grumman Corporation
Department of the Navy
Town of Oyster Bay

Northrop Grumman signed a Remedial Investigation and Feasibility Study (RI/FS) Order on Consent in July 2005 for the Former Grumman Settling Ponds, or Operable Unit 3 (OU3). Northrop Grumman also signed an RI/FS order on consent for Operable Unit 1 and Operable Unit 2 (OU1 and OU2) in 1989. To date, Grumman has not signed a Remedial Design and Remedial Action (RD/RA) order on consent for OU1 and OU2. The Navy signed a Federal Facilities Site Remediation Agreement in 2005 for implementation of the OU 2 remedy. The Town of Oyster Bay is a responsible party for this site as they are the property owner of the Bethpage Community Park. The Town of Oyster Bay did enter into an order for an IRM in July 2005 to investigate and remediate 7 acres of the Bethpage Community Park.

SECTION 6: SITE CONTAMINATION

6.1: Summary of the Remedial Investigation

A Remedial Investigation (RI) has been conducted. The purpose of the RI was to define the nature and extent of any contamination resulting from previous activities at the site. The field activities and findings of the investigation are described in the RI Report.

The following general activities are conducted during an RI:

- Research of historical information,
- Geophysical survey to determine the lateral extent of wastes,
- Test pits, soil borings, and monitoring well installations,
- Sampling of waste, surface and subsurface soils, groundwater, and soil vapor,
- Sampling of surface water and sediment,
- Ecological and Human Health Exposure Assessments.

The analytical data collected on this site includes data for:

- air
- groundwater
- soil
- soil vapor; and
- indoor air

6.1.1: Standards, Criteria, and Guidance (SCGs)

The remedy must conform to promulgated standards and criteria that are directly applicable or that are relevant and appropriate. The selection of a remedy must also take into consideration guidance, as appropriate. Standards, Criteria and Guidance are hereafter called SCGs.

To determine whether the contaminants identified in various media are present at levels of concern, the data from the RI were compared to media-specific SCGs. The Department has developed SCGs for groundwater, surface water, sediments, and soil. The NYSDOH has developed SCGs for drinking water and soil vapor intrusion. The tables found in Exhibit A list the applicable SCGs in the footnotes. For a full listing of all SCGs see: www.dec.ny.gov/regulations/61794.html.

6.1.2: RI Information

The data have identified contaminants of concern. A "contaminant of concern" is a hazardous waste that is sufficiently present in frequency and concentration in the environment to require evaluation for remedial action. Not all contaminants identified on the property are contaminants of concern. The nature and extent of contamination and environmental media requiring action are summarized in Exhibit A. Additionally, the RI Report contains a full discussion of the data. The contaminant(s) of concern identified for this Operable Unit at this site is/are:

Trichlorethylene	Tetrachloroethene
1,1,1 Trichloroethane	Toluene
Aviation engine oil	Chlorodifluoromethane
Chrome Etchant	Dichlorodifluoromethane
Machine Oil	Chromium
Paint	Cadmium
Paint Solvents	Arsenic
Polychlorinated Biphenyl oil	Freon 113

As illustrated in Exhibit A, the contaminant(s) of concern exceed the applicable SCGs for:

- groundwater; and
- soil

6.2: Interim Remedial Measures

An interim remedial measure (IRM) is conducted at a site when a source of contamination or exposure pathway can be effectively addressed before issuance of the Record of Decision.

The following IRM(s) has/have been completed at this site based on conditions observed during the RI.

Soil Excavation IRM

The Town of Oyster Bay (TOB) completed the investigation and remediation IRM for 7 of the 12 acres comprising the OU3, or Bethpage Community Park Site. The Town of Oyster Bay addressed soils contamination in those seven acres. This TOB IRM included the excavation and off-site disposal of approximately 175,000 cubic yards of soil contaminated with the chlorinated solvents, PCBs, metals and Freon compounds dichlorodifloromethane (R-12) and chlorodifloromethane (R-22) from this area The excavated materials were replaced with clean soils. The Northrop Grumman RI identified that operation of the former Town ice rinks (since replaced by a new rink) were the source of the Freon contamination. Subsequently, the TOB submitted an application that was approved for a Brownfields Cleanup Agreement for the Ice Rink portion of the site. This agreement will address Freon contamination related to the Ice Rink area. The boundaries of OU3 have been adjusted and the area of the TOB IRM is no longer an onsite part of the OU3 program.

Grumman Soil Vapor Extraction (SVE) IRM

A SVE system was installed along the southern boundary of the site to intercept/contain contamination in the soil vapor emanating from the on-site source areas before they could potentially impact off-site structures. Construction started in November of 2007 and was complete by the end of February 2008. The system went on line shortly afterward and has been operating continuously since then.

Groundwater Pump and Treat/Onsite Groundwater Containment System IRM

Grumman installed a groundwater extraction and treatment system along the southern Grumman access road to address the offsite migration of contaminated groundwater. This consists of 4 groundwater extraction wells and treatment on the adjacent McKay Field. The system collects and treats approximately 250 gpm of groundwater extracted from depths between 50 and 75 feet using air stripping as treatment. Construction started in late 2008 and the system went online in July 2009. This onsite groundwater treatment system has been fully operational since that time.

6.3: Summary of Human Exposure Pathways

This human exposure assessment identifies ways in which people may be exposed to site-related contaminants. Chemicals can enter the body through three major pathways (breathing, touching or swallowing). This is referred to as *exposure.*

Since the site is fenced and/or covered by asphalt, concrete or clean fill, people will not come into contact with site-related contaminants in soil unless they dig below the surface. The potential exists for contact with contaminants in soil in limited off-site residential areas. People are not drinking the contaminated groundwater because the area is served by a public water supply that is treated to remove this contamination. Volatile organic compounds in the groundwater may move into the soil vapor (air spaces within the soil), which in turn may move into overlying buildings and affect the indoor air quality. This process, which is similar to the movement of radon gas from the subsurface into the indoor air of buildings, is referred to as soil

vapor intrusion. Because there are no on-site buildings, inhalation of site contaminants in indoor air due to soil vapor intrusion does not represent a concern for the site in its current condition. However, the potential exists for the inhalation of site contaminants due to soil vapor intrusion for any future on-site development. Sampling indicates soil vapor intrusion is not a concern for off-site buildings.

6.4: Summary of Environmental Assessment

This section summarizes the assessment of existing and potential future environmental impacts presented by the site. Environmental impacts may include existing and potential future exposure pathways to fish and wildlife receptors, wetlands, groundwater resources, and surface water.

The OU 3 investigation found significant soil, soil vapor, and groundwater contamination at the Site.

Nature and Extent of Contamination: The contaminants of concern in the areas of concern identified in OU 3 are as follows:

- PCB Fill Material - PCBs
- Low Permeability Zone – Volatile Organic Compounds (VOCs)
- Rag Pit Disposal Area - VOCs
- Former Grumman Settling Ponds – Chrome
- and PCBsGrumman Access Road – PCBs, chromium and cadmium
- Onsite and Off-site Groundwater – VOCs
- Off-site Residential Soil – PCBs and Chrome

Soil: The primary soil contaminants in soil are TCE and its breakdown products, toluene, PCBs, chromium and cadmium. The Sludge Dewatering/Buried Settling Ponds contain chromium and PCB impacted fill materials. The Rag Pit Disposal Area contains chlorinated and non-chlorinated VOCs. The Low Permeability Zone above the water table is impacted mainly with chlorinated VOCs. The Grumman Access Road soils are impacted with PCBs, chromium, and to a lesser extent, cadmium.

Groundwater: The primary site-related groundwater and soil vapor contaminants is TCE and its breakdown products. The continued offsite migration of impacted groundwater has largely been addressed by the onsite groundwater pump and treatment system IRM. There are also Freon compounds in the groundwater which are not a result of Grumman's historic operations, but attributable to the Park ice rinks. Groundwater migration from the OU3 area has resulted in a significant off-site groundwater plume which has impacted both the Upper Glacial and Magothy Formations. As the OU3 groundwater plume leaves the site, as a distinct plume, it becomes comingled with the larger OU2 Grumman/NWIRP groundwater plume. While generally comingled at depths of less than 400 feet, the OU 3 plume continues deeper than the OU2 plume, extending to a depth of at least 550 feet below ground surface. Within the OU3 plume an area of elevated concentrations, or “hotspot”, plume of VOCs has been identified approaching the Bethpage Water District No. 4 well field.

Soil Vapor: The on-site soil vapor and associated potential migration of soil vapor impacts to adjacent residences has already been addressed by Grumman through the implementation of the soil vapor extraction (SVE) Interim Remedial Measure (IRM). There are also Freon compounds in the soil vapor which are not a result of Grumman's historic operations.

Residential soils: Several properties to the south of the Grumman Access Road parcel have also had soil samples taken from the yard areas. These analytical results have identified several homes with soils impacted with PCBs and chrome.

Special Resources Impacted/Threatened: The Long Island Sole Source Aquifer has been impacted with site-related contamination.

SECTION 7: SUMMARY OF THE EVALUATION OF ALTERNATIVES

To be selected, the remedy must be protective of human health and the environment, be cost-effective, comply with other statutory requirements, and utilize permanent solutions, alternative technologies or resource recovery technologies to the maximum extent practicable. The remedy must also attain the remedial action objectives identified for the site, which are presented in Exhibit B. Potential remedial alternatives for the Site were identified, screened and evaluated in the FS report.

A summary of the remedial alternatives that were considered for this site is presented in Exhibit C. Cost information is presented in the form of present worth, which represents the amount of money invested in the current year that would be sufficient to cover all present and future costs associated with the alternative. This enables the costs of remedial alternatives to be compared on a common basis. As a convention, a time frame of 30 years is used to evaluate present worth costs for alternatives with an indefinite duration. This does not imply that operation, maintenance, or monitoring would cease after 30 years if remediation goals are not achieved. A summary of the Remedial Alternatives Costs is included as Exhibit D.

7.1: Evaluation of Remedial Alternatives

The criteria to which potential remedial alternatives are compared are defined in 6 NYCRR Part 375. A detailed discussion of the evaluation criteria and comparative analysis is included in the FS report.

The first two evaluation criteria are termed "threshold criteria" and must be satisfied in order for an alternative to be considered for selection.

1. Protection of Human Health and the Environment. This criterion is an overall evaluation of each alternative's ability to protect public health and the environment.

2. Compliance with New York State Standards, Criteria, and Guidance (SCGs). Compliance with SCGs addresses whether a remedy will meet environmental laws, regulations, and other

standards and criteria. In addition, this criterion includes the consideration of guidance which the Department has determined to be applicable on a case-specific basis.

The next six "primary balancing criteria" are used to compare the positive and negative aspects of each of the remedial strategies.

3. Long-term Effectiveness and Permanence. This criterion evaluates the long-term effectiveness of the remedial alternatives after implementation. If wastes or treated residuals remain on-site after the selected remedy has been implemented, the following items are evaluated: 1) the magnitude of the remaining risks, 2) the adequacy of the engineering and/or institutional controls intended to limit the risk, and 3) the reliability of these controls.

4. Reduction of Toxicity, Mobility or Volume. Preference is given to alternatives that permanently and significantly reduce the toxicity, mobility or volume of the wastes at the site.

5. Short-term Impacts and Effectiveness. The potential short-term adverse impacts of the remedial action upon the community, the workers, and the environment during the construction and/or implementation are evaluated. The length of time needed to achieve the remedial objectives is also estimated and compared against the other alternatives.

6. Implementability. The technical and administrative feasibility of implementing each alternative are evaluated. Technical feasibility includes the difficulties associated with the construction of the remedy and the ability to monitor its effectiveness. For administrative feasibility, the availability of the necessary personnel and materials is evaluated along with potential difficulties in obtaining specific operating approvals, access for construction, institutional controls, and so forth.

7. Cost-Effectiveness. Capital costs and annual operation, maintenance, and monitoring costs are estimated for each alternative and compared on a present worth basis. Although cost-effectiveness is the last balancing criterion evaluated, where two or more alternatives have met the requirements of the other criteria, it can be used as the basis for the final decision.

8. Land Use. When cleanup to pre-disposal conditions is determined to be infeasible, the Department may consider the current, intended, and reasonable anticipated future land use of the site and its surroundings in the selection of the soil remedy.

The final criterion, Community Acceptance, is considered a "modifying criterion" and is taken into account after evaluating those above. It is evaluated after public comments on the Proposed Remedial Action Plan have been received.

