# Hydraulic Effectiveness Evaluation Work Plan for the Operable Unit 2 On-Site Containment System

Northrop Grumman and NWIRP Sites, Bethpage, New York
NYSDEC Sites 1-30-003A & B

PREPARED FOR

Northrop Grumman Corporation
Bethpage, New York

ARCADIS
*Infrastructure, buildings, environment, communications*

ARCADIS

David E. Stern
Project Hydrogeologist

Carlo San Giovanni
Project Manager

Michael F. Wolfert
Project Director

# Hydraulic Effectiveness Evaluation Work Plan for the Operable Unit 2 On-Site Containment System

Northrop Grumman and NWIRP Sites, Bethpage, New York
NYSDEC Sites 1-30-003A & B

Prepared for:
Northrop Grumman Corporation

Prepared by:
ARCADIS G&M, Inc.
88 Duryea Road
Melville
New York 11747
Tel 631 249 7600
Fax 631 249 7610

Our Ref.:
NY001348.0001.00001

Date:
28 June 2002

# Table of Contents

## 1. Introduction

This work plan was prepared by ARCADIS on behalf of the Northrop Grumman Corporation to comply with the requirements of the March 2001 Record of Decision (ROD) for Operable Unit 2 (OU2) (NYSDEC 2001) and the anticipated requirements, under Exhibit K, of the OU2 Remedial Design/Remedial Action (RD/RA) Consent Order, which is currently being prepared by the New York State Department of Environmental Conservation (NYSDEC) in cooperation with the NYS Department of Health (NYSDOH), for the Northrop Grumman Corporation (NGC) and Naval Weapons Industrial Reserve Plant (NWIRP) Bethpage, New York sites. This work plan describes the proposed scope of work and methodologies to be used to conduct a hydraulic effectiveness evaluation of the OU2 on-site containment system currently in operation at the NGC site.

The key objectives of the OU2 on-site containment system hydraulic effectiveness evaluation are as follows:

- Evaluate whether the goals described in the OU2 ROD for the on-site containment system are being achieved by implementing a phased investigation/evaluation to determine whether the on-site containment system creates and maintains an effective hydraulic barrier that prevents the off-site migration of groundwater impacted by volatile organic compounds (VOCs).
- Re-evaluate the delineation of the on-site VOC plume, and supplement the data currently available to determine the horizontal and vertical extent of VOCs relative to the screen zones of the OU2 remedial wells, particularly Remedial Well ONCT-1, which exhibits the highest VOC concentrations of the OU2 remedial wells.

The Navy work plan addendum (Appendix A) provides additional details of the work elements associated with the field program. Changes to this work plan will be reflected accordingly in the Navy work plan addendum. The field investigation and subsequent data evaluation and reporting described in this work plan will be conducted separately from the ongoing OU2 quarterly groundwater monitoring, which includes the collection of hydraulic and groundwater quality data from monitoring wells and the OU2 on-site containment system. A description of the proposed scope of work and the associated rationale is provided below.

## 2. Scope of Work

The site plan is shown on Figure 1. The OU2 on-site containment system described in the ROD consists of the following:

- Remedial Well GP-1 and the associated groundwater treatment system (i.e., the GP-1 system).

- Remedial Wells ONCT-1, ONCT-2, and ONCT-3 and the associated groundwater treatment system (i.e., the ONCT system).
- The Plant 5 Recharge Basins and the South Recharge Basins.

In general, the proposed scope of the field investigation consists of drilling vertical profile borings (VPBs); drilling, installing, and developing permanent monitoring wells; collecting depth-to-groundwater (hydraulic) measurements; and collecting groundwater samples from the new and select existing wells in the vicinity of the southern boundary of the NGC site. A detailed rationale for the scope of work described below is provided in Section 3 (Rationale) of this work plan.

Drilling services for the proposed field investigation will be performed by a NYS-licensed well driller. Field oversight during drilling operations will be provided by a qualified geologist.

Drilling, well installation, equipment decontamination, investigation-derived waste (IDW) management, IDW disposal, and site restoration activities will be performed in accordance with methods provided in the NYSDEC-approved work plans that were prepared by the U.S. Navy (U.S. Navy 2000).