9. Community Acceptance. Concerns of the community regarding the investigation, the evaluation of alternatives, and the PRAP are evaluated. A responsiveness summary will be prepared that describes public comments received and the manner in which the Department will address the concerns raised. If the selected remedy differs significantly from the proposed remedy, notices to the public will be issued describing the differences and reasons for the changes.

7.2: Elements of the Proposed Remedy

As detailed below, the Department is proposing "Excavation and Off-site Disposal of Park soils including removal of hazardous waste levels of PCB impacted soils, Low Permeability Zone Soil Remediation, Excavation of Grumman Access Road Soils, Onsite Groundwater Containment and, Excavation of impacted Adjacent residential Yards and Address Soil Vapor." For the off-site groundwater, the Department is proposing "Off-site Elevated Groundwater Collection and Treatment." These alternatives are collectively labeled "Alternative 5." The estimated present worth cost to implement the remedy is $81,000,000. The cost to construct the remedy is estimated to be $61,500,000 and the estimated average annual cost is $1,250,000. The basis for the Department's proposed remedy is set forth at Exhibit E.

The elements of the proposed remedy, for the areas shown on Figure 2, are as follows:

1. Implementation of a remedial design program to provide the details necessary for the construction, maintenance and monitoring of the remedial program. Green remediation principals and techniques will be implemented to the extent feasible in the design, implementation, and site management of the remedy as per NYSDEC Division of Environmental Remediation (DER) Guidance-31. The major green remediation components are as follows:

- considering the environmental impacts of remedy stewardship over the long term;
- reducing direct and indirect greenhouse gas and other emissions;
- increasing energy efficiency and minimizing use of non-renewable energy;
- conserving and efficiently managing resources and materials;
- reducing waste, increasing recycling and increasing reuse of materials which would otherwise be considered a waste;
- maximizing habitat value and creating habitat when possible
- fostering green and healthy communities and working landscapes which balance ecological, economic and social goals;
- integrating the remedy with the end use where possible and encouraging green and sustainable re-development; and
- preference for the disposition of the treated groundwater will be given for a reuse, such as irrigation of the golf courses at Bethpage State Park.

2. The Former Grumman Settling Ponds area, located in the ball fields and areas adjacent to the ball fields, in the Bethpage Community Park will be excavated to remove PCB contaminated fill from an approximately three acre area. In this area, all soil exceeding 50 ppm for PCBs (approximately 25,000 cubic yards) will be excavated and disposed off-site at a permitted disposal facility. The soil exceeding 50 ppm is predominantly present between 10 to 20 feet below ground surface (bgs) and the excavation limits will be extended as necessary to attain the 50 ppm level. Chromium sludge which is co-located with the PCB impacted soil will be removed to the extent necessary to achieve the PCB removal goals.

The soil from the surface to 10 feet bgs, will be excavated either to achieve the Commissioners Policy (CP 51) on soil cleanup approach for PCBs or as necessary to access the deeper PCB

contaminated soil. The remaining soil in the upper two feet site-wide will also achieve the 1ppm SCO for PCBs or other applicable SCOs for metals or semi-volatile organic compounds to establish a site cover.

The soil excavated which is less than 50 ppm (approximately 45,000 cubic yards) may be stockpiled for reuse as backfill in the excavation areas deeper than 10 feet, as part of an on-site soil management plan. All soil with PCB levels exceed 50 ppm will be transported off-site to a permitted disposal facility.

3. A site cover will be required to allow for restricted residential use of the site. The cover will consist either of the structures such as buildings, pavement, sidewalks comprising the site development or a soil cover in areas where the upper two feet of exposed surface soil will exceed the applicable soil cleanup objectives (SCOs). Where the soil cover is required it will be a minimum of two feet of soil, meeting the SCOs for cover material as set forth in 6 NYCRR Part 375-6.7(d) for restricted residential use. The soil cover will be placed over a demarcation layer, with the upper six inches of the soil of sufficient quality to maintain a vegetation layer. Any fill material brought to the site will meet the requirements for the identified site use as set forth in 6 NYCRR Part 375-6.7(d).

4. The Grumman Access Road right-of-way area will be excavated to remove PCB and chromium contaminated fill from an approximately 1,000 foot long area beneath and adjacent to the access road. Soil will be removed to achieve 1 ppm in the upper two feet and 10 ppm of PCBs at depth. It is estimated that approximately 6,000 cubic yards of soil will be removed, for the most part to depths from 0 to 3.5 feet bgs. The soil excavated can also be handled in accordance with the on-site soil management plan, as set forth in Item 2 above.

5. The approximately 1 acre VOC source area(s)in a low permeability zone present approximately 40 feet bgs in the Former Grumman Settling Pond Area, will be remediated using an in-situ thermal desorption and soil vapor extraction technology. The area to be addressed will be treated to attain the protection of groundwater SCOs for the VOCs.

6. Residential yards located between Sycamore Avenue and the Grumman Access Road, where design sampling identifies PCB impacts greater than 1 ppm and chromium in excess of the residential SCO will be excavated, followed by restoration of the yards. The soil excavated can also be handled in accordance with the on-site soil management plan, as set forth in Item 2 above.

7. The areas to be excavated, with the exception of the Grumman Settling Pond Area subject to the on-site soil management plan, will be backfilled with fill material brought to the site which meets the requirements for the identified site use as set forth in 6 NYCRR Part 375-6.7(d). Excavated areas will be graded and restored to pre-excavation conditions, unless an alternative restoration is agreed to with the property owner.

8. The existing groundwater extraction and treatment IRM will continue to be operated and upgraded as necessary, based on a review of its effectiveness, to assure the capture/containment

of the full depth and area of contaminated groundwater leaving the Site. Additional extraction wells will be installed as needed to ensure the containment of the full depth of the area of contaminated groundwater leaving the site. The treatment capacity will be upgraded as needed to treat any increased ground water extracted to ensure that the discharge meets applicable SCGs.

9. Continue operation of the existing IRM soil vapor extraction and treatment system in place along the Grumman Access Road to prevent migration of contaminated soil vapor.

10. At least one groundwater extraction well with necessary treatment (the exact number to be determined during the design phase) will be installed in the groundwater plume emanating from OU3 in a location downgradient of the area(s) of elevated contaminant levels which have been identified upgradient of Bethpage Water District Plant 4. This extraction well, or wells, will be designed to capture and treat the shallow and deep components of this “hot spot” area of the plume, as recommended by the Technical Team for Optimization of the Bethpage Plume Remedy in their June 15, 2011 report prepared for the U.S. Navy. The performance standard for groundwater extraction will be 90 percent mass removal for groundwater migrating downgradient from the elevated "hotspot area(s)." Considerations may be given to the use of Bethpage Water District facilities for all or part of treatment system. Additional wells to better delineate the leading edge of the OU3 plume will also be installed and monitored.

11. The Wellhead Treatment Contingency Plan put in place as a requirement of the OU 2 ROD will remain in place. Nothing in this decision should be considered as affecting any review of the Wellhead Treatment Contingency Plan that may be conducted by the Department or other interested agencies and parties.

12. Imposition of an institutional control in the form of an environmental easement that will:

- require the remedial party or site owner to complete and submit to the Department a periodic certification of institutional and engineering controls in accordance with Part 375-1.8 (h)(3);
- allow the use and development of the controlled property for restricted residential, as defined by Part 375-1.8(g), although land use is subject to local zoning laws;
- restrict the use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by the Department, NYSDOH or County DOH;
- prohibit the raising of dairy cattle as per 6 NYCRR Part 375or vegetable gardens on the controlled property; and
- require compliance with the Department approved Site Management Plan;

13. A Site Management Plan is required, which includes the following:

(a) An Institutional and Engineering Control Plan that identifies all use restrictions and engineering controls for the site and details the steps and media-specific requirements necessary to ensure the following institutional and/or engineering controls remain in place and effective:

Institutional Controls: The Environmental Easement discussed in Paragraph 12 above.

Engineering Controls: The continued operation of the onsite ground water containment pump and treat system, the Soil Vapor Extraction (SVS) system described in paragraph 9 and treatment of the elevated groundwater hot spot offsite described in paragraph 10.

Areas below the final depth of excavation and clean backfill, with remaining elevated site-related contamination, would be restricted for intrusive activities.

This site management plan includes, but may not be limited to:

- an excavation plan which details, if necessary, the provisions for management of future excavations in areas of remaining contamination;
- a description of the provisions of the environmental easement including any land use, groundwater and/or surface water use restrictions;
- provision for evaluation of the potential for soil vapor intrusion, if necessary once remediation is complete, for any buildings developed on the site, including provision for implementing actions recommended to address exposures related to soil vapor intrusion;
- Provisions for the management and inspection of the identified engineering controls;
- maintaining site access controls and Department notification; and
- the steps necessary for the periodic reviews and certification of the institutional and/or engineering controls;

(b) A Monitoring Plan to assess the performance and effectiveness of the remedy. The plan includes, but may not be limited to:

- the onsite pump and treat system, offsite pump and treat system, the SVE system and any plume migration beyond the offsite treatment area that becomes part of the OU 2 plume;
- monitoring of groundwater and soil vapor to assess the performance and effectiveness of the remedy; a schedule of monitoring and frequency of submittals to the Department; and
- monitoring for vapor intrusion for any buildings occupied or developed on the site, as may be required pursuant to the site management plan;
- additional sampling and/or monitoring well installation, as necessary, along the eastern boundary to better define the lateral extent of groundwater contamination.

(c) An Operation and Maintenance Plan to ensure continued operation, maintenance, monitoring, inspection, and reporting of for any mechanical or physical components of the remedy. The plan includes, but is not limited to:

- the onsite and off-site pump and treat systems;
- the SVE system;
- compliance monitoring of treatment systems to ensure proper O&M as well as providing the data for any necessary permit or permit equivalent reporting; maintaining site access controls and Department notification; and
- providing the Department access to the site and O&M records.

Exhibit A

Nature and Extent of Contamination

This exhibit describes the findings of the Remedial Investigation for all environmental media that were evaluated. As described in Section 6.1.2, samples were collected from various environmental media to characterize the nature and extent of contamination.

For each medium, a table summarizes the findings of the investigation. The tables present the range of contamination found at the site in the media and compares the data with the applicable standards, criteria, and guidance values (SCGs) for the site. The contaminants are arranged into five categories; volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), metals and cyanide. For comparison purposes, the SCGs are provided for each medium that allows for unrestricted use. For soil, if applicable, the appropriate restricted use SCGs identified in Section 6.1.1 are also presented.

This exhibit identifies the wastes found in OU 3 and is followed by environmental media, the individual contaminants in each environmental media that are associated with the disposal and/or operations identified at the site. Each media discussion includes a table that compares the site data to the appropriate Unrestricted SCGs for that medium. In addition, the soil tables include a comparison of the analytical data to the appropriate Restricted SCO found in Part 375-6.8 (b) for each individual contaminant.

Waste and/or Source Areas

As described in the RI report, waste disposal and/or source areas were identified at the Former Grumman Settling Ponds, Operable Unit No. 3 (OU3), (hereafter the "site" for purposes of this document) that are impacting soil, groundwater and soil vapor. Wastes are defined in 6 NYCRR Part 375-1.2 and include solid, industrial and/or hazardous wastes. Source Areas are also defined in 6 NYCRR Part 375. Source areas are locations of concern at a site where substantial quantities of contaminants are found which can migrate in that medium and/or release significant levels of contaminants to another environmental medium. Both waste/source materials and source areas are present on OU3 (see figure 2). The wastes disposed at this site include:

- paint, coating materials and oily wastes;
- PCBs and/or PCB impacted soils;
- chromium laden sludge;
- cadmium and to a less extent arsenic;
- chlorinated and non-chlorinated solvents; and
- semi-volatile organic compounds.

The waste disposal in OU3 has resulted in the identification of 7 areas of concern (AOC), related to waste disposal or soil contamination:

- PCB Fill Material
- Low Permeability Zone
- Rag Pit Disposal
- Former Grumman Settling Ponds
- Grumman Access Road

- Onsite and Offsite Groundwater
- Offsite Residential Soil

The following areas of concern are the primary source areas to the on and off-site groundwater plume:

- the rag disposal pit area; and
- the low permeability zone located on-site, approximately 40 feet below ground surface (bgs), which has collected solvents on their downward migration and is now acting as a continuing source of VOCs to the aquifer.

The waste disposal in OU3 has resulted in the identification of two areas of concern (AOC), related to groundwater contamination:

- on-site groundwater; and
- off-site groundwater.

Some of the impacts to soil vapor and groundwater from the former rag pit disposal area and the lower permeability zone have been addressed, by the IRM(s) described in Section 6.2 of this document. The remaining waste/source area(s) identified during the RI for OU3 will be addressed in the remedy selection process. The onsite source areas impacts to the groundwater, soil and soil vapor are described below.

Groundwater

On- Site Groundwater: The groundwater table at the site is located at a depth ranging from 50 to 55 feet below ground surface (bgs) in the Upper Glacial Formation. The groundwater flow direction is primarily horizontal with a downward component to the south-southeast in and around OU3. Contamination in the on-site groundwater exceeds SCGs for chlorinated volatile organic compounds (VOCs); trichloroethene (TCE), cis-1, 2 dichloroethene (cis-1, 2-DCE), dichloroethane (DCA), vinyl chloride, as well as aromatic hydrocarbon VOCs such as toluene, and to a lesser extent xylene, ethyl benzene and benzene (see figure 3). In addition a source of chlorodifloromethane (Freon-22) and dichlorodifloromethane (Freon-12), resulting from the operation of the two former Town of Oyster Bay Ice Skating Rinks is located east of OU3. The Freon plume emanating from the Ice Rinks is comingled with OU3 related VOCs. This contamination is anticipated to be addressed by the Town of Oyster Bay under the Brownfields Cleanup Program. The on-site groundwater just south of the Former Grumman Settling Ponds also exceeds the SCG for total chromium. Impacted on-site groundwater is found as deep as 150 feet bgs. Migration of onsite groundwater is prevented by the existing groundwater pump and treat system IRM (see figure 4), described in more detail in Section 6.2.

A highly contaminated area of perched groundwater, which lies above a zone of low permeability soil beneath a portion of OU, which has been delineated as an area of concern 3. This lower permeability zone soil and the perched groundwater above it, come in contact with, and add to the contamination in the shallow groundwater, due in part to seasonal variation in the water table. As groundwater flows south-southeast past the Park boundary, the OU 3 plume becomes commingled with the area-wide groundwater solvent plume from the OU2 portion of the Grumman and Naval Weapons Industrial Reserve Plant sites.

Table 1 – On-Site Groundwater

Detected Constituents	Concentration Range Detected[a]	SCG[b]	Frequency Exceeding SCG /Total Number of Samples
VOCs			
1,1,1 Trichloroethane	BD- 5	1	4 / 296
1,1,2-Trichloroethane	BD- 4	5	45 / 296
1,1,-Dichloroethane	BD- 110	5	24 / 296
1,1,Dichloroethene	BD- 83	0.6	24 / 296
1,2-Dichloroethane	BD- 8.8	1	12 / 96
1,2-Dichloropropane	BD- 14	50	13 / 296
Acetone	BD- 52	1	1 / 296
Benzene	BD- 5	1	4 / 296
Dichlorofluoromethane R-22	BD- 220	5	10 / 296
Carbon Tetrachloride	BD- 8	5	1 / 296
Chloriform	BD- 110	7	48 / 296
Chlorimethane	BD- 240	5	1 / 296
Cis-1,2-Dichloroethene	BD- 83	5	162 / 296
Ethyl benzene	BD- 510	5	5 / 296
Methylene Chloride	BD- 8	5	1 / 296
Styrene	BD- 6	5	1 / 296
Toluene	BD- 84,000	5	25 / 296
Trans-1,2-dichloroethene	BD- 95	5	12 / 296
Trans- 1,3-dichloropropene	BD- 2	0.4	1 / 296
Trichloroethelyene	BD- 2,700	5	182 / 296
Vinyl Chloride	BD- 5,900	5	28 / 296
Xylenes, m,p	BD- 300	10	3 / 33
SVOCs			
4-Methyl-Phenol	BD- 120	1	2 / 64
Bis(2-chloroethyl)ether	BD- 2	1	1 / 64
Bis(2-ethylhexyl)phalate	BD- 100	5	2 / 64

Detected Constituents	Concentration Range Detected[a]	SCG[b]	Frequency Exceeding SCG /Total Number of Samples
Napthalene	BD- 13	10	1 / 66
Phenol	BD- 66	1	14 / 64
Metals			
Arsenic	BD- 49.2	25	2 / 64
Beryllium	BD- 5.9	3	1 / 40
Chromium	BD- 729	50	5 / 40
Iron	28.8- 37,000	300	25 / 38
Lead	BD- 111	25	1 / 40
Manganese	BD- 782	300	3 / 38

a – All values in parts per billion (ppb), which is equivalent to micrograms per liter (ug/L).
b- SCG: Standard Criteria or Guidance – Based on Ambient Water Quality Standards and Guidance Values (TOGs 1.1.1), 6 NYCRR Part 703, Surface water and Groundwater Quality Standards, and Part 5 of the New York State Sanitary Code (10 NYCRR Part 5).
BD = below detection

Off-Site Groundwater: Groundwater migration from OU3 has resulted in a significant and discernible off-site groundwater plume, which has impacted both the Upper Glacial and Magothy Formations. While the OU3 groundwater plume leaves the site as a distinct plume it soon becomes comingled with the OU2 groundwater plume, as shown on Figures 5 and 6. While generally comingled at depths of less than 400 feet bgs, the OU 3 plume continues deeper than the OU2 plume, extending to a depth of at least 550 feet bgs. The OU 3 plume, within the area-wide OU2 plume, is deeper, narrower, varied in width and is a more concentrated. This plume has VOC levels ranging from 5 ppb to 10 ppm, and extends approximately 5,400 feet down gradient of the Park boundary. Within the offsite OU3 plume an elevated, or "hotspot" area of VOCs has been identified that is characterized by elevated levels of TCE (9,100 ug/l) and the breakdown product DCE (3,400 ug/l). This hot spot is presently located approximately 2,500 feet up gradient of, and approaching, the Bethpage Water District No. 4 well field. In addition, the off-site groundwater is also impacted by the Freon plume from the former Town of Oyster Bay Ice Skating Rinks.

Table 2. Off-site Groundwater

Detected Constituents	Concentration Range Detected [a]	SCG[b]	Number of Samples Exceeding SCG/Total Number of Samples
VOCs			
1,1,1-Trichloroethane	BD - 110	10	10 / 822
1,1,2-Trichloroethane	BD - 5	1	3 / 822
1,1-Dichloroethane	BD - 64	5	74 / 819
1,1-Dichloroethene	BD - 110	5	38 / 822
1,2-Dichloroethane	BD - 27	0.6	42 / 822
1,2-Dichloropropane	BD - 5	1	7 / 822

Chloroform	BD - 45	7	30 / 822
cis-1,2-dichloroethene	BD - 3,400		177 / 779
Dichlorofluoromethane (Freon 22)	BD - 9.6	5	20 / 179
Dichlorodifluoromethane (Freon 12)	BD - 13	5	4 / 647
Tetrachloroethene	BD - 620	5	106 822
Toluene	BD - 21	5	11 / 779
trans-1,2-dichloroethene	BD - 43	5	11 / 779
Trichloroethylene	BD - 9,100	5	363 / 822
Trichlorotrifluoroethane (Freon 113)	BD - 10	5	14 / 806
Vinyl Chloride	BD - 55	2	37 / 822
Metals			
Chromium	BD - 875	50	29 / 57
Iron	BD - 3,440	300	2 / 3
Nickel	BD - 442	100	1 2
Sodium	30,800 - 39,300	20,000	2 / 2

a –All values in parts per billion (ppb), which is equivalent to micrograms per liter,(ug/L), in water.
b- SCG: Standard Criteria or Guidance – Based on Ambient Water Quality Standards and Guidance Values (TOGs 1.1.1), 6 NYCRR Part 703, Surface water and Groundwater Quality Standards, and Part 5 of the New York State Sanitary Code (10 NYCRR Part 5).
BD = below detection

Based on the findings of the RI, the disposal of hazardous waste has resulted in the contamination of on-site and off-site groundwater. The VOCs and to a lesser extent, inorganic site contaminants that are considered to be the primary contaminants of concern that will drive the remediation of on- and off-site groundwater to be addressed by the remedy selection process are: tetrachloroethene, trichlorethene, cis-1, 2 dichloroethene, vinyl chloride, dichlorodiflormethane (R-12), chlorodiflormethane (R-22), as well as the aromatic hydrocarbon VOCs such as toluene, and to a lesser extent xylene, ethyl benzene and benzene and chromium.

Soil

Onsite soils in Fill Material, the Low Permeability Zone, the Rag Pit Disposal and the Grumman Access Road (see figure 2 have been impacted with PCBs, TCE, PCE, DCE, toluene, xylene, and Freon. Some off site soils are also contaminated with PCB's and chromium.

Significant portions of OU-3 on-site soils are contaminated with PCB's. Based on the Feasibility Study figures, the contamination includes approximately: 150 CY of hazardous waste levels of PCBs (> 50 ppm) and 4000 CY of PCB contaminated soil above the SCO between 0 and 2' below ground surface (bgs); 3000 CY of hazardous waste levels of PCBs and 6000 CY of PCB contaminated soil above the SCO between 2' and 10' bgs; 12000 CY of hazardous waste levels of PCBs between 10' and 20' bgs and 6500 CY of hazardous waste levels of PCBs below 20' bgs. As indicated in Table 3 below, levels of PCBs range up to 3,400 ppm. Chromium contamination exists in some of the PCB contaminated soil.

The Rag Pit Disposal Area (see figure 2) is highly impacted with chlorinated and non-chlorinated solvents. Spent paint, coating materials, waste rags and machine oil were buried in this area. Additionally, the low permeability zone that contains silts and clays has also been highly impacted with site-related VOC contamination including TCE, PCE, DCE, toluene and Xylene.

Surface and subsurface soil in the Grumman Access Road, located to the south and west of the Bethpage Community Park have been impacted mainly with PCBs, chromium and, to a less extent, cadmium. A number of rounds of sampling have delineated the extent of this contamination on the access road parcels.

Additionally, soil samples from private properties located to the south of the Grumman Access Road have identified several properties with PCB levels greater than 1 ppm in surface and subsurface soil.
Results also indicated chromium impacts in residential yards at levels greater than 6 NYCRR Part 375 unrestricted use soil clean up criteria.

Table: 3 Soil Sample Results

Detected Constituents	Concentration Range Detected [a]	SCG[b,d] Unrestricted Use	SCG [C] Restricted Residential	Frequency Exceeding SCG/ Total Number of Samples
VOCs				
Cis 1,2-Dichloroethene	BD- 1,300,000	270	100,000	6 / 866
Ethyl benzene	BD- 220,000	1,000	41,000	23 / 866
Toluene	BD- 8,200,000	700	100,000	23 / 866
Trichloroethene	BD- 8, 200,000	470	21,000	11 / 866
Vinyl Chloride	BD- 30,000	20	900	5 / 866
Xylene (Total)	BD- 230,000		100,000	8 / 551
p-Xylene	BD- 110,000	260	100,000	1 / 234
o-Xylene	BD- 140.000	260	100,000	02 / 620
Xylene-m,p	BD- 350,000	260	100,000	5 / 386
SVOCs				
Benzo(a)anthrecene	BD- 30, 000	N/A	1,000	57 / 492
Benzo(a)pyrene	BD- 23,000	N/A	1,000	13 / 492
Benzo(b)fluoranthene	BD- 32,000	N/A	1,000	70 / 492
Benzo(k)fluornthene	BD- 15,000	N/A	3,900	7 / 492
Chrysene	BD- 35,000	N/A	3,900	13 / 492
Dibenzo(a,h)anthracene	BD- 6,200	N/A	330	17 / 492
Indeno(1,2,3-cd)pyrene	BD- 9,500	N/A	500	43 / 492
Pentachlorophenol	BD- 11,500	N/A	6,700	2 / 405
Metals				
Arsenic	BD- 1,000,000	N/A	16,000	12 / 338
Barium	BD- 735,000	N/A	400,000	1 / 338
Cadmium	BD- 2,400,000	N/A	4,300	157 / 642
Chromium	BD- 50,400,000	30,000	110,000	187 / 830
Copper	BD- 1,420,000	N/A	270,000	3 / 69
Pesticides/PCBs				
PCBs (Total)	BD- 3,400,000	N/A	1,000	36 / 1,345

a – All concentrations are in parts per billion (ppb), which can be converted to milligrams per kilogram (mg/kg) in soil by dividing by 1,000;

b - SCG: Part 375-6.8(a), Unrestricted Soil Cleanup Objectives.
c - SCG: Part 375-6.8(b), Restricted Residential Use Soil Cleanup Objectives for the Protection of Public Health, unless otherwise noted.
d - SCG: Part 375-6.8(b), Unrestricted Use Soil Cleanup Objectives for the Protection of Groundwater.