### 2.1 Vertical Profile Borings

The locations of the proposed VPBs are shown on Figure 1. Two VPBs will be drilled and sampled, as follows: VPB-39 will be drilled and sampled immediately north of Well ONCT-1 and VPB-73 will be drilled and sampled along the north side of the South Recharge Basins adjacent to existing Monitoring Well GM-73D2. VPB drilling and sampling methodologies will be consistent with those described in the NYSDEC-approved work plans that were prepared by the U.S. Navy (U.S. Navy 2000). Mud rotary (MR) drilling/split spoon sampling and Hydropunch sampling will be used to collect lithologic and groundwater samples, respectively. Split spoon (lithologic) samples will be collected at 20 ft intervals from land surface to total depth, and Hydropunch groundwater samples will also be collected at the same frequency, but starting at the water table, which is approximately 50 ft bls. The maximum drilling depth of the VPBs will be to the top of the Raritan Formation, approximately 800 feet below land surface (ft bls). Once the total depth of the VPB has been attained, the borehole will be geophysically logged using the natural gamma method. The VPB borehole will then be abandoned in accordance with NYSDEDC-approved methods (U.S. Navy 2000).

Groundwater samples will be submitted for laboratory analysis of the Target Compound List (TCL) VOCs using United States Environmental Protection Agency (USEPA) Method 8260 or NYSDEC Analytical Services Protocol (ASP) Method 95-1.

### 2.2 Monitoring Well Installation

After completion of VPB-39, a permanent two-well cluster designated as GM-39D and GM-39D2 will be installed. The total depths and screened zones for the wells comprising this cluster will be determined based on the VPB-39 results. After completion of VPB-73, a permanent monitoring well designated as Well GM-73D will be installed such that it is clustered with existing Monitoring Well GM-73D2. The need for additional monitoring wells will be evaluated based on the results of the VPBs. If necessary, additional monitoring wells (i.e., Wells GM-39D3 and GM-73D3) may be installed at the respective locations (see Section 3.1 of this work plan).

Each monitoring well borehole will be of 8-inch nominal diameter and will be drilled using the MR method, in accordance with NYSDEC approved procedures. Permanent monitoring wells will be installed to total depths that will be based on VPB data (i.e., lithologic, groundwater quality, and geophysical). Monitoring well construction material will consist of the following: nominal 4-inch inner diameter, National Sanitary Foundation (NSF)-grade, Schedule 80 polyvinyl chloride (PVC) with no more than 20 feet of 0.010-inch slot screen. Wells will be completed with a flush-mounted wellhead protective assembly. Monitoring wells will be developed no sooner than 24 hours after installation using a combination of air lift/over-pumping and surging methodologies, consistent with NYSDEC approved procedures.

A NYS-licensed surveyor will survey the locations of the permanent wells to the NYS Plane Coordinate System and land surface and inner casing elevations to the National Geodetic Vertical Datum (NGVD).

### 2.3 Water-Level Measurements

Two rounds of groundwater-level (hydraulic) measurements will be carried out: the first round will be a minimum of two weeks after development of all proposed monitoring wells has been completed, followed by a second round a minimum of one month later. Sixteen or eighteen wells will be measured as part of these rounds, as follows:

- On-site Monitoring Wells GM-33D2; GM-73D2; GM-74I; GM-74D; and GM-74D2.
- Off-site Monitoring Wells GM-75D2; N-10627; GM-20I; and GM-20D.
- Proposed Monitoring Wells (i.e., GM-39D, GM-39D2, GM-73D, along with any additional new wells [i.e., GM-39D3 and GM-73D3]).
- OU2 Remedial Wells ONCT-1; ONCT-2; ONCT-3; and GP-1.

Collection of depth-to-groundwater measurements and calculation of water-level elevations will be performed consistent with the methods described in the OU2 quarterly groundwater monitoring reports (ARCADIS Geraghty & Miller, Inc., 2001).

### 2.4 Groundwater Sampling

As part of this investigation, two rounds of groundwater samples will be collected beginning a minimum of two weeks after development of the new wells has been completed, with the second round performed one month after the groundwater quality data from the first round has been received. Four or six wells will be sampled as part of these rounds, as follows:

- If additional monitoring wells (i.e., Wells GM-39D3 and GM-73D3) are not installed, then Wells GM-39D and GM-39D2, GM-73D, and GM-73D2 will be sampled.
- If additional monitoring wells (i.e., Wells GM-39D3 and GM-73D3) are installed, then Wells GM-39D, GM-39D2, GM-39D3, GM-73D, GM-73D2, and GM-73D3 will be sampled.