Soil Vapor

The potential for soil vapor intrusion resulting from the presence of site-related soil or groundwater volatile organic compound contamination was evaluated during the RI. Soil vapor sampling was initially conducted to determine the nature and extent of soil vapor contamination onsite, along the Grumman Access Road, Sycamore Avenue and adjacent numbered side streets. The results of these soil vapor samples for field screening (see figure 7) then led to the collection of sub-slab soil vapor, indoor air and outdoor air samples used to evaluate the potential for soil vapor intrusion to impact indoor air. Based on the sampling results, in comparison with the NYSDOH Soil Vapor Intrusion Guidance, no site-related soil vapor contamination of concern was identified in the off-site areas evaluated, and impacts to indoor air are not occurring. Therefore, no further action was necessary for off-site residential properties (see figure 8).

Based on the findings of the RI, the soil gas analytical results indicated trichloroethylene (TCE), dichlorethene and toluene were present in soil gas at elevated levels on the site. Soil vapor contamination on the site identified during the RI was addressed during the IRM described in Section 6.2.

Exhibit B

Description of Remedial Alternatives

The alternatives described in this proposed plan were assembled to address the various media impacted by the site-related contamination identified for OU 3. Each of the five alternatives presented include one option from the remedial technologies evaluated for each media.

The remedial technologies evaluated in the On-site (Site Area) and Off-site (Study Area) Feasibility Studies were assembled by the NYSDEC into five alternatives, based on the results from the On-site and Off-site RIs, information generated during the IRMs, technical review by the NYSDEC and the screening and detailed analysis of remedial technologies described in the FS reports. The Soil and groundwater alternatives will address the eight AOCs which are the PCB Fill Materials, low permeability zone, Rag Pit Disposal Area, Sludge Dewatering/Buried Settling Ponds, Grumman Access Road, properties south of the Grumman Access Road, onsite groundwater and offsite groundwater, as set forth in the table below.

	Soil Remedial Alternatives	No Further Action	Capping	Partial Excavation	Substantial Excavation	Complete Excavation	Thermal Desorption w/ Soil Vapor Extraction
Areas of Concern	**PCB Fill Material**	Alternatives 1& 2	Alternative 4	Alternative 4	Alternative 5	Alternative 3	NA
	Low Permeability Zone	Alternatives 1& 2	NA	NA	NA	NA	Alternative 3,4 &5
	Rag Pit Disposal	Alternatives 1& 2	NA	NA	NA	NA	Alternative 3,4 &5
	Former Grumman Settling Ponds	Alternatives 1& 2	Alternative 4	NA	Alternative 5	Alternative 3	NA
	Grumman Access Road	Alternatives 1& 2	Alternative 4	Alternative 4	Alternative 5	Alternative 3	NA
	Adjacent Properties	Alternatives 1& 2	NA	NA	NA	Alternatives 3,4 &5	NA
	Groundwater Remedial Alternatives	**No Further Action**	**Partial Removal**	**Substantial Removal[1]**	**Substantial Containment[2]**	**Complete Containment**	**Wellhead Treatment Upgrades[3]**
	Onsite (Site Area) Groundwater	Alternatives 1 & 2	NA	N/A	N/A	Alternative 3, 4 & 5	Alternatives 3, 4 & 5
	Offsite (Study Area) Groundwater	Alternatives 1 & 2	Alternative 4	Alternatives 5	Alternative 3	N/A	Alternatives 3, 4 & 5

NA = Not Applicable

[1]Substantial Removal: Highly Impacted Offsite Groundwater Removal and Treatment with a 90 Percent Mass Removal Goal

[2]Subtantial Containment: Goal, to the extent practicable, of preventing offsite migration of100 Percent of Groundwater Contamination

[3]Wellhead Treatment Upgrades Acknowledges the Wellhead Treatment Contingency Plan of Operable Unit 2.

Common Elements

With the exception of Alternatives 1 and 2, the following common elements are included in all of the other alternatives being evaluated:

- evaluate and upgrade, if necessary, the current onsite pump and treat system, to achieve complete containment at the down gradient edge of the site, of all impacted groundwater above groundwater standards;
- maintain the soil vapor extraction IRM on-site and in the Grumman Access Road;
- excavation, based on sampling of PCBs present above 1 ppm and chromium above residential SCOs in the soil of the offsite properties;
- the Wellhead Treatment Contingency Plan put in place as a requirement of the OU 2 ROD will remain in place and will be applicable for any impacts attributable, in whole or in part, to the OU 3 off-site groundwater plume. This includes continued implementation of the wellhead treatment upgrades, as necessary, for Bethpage Water District Plants 4, 5 and 6;
- treatment of the VOCs in the low permeability zone (LPZ) and Rag Pit AOC(s) with in-situ thermal desorption and soil vapor extraction to prevent further impacts to the groundwater;
- an institutional control (IC) in the form of an environmental easement placed on the site to restrict use of the site and groundwater and implement the Site Management Plan (SMP); and
- a Site Management Plan (SMP) for management of the on- and off- site elements of the remedy.

Description of Common Element Technologies

Soil vapor extraction (SVE) is an in-situ technology used to treat volatile organic compounds (VOCs) in the soil. The process physically removes contaminants from the soil by applying a vacuum to a well that has been installed into the vadose zone (the area below the ground but above the water table). The vacuum draws air through the soil which carries the VOCs from the soil to the SVE well. The air extracted from the SVE wells is then treated by activated carbon or other air treatment process, as applicable, to remove the VOCs before the air before discharge to the atmosphere.

In-situ thermal desorption (ISTD) uses various approaches to heat the subsurface soil to remove VOCs. The VOCs are forced into the vapor phase and then removed by the SVE described above.

A pump and treat system involves the installation of groundwater extraction wells to prevent migration and remove contaminated groundwater and the associate, piping, groundwater pumps as well as treatment system for the extracted water and, if necessary, for the air stream. The design of a pump and treatment system must incorporate the geology and aquifer hydrology in order to optimize the pump and treat system as well as identify a point of discharge for the treated water.

Remedial Alternatives for OU3

Alternative 1: No Further Action

The No Further Action Alternative recognizes the remediation of the site completed to date by the IRM(s) described in Section 6.2 of the PRAP. This alternative leaves the site in its present condition, turns off the pump and treat and SVE systems that were installed as IRMs and does not provide any additional protection of

the environment and public health. No additional capital costs are associated with this alternative.

Alternative 2: Site Management

The Site Management Alternative recognizes the remediation of the site completed by the IRM(s) described in Section 6.2 with continued operation of the groundwater pump and treat and SVE system IRMs. Site management, engineering and institutional controls are necessary to continue the effectiveness of the IRM. This alternative maintains engineering controls which were part of the IRMs and includes institutional controls, in the form of an environmental easement and site management plan, as part of the objective to protect public health and the environment from contamination remaining at the site after the IRMs.

Present Worth Total: $10,450,000
Capital Cost: None
Annual Costs Total: $ 650,000

Alternative 3: Restoration to Pre-Disposal Conditions, to the Extent Practicable

Alternative 3 would achieve all of the SCGs discussed in Section 6.1.1 and Exhibit A, with soil meeting the restricted residential use soil cleanup objectives listed in Part 375-6.8 (a). This alternative would include:

- excavation of all contaminated soils above unrestricted use SCOs at Former Grumman Settling Ponds and adjacent areas (OU3 onsite), on the Grumman Access Road , and on the properties south of the Grumman Access Road ;
- maximization of off-site groundwater pump and treat system, to the extent practicable, to all areas of the OU3 plume above groundwater standards; and,
- the Common Elements.

This remedy will have an annual cost to continue to operate the groundwater remedial systems. The time to implement this remedy would be approximately 24 months.

Present Worth: $194,000,000
Capital Cost: $189,500,000
Annual Costs: $ 3,500,000

Alternative 4: Capping OU3 and Grumman Access Road Soils, Offsite Elevated Groundwater Collection and treatment.

This alternative includes:

- a soil cap of all contaminated fill soils for OU3 onsite;
- elevated groundwater contamination removal;
- a cap on soils in the Grumman Access Road above unrestricted residential use ; and
- the Common Elements.

The time to implement this remedy would be about 18 months.

Present Worth: $ 58,000,000
Capital Cost: $ 40,250,000
Annual Costs: $ 1,100,000

Alternative 5: Excavation and, as necessary, off-site Disposal of OU3 Onsite soils, Removal of hazardous waste levels of PCB impacted soils, Excavation of Grumman Access Road Soils, and Offsite Elevated Mass Removal Groundwater Collection and treatment.

This alternative would include:

- excavation of all contaminated fill and soils in the OU3 Onsite AOCs above restricted residential use and/or CP-51 to a depth of 10 feet, removal of all soil with PCBs concentrations of 50 ppm or greater (see figure 9);
- removal of PCB impacted soil from the Grumman Access Road to achieve PCB levels of 1 ppm in the upper two feet and 10 ppm at depth (see figure 9);
- maximize, , to the extent practicable, the removal of contaminated groundwater in off-site hotspot (see figure 10) with a groundwater pump and treatment system, in the hotspot area above groundwater standards with a goal of 90 percent mass removal as recommended by the Technical Team for the Optimization of the Bethpage Plume Remedy in their June 15, 2011 report entitled "Remedy Optimization Team Report for the Bethpage Groundwater Plume remedy;
- remove soils with PCBs greater than 1ppm and chromium in excess of the residential soil cleanup objectives on residential properties south of the Grumman Access Road;
- consideration will be given to utilizing the Bethpage Water District Plant 4 treatment system as part of the offsite groundwater remedy ; preference will also be given for green use disposition of the treated water such as golf course irrigation at the Bethpage State Park; and
- Common Elements.

The time to implement this remedy would be about 24 months.

Present Worth: $81,000,000
Capital Cost: $61,500,000
Annual Costs: $ 1,250,000

Exhibit C

Remedial Alternative Costs

Remedial Alternative	Capital Cost ($)	Annual Costs ($)	Total Present Worth ($)
Alternative 1	$0	$0	$0
Alternative 2	$0	$ 650,000	$10,450,000
Alternative 3	$189,000,000	$3,500,000	$194,000,000
Alternative 4	$40,250,000	$1,100,000	$58,000,000
Alternative 5	$61,500,000	$1,250,000	$81,000,000

Exhibit D

SUMMARY OF THE PROPOSED REMEDY

Basis for Selection: The proposed remedy, Alternative 5, is based on the results of the RI and the evaluation of alternatives. Alternative 5 is being proposed because, as described below, it satisfies the threshold criteria and provides the best overall response to achieving the primary balancing criterion described in Section 7. Implementation of this remedy would achieve the remediation goals for the site by:

- Restoring soils of OU3 to restricted residential use to a minimum of 10 feet;
- Removal of the PCBs above 50 ppm within all AOCs;
- Chromium sludge source areas are co-located with the PCB impacted soils and will be removed with the PCB removal;
- Implementation of appropriate institutional controls in the form of an environmental easement;
- Treatment of soils above the Low Permeability Zone (LPZ) and former rag pit source area(s);
- The elimination of the off-site migration of contaminated groundwater;
- Treatment of the offsite groundwater hot spot
- Removal of soils with PCBs greater than 1ppm and chromium in excess of residential soil cleanup objectives on residential properties.

Provision of Alternative 5 with respect to the Wellhead Treatment Contingency Plan (see common elements) would prevent exposure to public health and the environment to site-related contamination, mitigate potential impacts to the public water supply and remove elevated concentration of groundwater contamination off-site.

Protection of Public Health and the Environment: Alternative 1, the "No Further Action" Alternative, is not protective of public health or the environment since it would discontinue the existing controls on groundwater and soil vapor migration thus deceasing, rather than achieving, protection of public health and the environment. Accordingly, Alternative 1 has been dropped from further consideration as it makes the current situation worse. Alternative 2 would not address the plume of contaminated groundwater down gradient of the park and the AOCs which are the source of the groundwater contamination. This alternative would also leave PCB contaminated soil potentially accessible to the public and the environment in soil both on and off the OU3 area. Alternative 3 would offer the greatest protection of public health and the environment based on restoration of the site to predisposal conditions. Alternatives 4 and 5 are protective of public health and the environment since they prevent exposure by a combination of providing clean soil cover, removing contaminated soil and addressing impacts to the groundwater. Alternative 5 has the best balance of protection of public health with substantial site restoration and off-site remediation consistent with the OU2 remedy. Alternative 4 is somewhat less protective than Alternative 5 since it leaves more contaminants in place and thus relies more on institutional and engineering controls. Alternative 2 offers the least protection of public health and the environment with no site restoration, only continued operation of the onsite IRMs.

Compliance with New York State Standards, Criteria, and Guidance (SCGs): The SCGs that will be used to evaluate the alternatives are those related to soil, groundwater and soil vapor intrusion. Alternative 2 includes the continued operation of the previously installed SVE and on-site groundwater extraction and treatment systems, but calls for no additional actions to address hazardous waste impacts to the soil and groundwater on or off the site. Alternative 3, by completely removing soil contaminated above the unrestricted soil cleanup objectives," meets the threshold criteria compliance with SCGs. Alternatives 4 and 5 also comply with these criteria, but to a lesser degree as all three would require permanent restrictions. Alternatives 3, 4 and 5 will not

reduce groundwater contamination to groundwater standards immediately but by addressing the sources of the contamination will allow eventual compliance. Since Alternative 2 will do nothing further for offsite groundwater to achieve compliance with SCGs it will not be carried forward. Since Alternatives 3, 4, and 5 satisfy the threshold criteria, the remaining criteria are particularly important in selecting a final remedy for the site.

Short-term Impacts and Effectiveness: Alternatives 3 through 5 all would have short-term impacts which could be readily controlled with available technology(s) or engineering controls. However, Alternative 4 would have the least short-term impact(s) as it involves the least amount of excavation and no off-site groundwater remediation system construction that would involve short term impacts to local residents. Alternative 3 would have the most potential for short term impacts due to the much larger volumes of material to be excavated, resulting in additional time during which needed engineering controls or control technologies will be required, as well as the significant increase in truck traffic to and from the site. Installation of an offsite maximized groundwater extraction and treatment system in a densely populated area would have significant short term impacts. There are increased short-term impacts due to the degree of difficulty of constructing larger offsite groundwater pump and treatment system. This includes a larger number of groundwater extraction wells, pipelines, treatment system(s) and points of discharge.

There are potential risks to the community, workers, and environment that would result from carrying out of the excavation options and soil removal in Alternatives 3, 4 and 5. These risks would be controlled with the appropriate health and safety measures and proper engineering controls. Regarding the short term impacts for soils remediation, Alternative 3 has the highest potential short term impacts and would take the longest to implement followed by Alternatives 5 and 4.

Long-term Effectiveness and Permanence: Long-term effectiveness and permanence is best accomplished by those alternatives involving excavation of the contaminated soils, and restoration of the aquifer, to the extent feasible. The time needed to achieve the remediation goals is the shortest for Alternative 4 and longest for Alternative 3. Alternatives 4 and 5 take less time than Alternative 3 to achieve the remediation goals. Alternatives 3, 4 and 5 rely upon onsite treatment and hydraulic containment of onsite contaminated groundwater with removal of the solvent source areas via in-situ thermal desorption in order to restore groundwater down gradient to groundwater standards. Therefore, for onsite groundwater, Alternatives 3, 4 and 5 all offer the same degree of permanence.

For offsite groundwater, Alternative 3 offers the closest to complete groundwater remediation. However, it is not possible to contain completely the OU 3 plume that lies mostly within the OU2 plume. Alternative 3 is followed by alternatives 4 and 5 for permanence for offsite groundwater.

Reduction of Toxicity, Mobility or Volume: Alternative 3, which includes complete excavation and off-site disposal, would reduce the toxicity, mobility and volume of on-site contaminated soil to the greatest degree, followed closely by Alternative 5 with a removal of between 65,000 to 70,000 cubic yards of contaminated soil, with a significantly lesser degree by Alternative 4 where only about 3,000 cubic yards of contaminated soil would be removed. Alternative 4 relies on a cover for the majority of the contamination on-site, thus not significantly reducing the toxicity or volume of contamination, but controlling the mobility at the surface. Only Alternative 3 permanently and completely eliminates the toxicity of all contaminated site soils. Alternative 5 removes less volume than Alternative 3 but more than Alternative 4. Alternative 3 and 5 remove all hazardous waste in the form of PCBs from the site.

Alternatives 3, 4 and 5 all address the on-site VOC source area(s) and thus reduce the toxicity, mobility of contaminants to the on-site and off-site groundwater. Alternative 3 would best address reduction of toxicity, mobility and volume compared to Alternative 5 and then Alternative 4. Alternative 5 would eliminate the most significant amount of offsite groundwater contamination.

Implementability: For the site soils, Alternative 4 is the most implementable based on the least amount of remedial construction, followed by Alternative 5. Alternative 3 would be least implementable as this alternative requires substantially more remedial construction. Alternative 3 also requires the most time to implement.

The groundwater remedies offer similar degrees of implementability for the onsite groundwater and differing degrees of implement ability for the offsite groundwater. The on-site portion of the groundwater remedy is mostly in place for Alternatives 3, 4 and 5. Alternatives 3, 4 and 5 all pose a similar degree of implementibility since the LPZ component is the same. Regarding the off-site groundwater component, Alternative 4 and 5 are most implementable, followed by Alternative 3 that include additional recovery wells and other ancillary equipment. Alternative 3 would attempt to completely remediate the OU3 groundwater plume. Since most of the OU3 plume is enveloped in the greater OU2 groundwater plume, this may not be feasible to measure.

There is a greater degree of difficulty of implementation for the offsite groundwater remedial program the larger the given pump and treatment system is. This includes the number of groundwater extraction wells, pipelines, treatment system(S) and points of discharge. All this would be occurring within highly developed residential areas.

For the onsite soil portion, increased amount of contaminated soil that would need to be removed under Alternative 3 complicates and decreases the implementability relative to the other Alternatives because of the increased number of trucks, the difficulties associated with excavating the majority of the site (significant sheetpiling) and lack of space to stage excavated soil prior to disposal. .

Cost-Effectiveness: The costs of the alternatives vary significantly. Alternative 3 is the most costly because it completely removes all the impacted soils onsite and strives to address all of groundwater plume offsite. Given the volume of soil to be handled, consolidation and capping (Alternative 4) would be much less expensive than Alternative 3. The present worth costs of Alternatives 4 and 5 are closer to each other, although the capital cost for Alternative 5 would be higher than that of Alternative 4. The long-term maintenance cost of the capped area with Alternative 4 would be higher than the long-term maintenance under Alternative 5. Alternative 5 is the most cost effective approach as Alternative 5 restores all the OU3 and adjacent areas to allow for most future construction , prevents any further offsite migration of contaminated groundwater, addresses the offsite groundwater hot spot and prevents exposure to public health at the public water supplies within a reasonably cost effective framework.

Land Use: It is anticipated that OU3 will continue to serve as part of the Bethpage Community Park. Alternatives 3,4 &5 would allow for the land use as a Park but Alternative 4 would have greater restrictions on any intrusive activities. Alternative 5 would have significantly less restrictions (excavation beneath 10 feet). Only Alternative 3 would result in no restrictions on intrusive activities. All alternatives would restrict use of onsite groundwater.