The monitoring wells will be purged and sampled using methods described in the 2000 annual groundwater monitoring report (ARCADIS Geraghty & Miller, Inc. 2001) and analyzed by a NYS-certified laboratory for the TCL VOCs using NYSDEC ASP Method 95-1. Purge water from monitoring wells will be discharged to the Nassau County Publicly-Owned Treatment Works (POTW), consistent with the ongoing OU2 quarterly groundwater monitoring program.

### 2.5 Data Evaluation and Reporting

In addition to documentation of the field effort (provided as a summary report to be prepared by Navy – see Appendix A), after receipt of the field investigation results (i.e., VPB lithologic, geophysical, and groundwater quality data, along with permanent monitoring well groundwater elevation data and groundwater quality results), a hydraulic effectiveness report will be prepared that will include the following:

- VPB-39 and VPB-73 groundwater quality data will be provided in a summary table, along with copies of the sample/core logs, geophysical logs, and water sampling logs.
- Water-level elevation data from the permanent wells will be plotted on a plan view base map and will be contoured (or triangulated, depending on the number of data points available) to determine groundwater flow directions in the various aquifer horizons (i.e., deep and deep2 zones). Water-level data may also be evaluated versus model-predicted head values and vertical gradients.

- Groundwater sampling data from the proposed monitoring wells will be validated using methods described in the 2000 annual groundwater monitoring report, tabulated, and compared to NYS Standards, Criteria, and Guidance values (SCGs).

The updated OU2 contaminant-transport model may also be used to evaluate the hydraulic data, based on vertical VOC distribution in the subject area (see discussion below).

## 3. Rationale

Based on our current knowledge of groundwater quality conditions at the site, OU2 Remedial Well ONCT-1 and the area along the western boundary of the NGC site have exhibited the highest VOC concentrations in groundwater predominantly in the horizons slightly above and within the screen zone of Well ONCT-1, as nearby shallow and intermediate wells have exhibited few or no VOC detections with no exceedences of NYSDEC SCGs. In addition, Well GM-73D2 has exhibited VOC impacts above SCGs and is located nearly equidistant from Remedial Wells ONCT-1 and ONCT-2. The area between Wells ONCT-1 and ONCT-2 has exhibited groundwater VOC concentrations that are close to one part per million in the D2 zone. If VOCs are detected below the screened interval of Remedial Well ONCT-1, then the next logical location to investigate would be at the location of Monitoring Well GM-73D2 to determine whether VOCs are present at depths greater than the ONCT well screens.

The field investigation will be conducted after confirmation that the OU2 containment system wells have operated at greater than 90 percent up-time and at or close to the design pumping rates of 1,075 gallons per minute (GPM) (GP-1); 1,000 GPM (ONCT-1); 600 GPM (ONCT-2); and 700 GPM (ONCT-3) for a minimum of one month, and that the associated treated water discharge is being routed to the South Recharge Basins/Plant 5 Recharge Basins consistent with the rates predicted by the model to prevent the off-site migration of VOCs. The pumping rates above are based on hydraulic evaluation using the groundwater flow model and, based on model predictions, will prevent the off-site migration of VOCs. Operation of the remedial wells at these rates before and during the field investigation will, therefore, produce conditions that are representative of the planned long-term operation of the system and serve as the most appropriate basis for evaluation of the hydraulic effectiveness of the system.

### 3.1 Vertical Profile Borings and Permanent Wells

The locations of proposed VPBs and wells are shown on Figure 1. VPB-39 will be drilled and sampled near the NGC site southern boundary, north of Remedial Well ONCT-1 and VPB-73 will be drilled and sampled near Well GM-73D2. Both VPBs will serve to characterize and vertically delineate VOC impacts in these areas. After

completion of the VPBs, permanent wells will be installed at the VPB-39 and VPB-73 locations. In general, the proposed permanent wells will be installed to better characterize VOC plume concentrations and monitor water levels at depth.

Permanent monitoring wells will be installed as follows:

- Based on the groundwater sampling conducted at VPB-39, if VOCs are detected above and within the screen zone of Well ONCT-1, then one D/D2 monitoring well cluster will be installed (i.e., Monitoring Wells GM-39D/GM-39D2). Data collected from these wells will be used to determine and monitor vertical hydraulic gradients and groundwater flow directions from these zones to determine whether VOCs will be captured and contained by the on-site containment system.
- Based on the groundwater sampling conducted at VPB-73, if VOCs are detected above and within the screen zone of Well ONCT-1, then one deep monitoring well will be installed (i.e., Monitoring Well GM-73D). Data collected from Proposed Well GM-73D and Existing Well GM-73D2 will be used to determine and monitor vertical hydraulic gradients and groundwater flow directions from these zones to determine whether VOCs will be captured and contained by the on-site containment system.
- Based on the groundwater sampling conducted at VPB-39 and VPB-73, if VOCs are detected at depths significantly below the screen zone of Well ONCT-1, then the need for additional monitoring wells will be evaluated to potentially include two deep3 monitoring wells installed at the VPB-39 and VPB-73 locations (i.e., Wells GM-39D3 and GM-73D3). Data collected from these wells will be used collectively with the other newly installed monitoring wells at these locations to determine and monitor vertical hydraulic gradients and groundwater flow directions from these zones to determine whether VOCs will be captured and contained by Remedial Wells ONCT-1 and ONCT-2.

### 3.2 Hydraulic Measurements and Groundwater Sampling

A minimum of two weeks after the new, permanent monitoring wells have been drilled, installed and developed, a round of hydraulic measurements (depth to groundwater) will be collected from the new, permanent monitoring wells and selected nearby existing monitoring wells to evaluate and monitor groundwater flow (both horizontally and vertically) in these areas. To confirm results of the first round, a second round will be conducted after evaluation of the first round of data is performed (using the model, if needed).

Following completion of the first hydraulic measurement round, the new, permanent monitoring wells will be sampled and analyzed for VOCs to confirm impacts identified in these zones during sampling of the VPBs.

### 3.3 Model Transport Simulations

The updated contaminant transport model may also be used as part of the data evaluation, as follows:

- If VOCs are detected at substantial concentrations over a substantial thickness of aquifer, and these concentrations are present at depths significantly below the total depth of OU2 Remedial Well ONCT-1, additional VOC transport simulations using the updated model may be performed to determine whether the on-site containment system would capture and contain this VOC mass.
- If VOCs are not detected at depths significantly below the total depth of Well ONCT-1 or are not detected entirely at these depths, then additional VOC transport simulations would not be performed.

## 4. References

ARCADIS Geraghty & Miller, Inc., 2001. 2000 Annual Groundwater Monitoring Report, Northrop Grumman Corporation, Bethpage, New York.

U.S. Navy. 2000. Work Plan for the Installation of Additional Vertical Profile Borings, Naval Weapons Industrial Reserve Site, Bethpage, New York.

ARCADIS

Table 1. Proposed Construction Specifications for Vertical Profile Borings and Monitoring Wells, Northrop Grumman Corporation, Bethpage, New York.

| VPB/ Well ID | Nominal Diameter of VPB/Well | Estimated Total Depth [a] (ft bls) | Well Screen/ VPB Sampling Intervals | Water Level Collected | Sample(s) Collected for TCL VOCs | Site Gamma Logged |
|---|---|---|---|---|---|---|
| **Vertical Profile Borings** | | | | | | |
| VPB-39 | 8 | 800 | Every 20 ft from LS to TD [b] | -- | X | X |
| VPB-73 | 8 | 800 | Every 20 ft from LS to TD [b] | -- | X | X |
| **Permanent Monitoring Wells** | | | | | | |
| GM-39D | 4 | TBD | 20 ft long | X | X | -- |
| GM-39D2 | 4 | TBD | 20 ft long | X | X | -- |
| ***GM-39D3*** | ***4*** | ***TBD*** | ***20 ft long*** | ***X*** | ***X*** | -- |
| GM-73D | 4 | TBD | 20 ft long | X | X | -- |
| ***GM-73D3*** | ***4*** | ***TBD*** | ***20 ft long*** | ***X*** | ***X*** | -- |

***Bold/Italics*** Denotes contingency wells that may/may not be installed based on the results of VPB-39 and VPB-73.

[a] Total depths of VPBs will be to the top of the Raritan Formation.
Total depths of wells will be based on the vertical distribution of VOCs in VPB-39 and VPB-73.

[b] Split spoon samples and groundwater hydropunch samples will be collected at 20-foot intervals from the water table (approximately 50 ft bls) to depth.

| | |
|---|---|
| VPB | Vertical Profile Boring |
| ft bls | feet below land surface |
| TCL VOCs | Target Compound List of Volatile Organic Compounds analyzed by NYSDEC ASP Method 95-1 |
| TD | Total Depth |
| X | Activity Performed |
| -- | Activity Not Performed |
| NYSDEC | New York State Department of Environmental Conservation |
| ASP | Analytical Services Protocol |
| TBD | To Be Determined |
| LS | Land Surface |