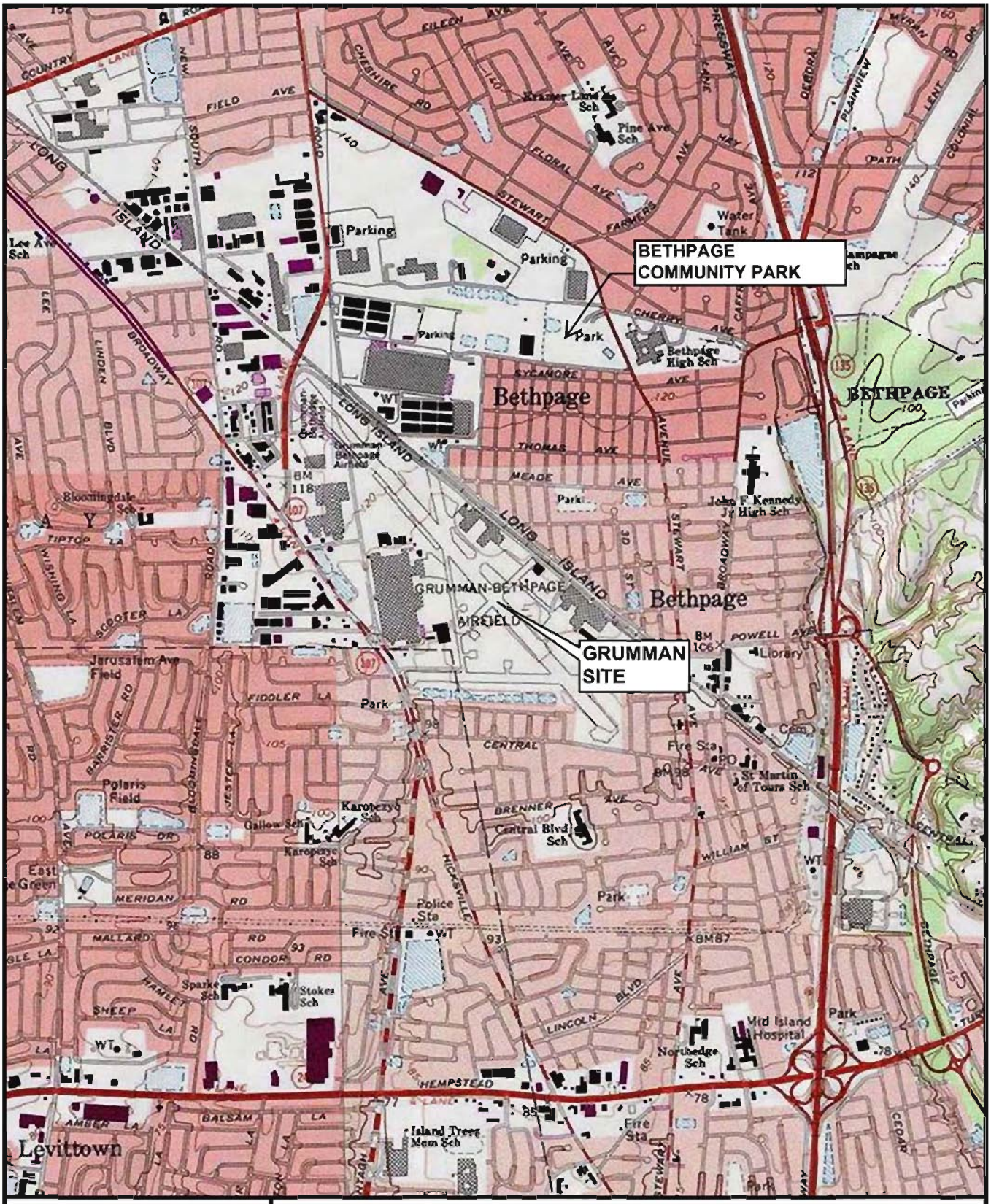


Figure 1

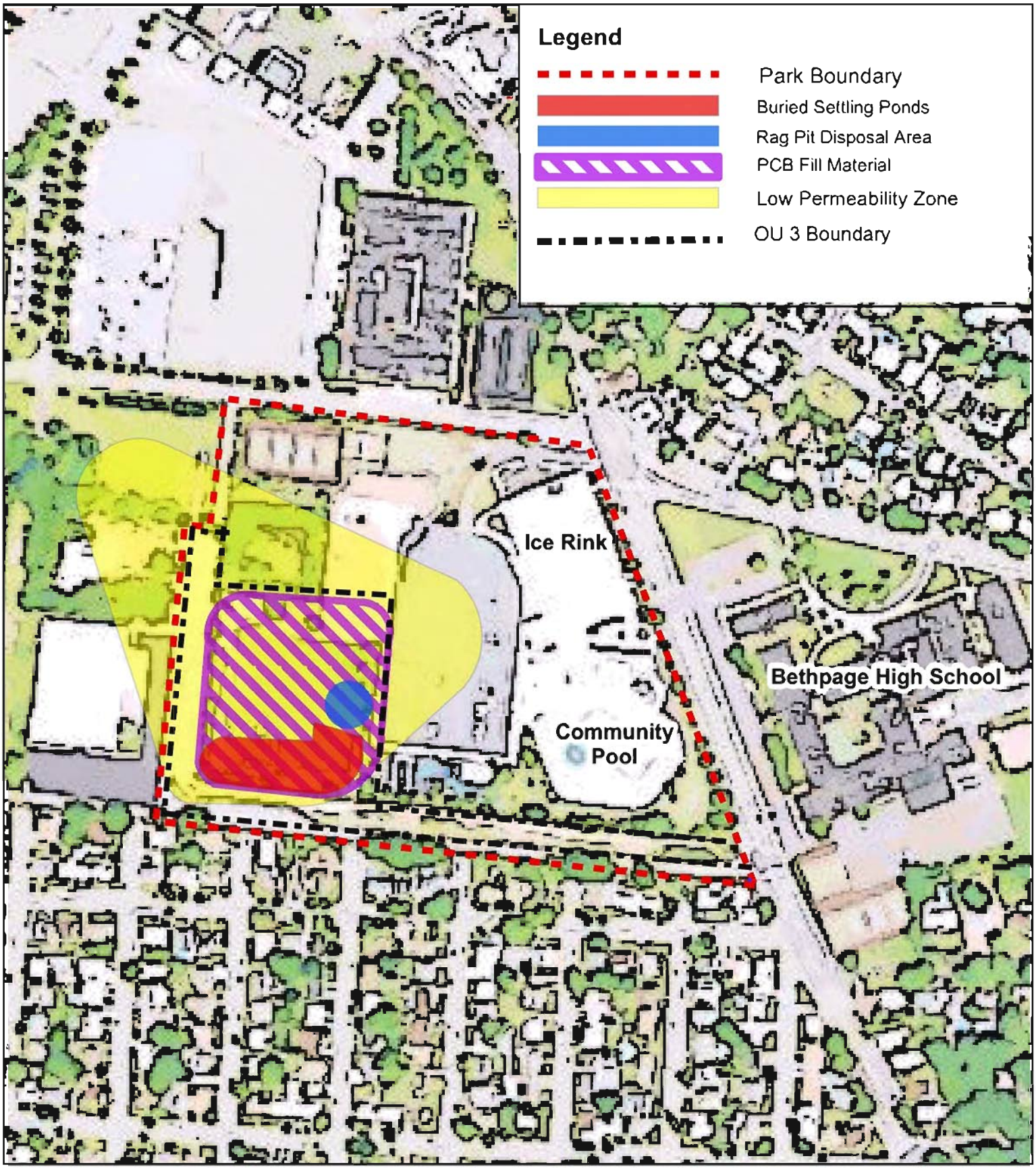
Site Location Map

Grumman

Town of Oyster Bay, Nassau County

Site No. 130003A-OU3

DEPARTMENT OF ENVIRONMENTAL CONSERVATION • NEW YORK STATE •



WASTE DISPOSAL AND SOURCE AREAS
New York State Department of Environmental Conservation
Grumman Aerospace-Bethpage Facility
Bethpage, Nassau County, New York

Figure 2

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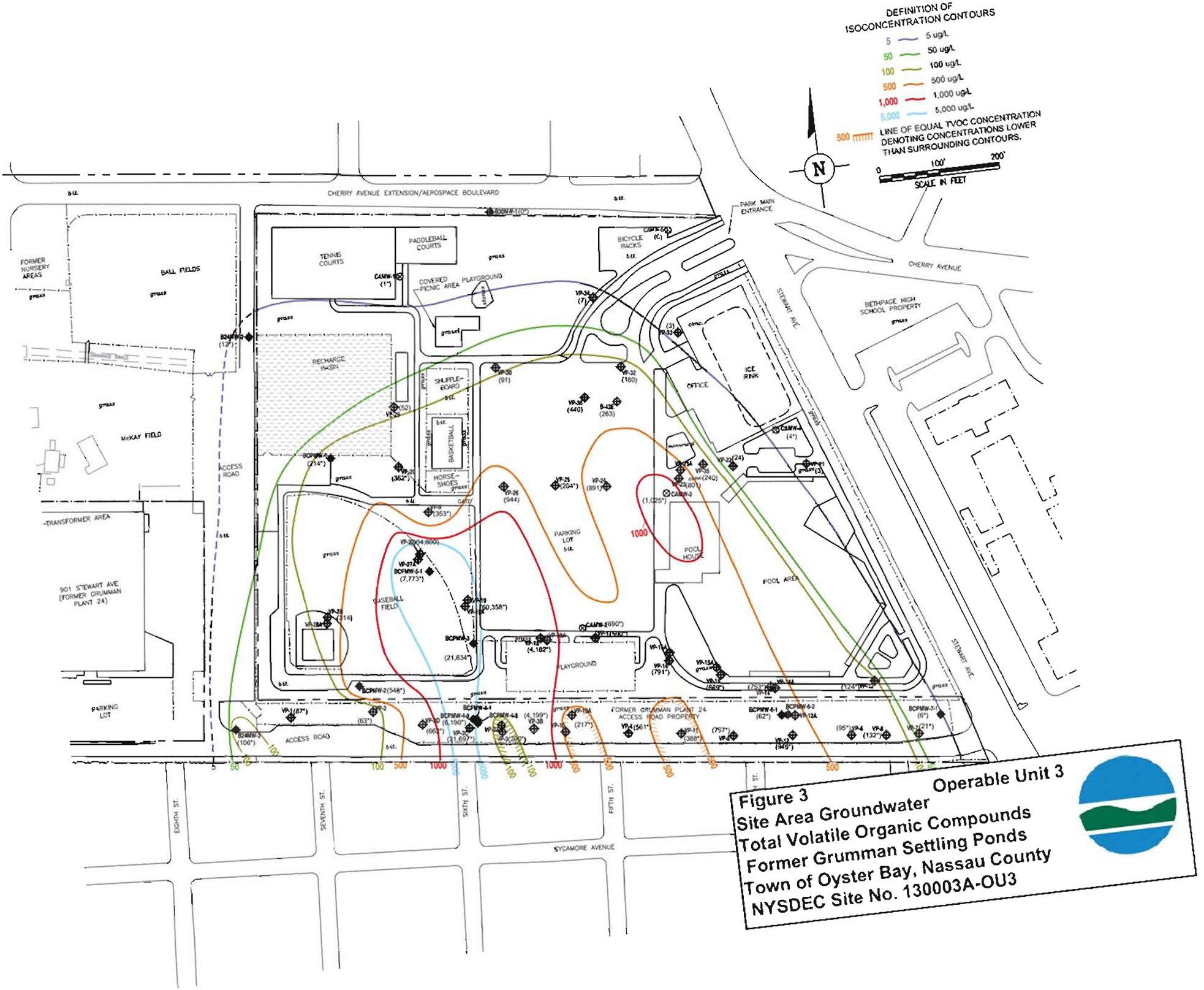
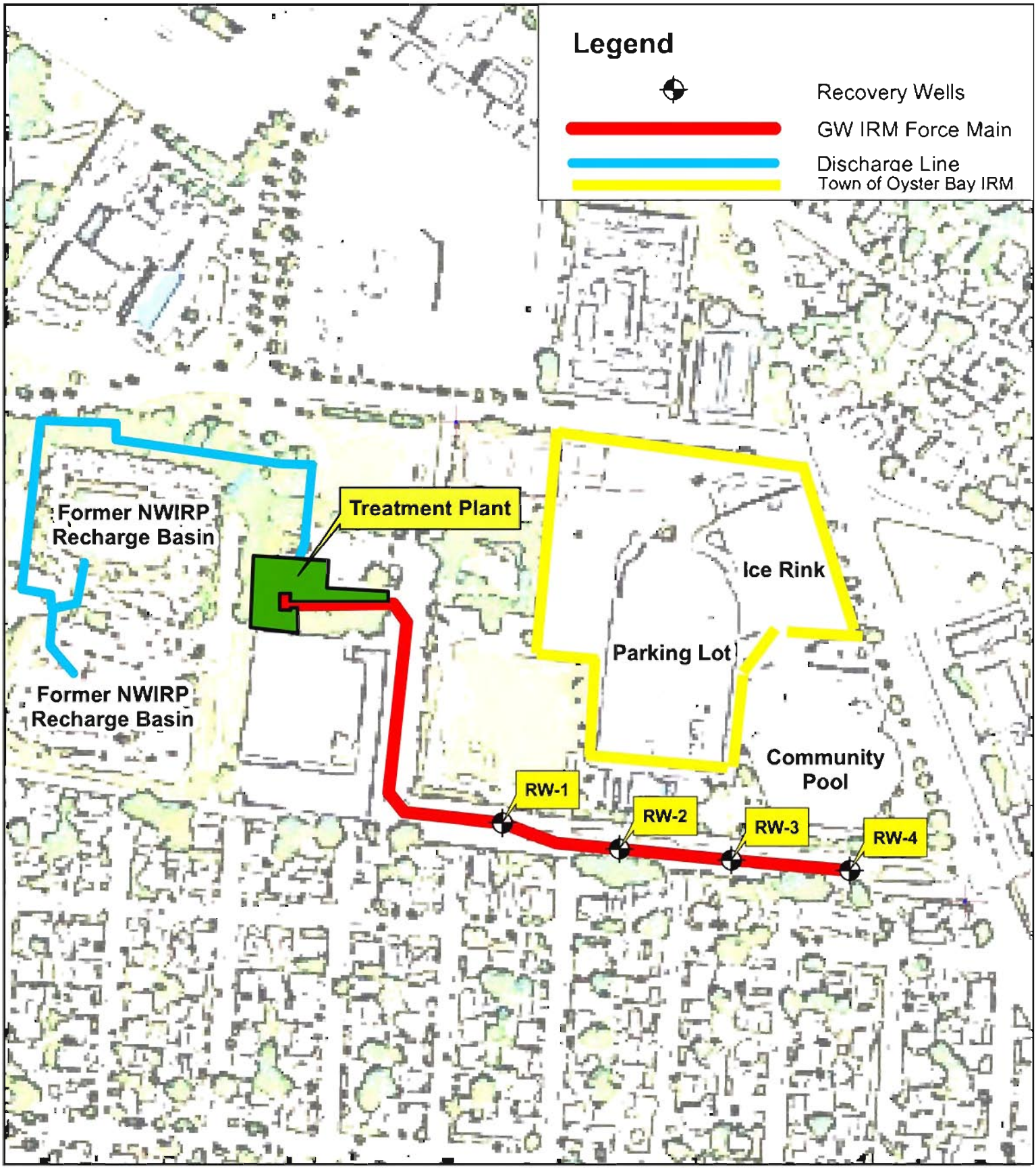


Figure 3 Operable Unit 3
Site Area Groundwater
Total Volatile Organic Compounds
Former Grumman Settling Ponds
Town of Oyster Bay, Nassau County
NYSDEC Site No. 130003A-OU3



GROUNDWATER INTERIM REMEDIAL MEASURE
New York State Department of Environmental Conservation
Grumman Aerospace-Bethpage Facility
Bethpage, Nassau County, New York

N

Figure 4

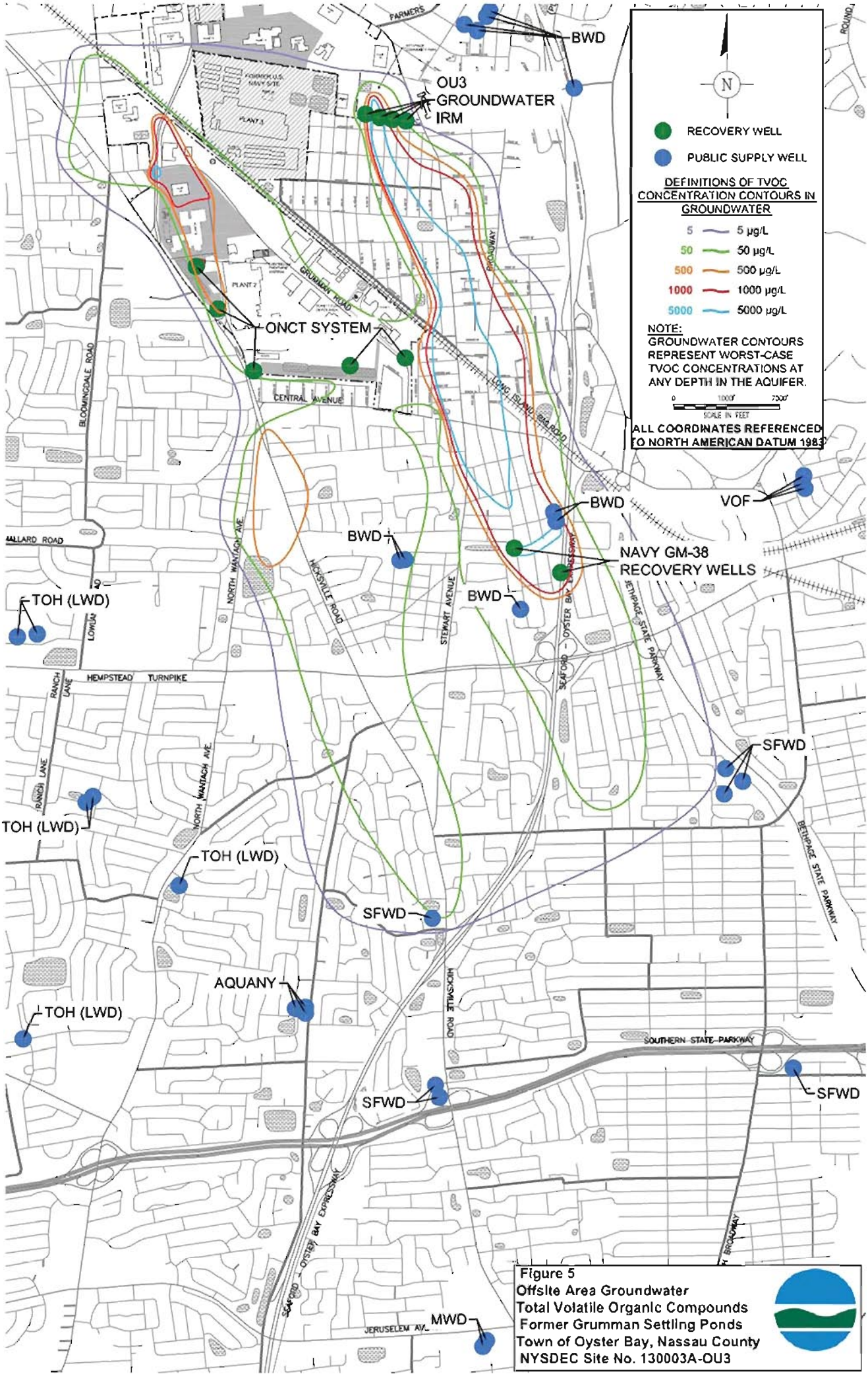
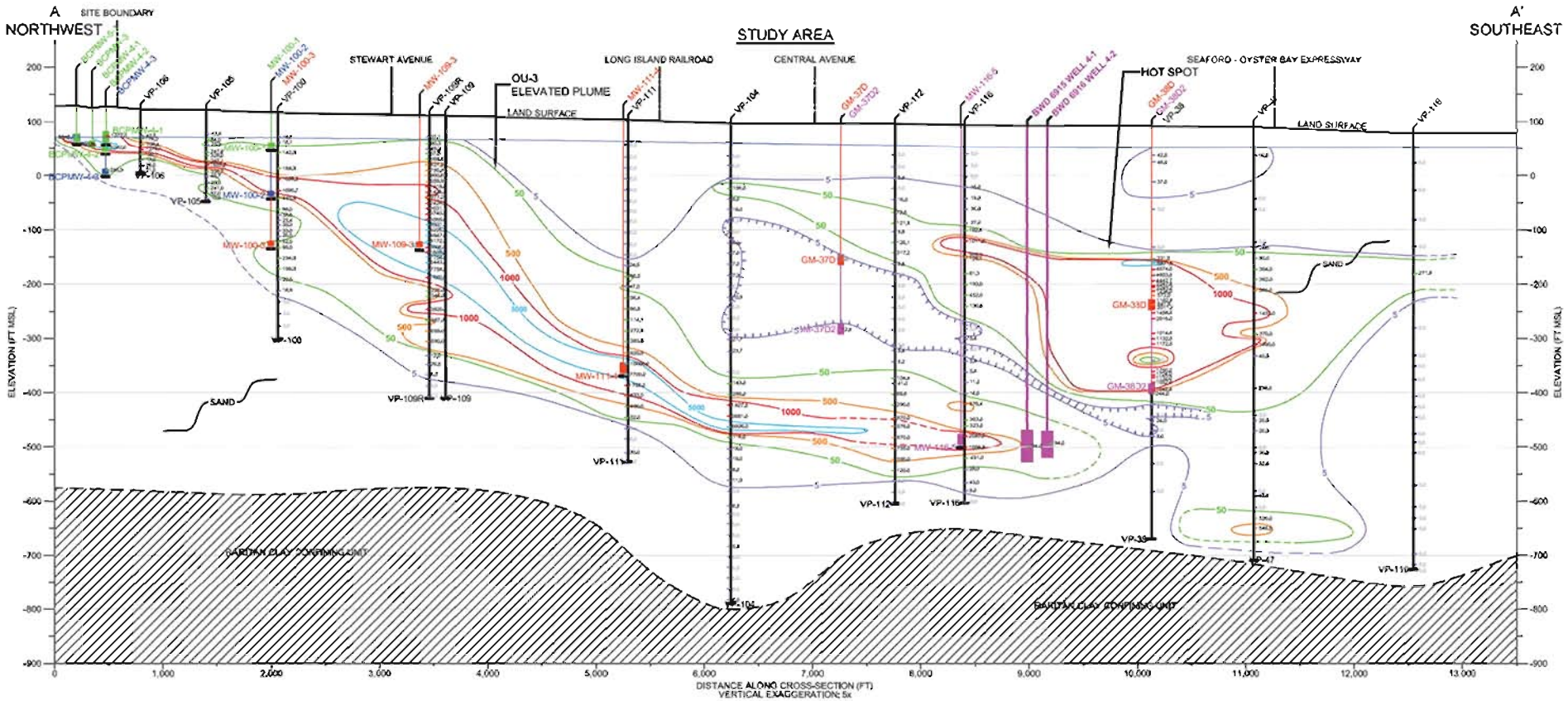
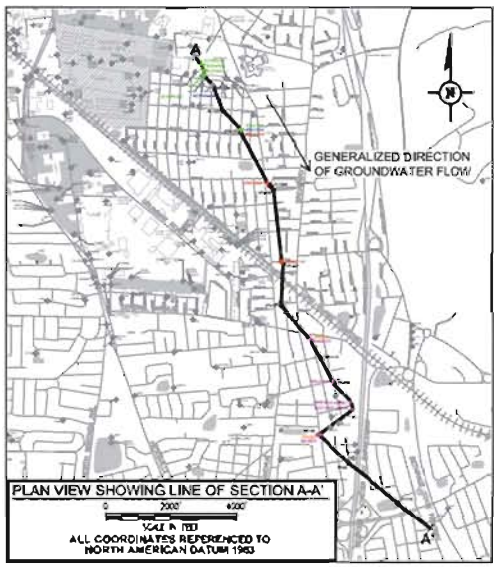


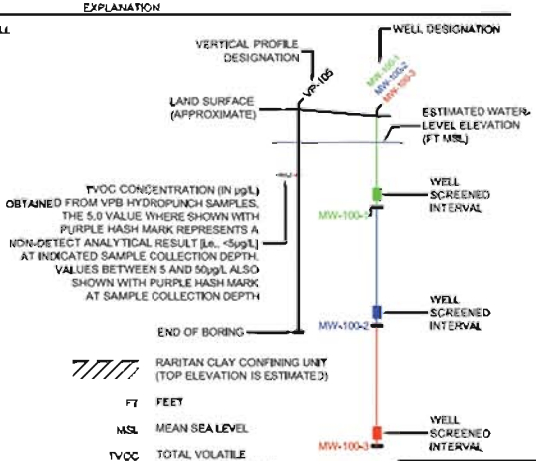
Figure 5
Offsite Area Groundwater
Total Volatile Organic Compounds
Former Grumman Settling Ponds
Town of Oyster Bay, Nassau County
NYSDEC Site No. 130003A-OU3





EXPLANATION

- OBSERVATION, MONITORING WELL
- PUBLIC SUPPLY WELL
- OU2 VERTICAL PROFILE BORING
- OU3 VERTICAL PROFILE BORING
- A — A' LINE OF SECTION



NOTES:

1. HYDROGEOLOGIC ZONE BASED ON MODEL LAYER ELEVATIONS PRESENTED IN COMPREHENSIVE GROUNDWATER MODEL (ARCADIS 2003).
2. VERTICAL PROFILE BORING LOCATIONS ARE BASED ON FIELD MEASUREMENTS.
3. MONITORING WELLS SURVEYED TO NAD 1983.
4. LAND SURFACE ESTIMATED FROM USGS QUADRANGLES (AMITYVILLE, HUNTINGTON, FREEPORT, AND HICKSVILLE).
5. THE GEOLOGICAL TERM "SAND" REFERENCED ABOVE IS DEFINED IN DETAIL IN THE STUDY AREA REMEDIAL INVESTIGATION REPORT. LOCALIZED LENSES OF LOWER PERMEABILITY NOT SHOWN. REFER TO STUDY AREA REMEDIAL INVESTIGATION REPORT FOR THIS INFORMATION (ARCADIS 2009).
6. CONTOURS DEPICTED WITH HASH MARKS DENOTE LINES OF EQUAL TVOC CONCENTRATION (5 ug/L) WHERE VALUES WITHIN THE BOUNDARY AREA ARE LESS THAN THE VALUES SHOWN ON THE ISOPLETH.

DESIGNATION OF HYDROGEOLOGIC ZONE FOR MONITORING WELL SCREENED INTERVALS (ARCADIS 2003)

- SHALLOW
- INTERMEDIATE
- DEEP
- DEEP2

TVOC CONTOURS

- 5 µg/L
- 50 µg/L
- 500 µg/L
- 1000 µg/L
- 5000 µg/L

Figure 6
Offsite Area Groundwater Cross-Section
Total Volatile Organic Compounds
NYSDEC Site No. 130003A-OU3

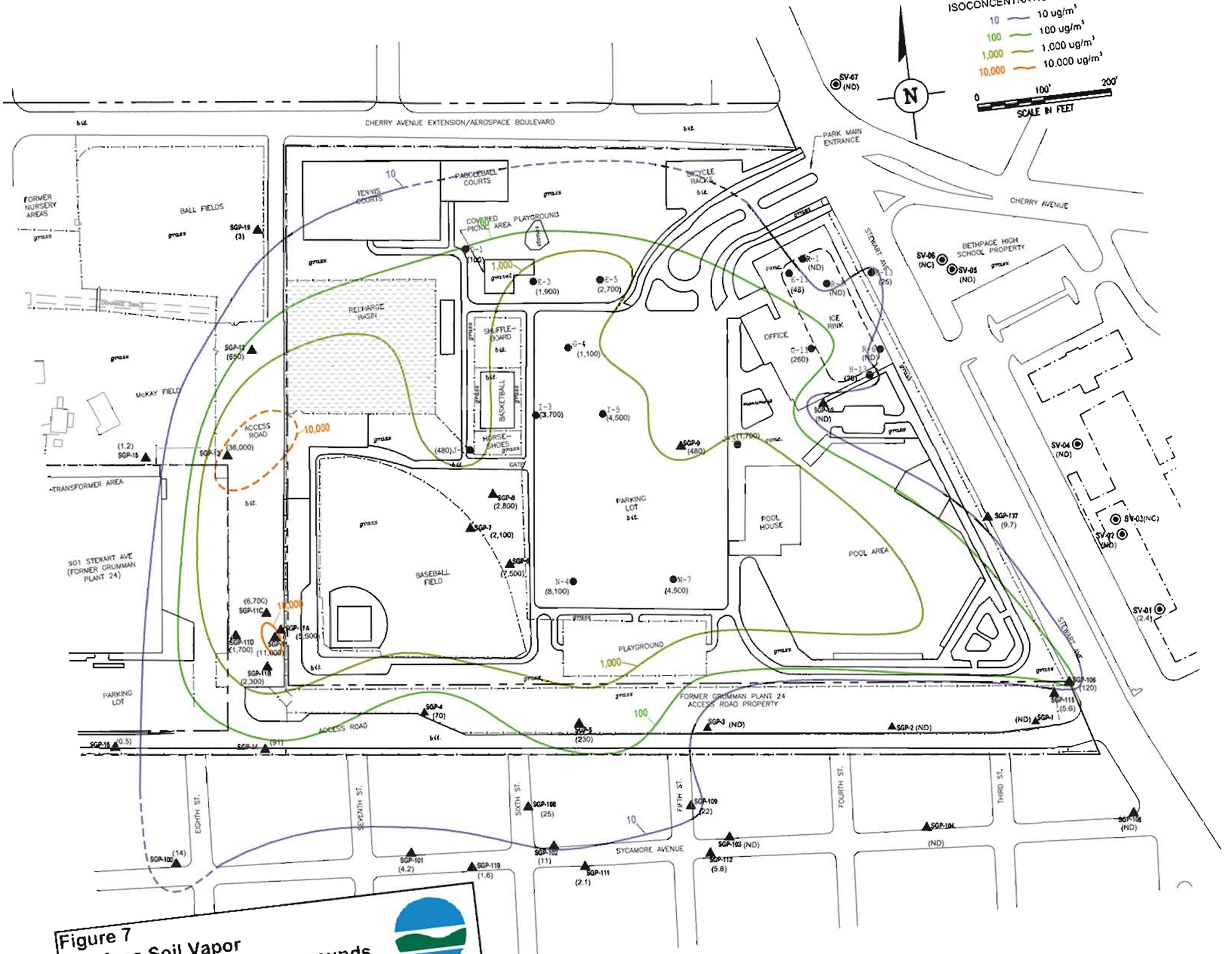
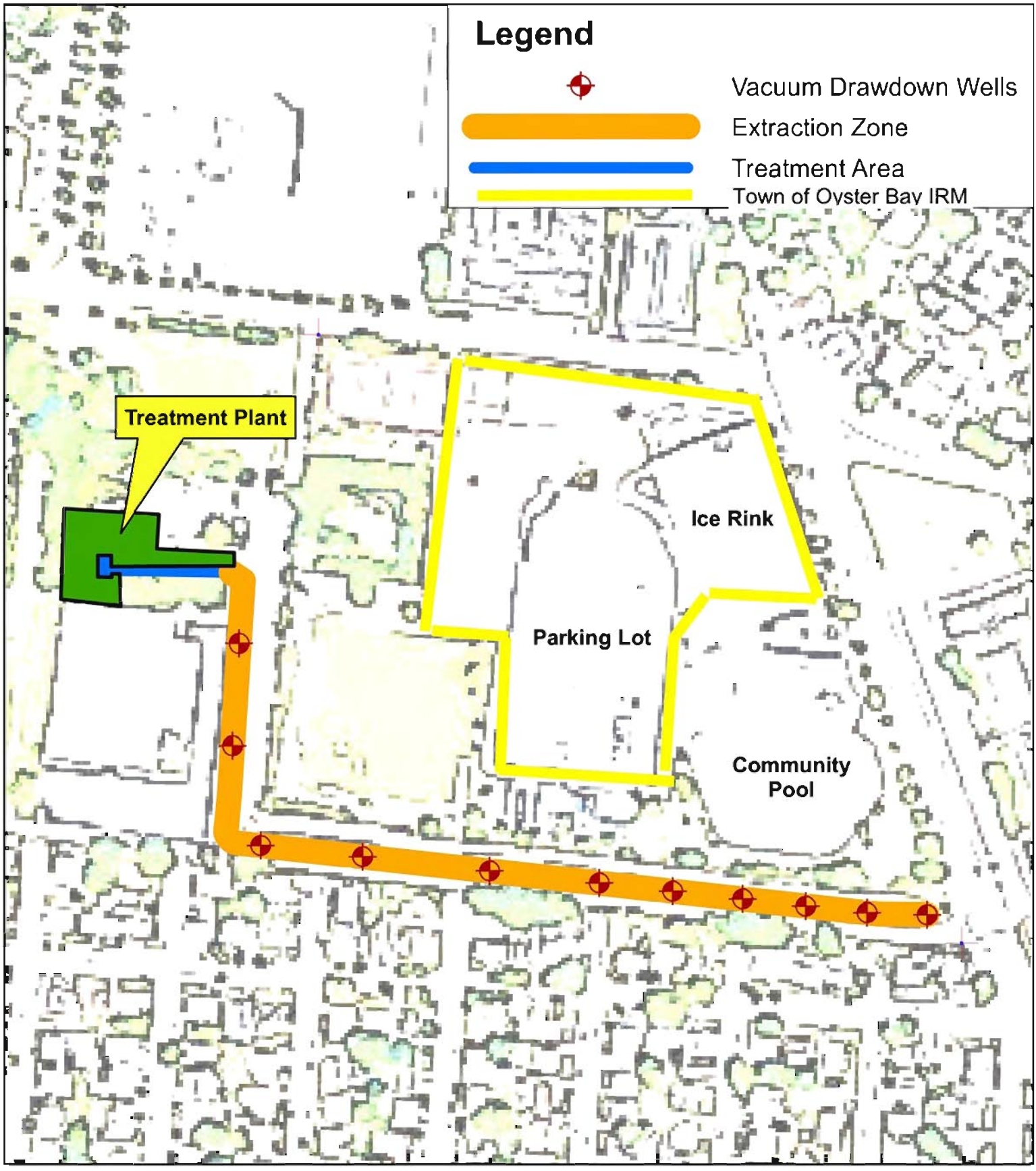


Figure 7
Site Area Soil Vapor
Total Volatile Organic Compounds
NYSDEC Site No. 130003A-OU3



SOIL GAS INTERIM REMEDIAL MEASURE
New York State Department of Environmental Conservation
Grumman Aerospace-Bethpage Facility
Bethpage, Nassau County, New York

Figure 8

ESTIMATED EXCAVATION AND THERMAL DESORPTION AREAS
New York State Department of Environmental Conservation
Grumman Aerospace-Bethpage Facility
Bethpage, Nassau County, New York

FIGURE 9

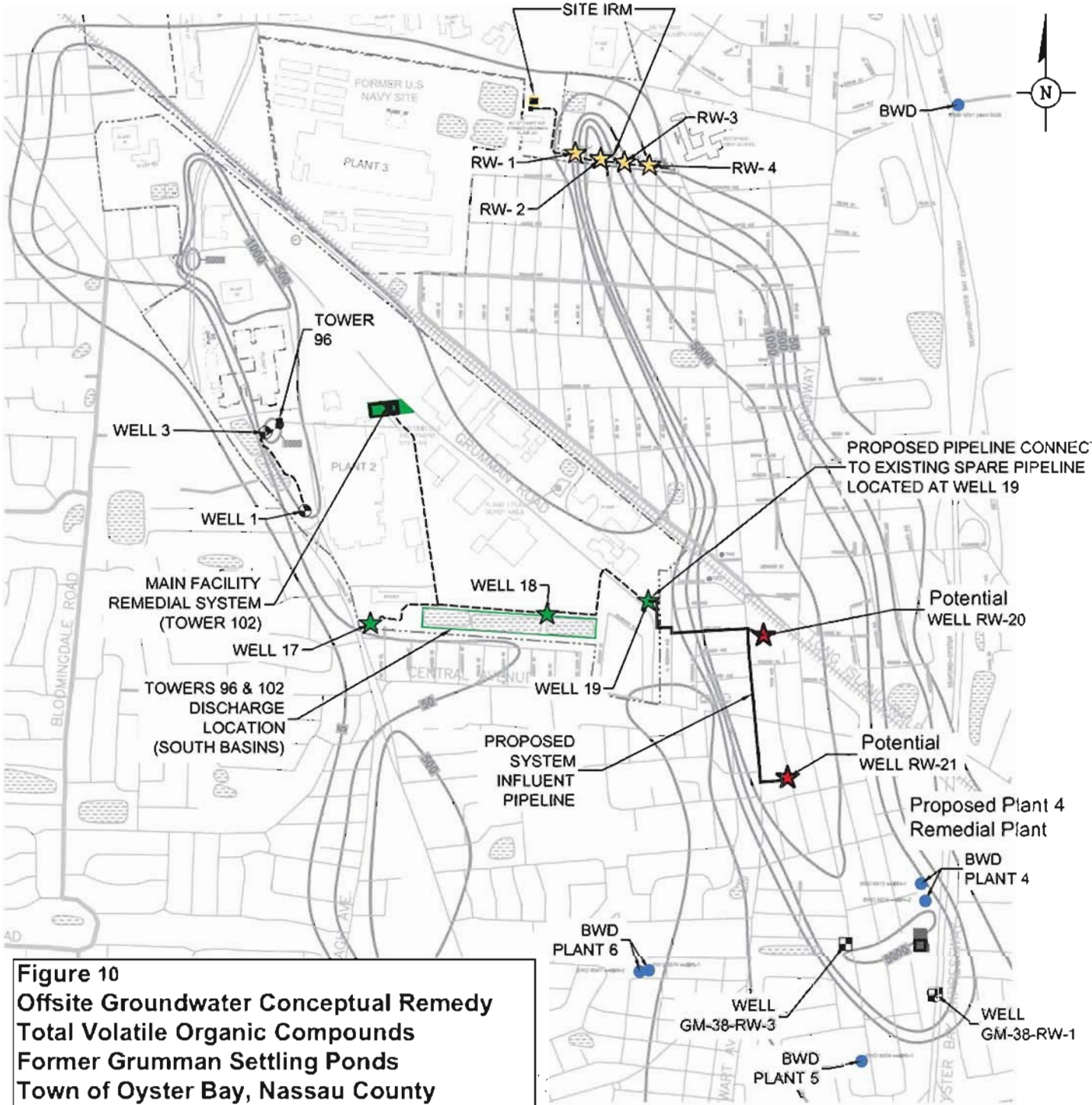


Figure 10
Offsite Groundwater Conceptual Remedy
Total Volatile Organic Compounds
Former Grumman Settling Ponds
Town of Oyster Bay, Nassau County
NYSDEC Site No. 130003A-OU3

LEGEND:

- PROPERTY BOUNDARY OF THE FORMER GRUMMAN AEROSPACE CORPORATION SITE
- PROPERTY BOUNDARY OF THE FORMER U.S. NAVY SITE
- PROPERTY BOUNDARY OF THE FORMER OCC SITE
- LONG ISLAND RAILROAD
- RECHARGE BASIN
- TVOC ISO-CONCENTRATION CONTOUR IN MICROGRAMS PER LITER (µg/L)
- PUBLIC SUPPLY WELL
- EXISTING MAIN FACILITY REMEDIAL WELL (TOWER 96)
- STUDY AREA PUBLIC SUPPLY WELL
- EXISTING THIRD PARTY REMEDIAL WELL (GM-38 AREA)
- EXISTING THIRD PARTY REMEDIAL TREATMENT SYSTEM (GM-38 AREA)
- EXISTING MAIN FACILITY REMEDIAL WELL (TOWER 102)
- EXISTING MAIN FACILITY REMEDIAL TREATMENT SYSTEM (TOWER 102)
- EXISTING SITE IRM REMEDIAL WELL
- EXISTING SITE IRM GROUNDWATER TREATMENT SYSTEM
- EXISTING SYSTEM INFLUENT PIPELINE
- PROPOSED REMEDIAL WELL
- PROPOSED SYSTEM INFLUENT PIPELINE

BWD	BETHPAGE WATER DISTRICT
TVOC	TOTAL VOLATILE ORGANIC COMPOUND
GPM	GALLONS PER MINUTE
IRM	INTERIM REMEDIAL MEASURE

NOTES:

1. ALTERNATIVE 2 PLUS TWO (2) NEW REMEDIAL WELLS; WELL RW-20 AND WELL RW-21 EACH PUMPING AT 500 GPM, TO REDUCE VOC MASS IN STUDY AREA GROUNDWATER. EXTRACTED GROUNDWATER FROM NEW WELLS WILL BE TREATED AT THE EXISTING MAIN FACILITY REMEDIAL TREATMENT SYSTEM.
2. GROUNDWATER CONTOURS REPRESENT WORST-CASE TVOC CONCENTRATIONS AT ANY DEPTH IN THE AQUIFER.

0 600' 1200'
SCALE IN FEET

ALL COORDINATES REFERENCED TO NORTH AMERICAN DATUM 1983