Five-Year Review Report

Third Five-Year Review
for
Barkhamsted-New Hartford Landfill
Barkhamsted, New Hartford, Connecticut

September 2013

Prepared by:

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ACRONYMS

ARAR	Applicable or Relevant and Appropriate Requirement
AWQCs	Ambient Water Quality Criteria
CD	Consent Decree
COC	Contaminant of Concern
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CSF	Cancer Slope Factor
CTDEP	Connecticut Department of Environmental Protection
CTDEEP	Connecticut Department of Energy and Environmental Protection
CTDOT	Connecticut Department of Transportation
DL	Detection Limit
DMP	2,4-Dimethylphenol
DPW	Department of Public Works
EE/CA	Engineering Evaluation and Cost Analysis
ELUR	Environmental Land Use Restriction
EPA	United States Environmental Protection Agency
FS	Feasibility Study
HHRA	Human Health Risk Assessment
MCL	Maximum Contaminant Level
MDC	Metropolitan District Commission
MEK	Methyl ethyl ketone
MNA	Monitored Natural Attenuation
NCP	National Contingency Plan
Nobis	Nobis Engineering, Inc.
NPL	National Priorities List
NTCRA	Non-Time-Critical Response Action
NUS	NUS Corporation
O&M	Operations and Maintenance
PCB	Polychlorinated biphenyl
POTW	Publically Owned Treatment Works
ppb	parts per billion
ppm	parts per million

ACRONYMS (cont.)

PRP	Potentially Responsible Party
RAO	Remedial Action Objective
RAWP	Remedial Action Work Plan
RfDs	USEPA Risk Reference Doses
RI	Remedial Investigation
ROD	Record of Decision
RP	Responsible Parties
RRDD	Regional Refuse Disposal District No. 1
SARA	Superfund Amendments and Reauthorization Act
SDWA	Safe Drinking Water Act
SVOC	Semivolatile organic compound
TBC	To Be Considered
TCE	Trichloroethylene
µg/L	micrograms per liter
UST	Underground storage tank
VC	Vinyl chloride
VOC	volatile organic compound
WQS	Water Quality Standards

EXECUTIVE SUMMARY

This is the third Five-Year Review for the Barkhamsted-New Hartford Landfill Superfund Site (Site). The triggering action for this review was the completion of the second Five-Year Review dated September 2008. The Five-Year Review is required since hazardous contamination remains at the Site above levels that allow for unlimited use and unrestricted exposure.

A Non-Time-Critical Response Action (NTCRA) was initiated in 1994 which included among other items the installation of a landfill cap and a leachate collection system.

The Record of Decision (ROD) for the Site was signed on September 28, 2001. Monitored Natural Attenuation (MNA) was selected as the preferred remedial option to reduce groundwater impacts at the Site. The remedy at this Site is designed to protect human health and the environment by eliminating, reducing or controlling exposures to human and environmental receptors through monitored natural reductions in toxicity, and engineering controls and institutional controls. More specifically, groundwater cleanup levels will be achieved through natural attenuation processes and exposures are controlled through the installation of the engineered landfill cap. Environmental Land Use Restrictions (ELURs) would prohibit residential use of the Site, use of groundwater for drinking or any other purpose, and avoid disturbance of the landfill cap installed under the NTCRA.

In spring of 2003, Regional Refuse Disposal District No. 1 (RRDD) initiated the long-term monitoring of groundwater. Groundwater and sediment monitoring data continues to be collected in support of restoration of contaminated groundwater via monitored natural attenuation, and to monitor the continued effectiveness of the NTCRA.

The ELURs attached to the property deeds of four parcels restrict the development options and groundwater usage on RRDD-owned property, and restrict groundwater usage on three downgradient properties.

MNA has not restored groundwater beyond the compliance boundary to below cleanup goals. The contaminants of concern (COCs) remaining above the applicable cleanup goals include benzene, methylene chloride, toluene, TCE, chloroethane, 2,4-dimethylphenol, 1,4-dichlorobenzene, arsenic, and manganese.

Based on current attenuation rates, residual concentrations of COCs may not reach their respective cleanup goals before December 31, 2017 as stated in the ROD.

On September 25, 2012, a drinking water supply well was installed southeast of the Site to supply the RRDD transfer station and the Town Garage with potable water. A sample was collected in 2013 from this well and did not contain detectable VOCs, SVOCs, or metals concentrations in excess of established standards. This well should be included in the long-term monitoring program.

The remedy at the Site currently protects human health and the environment because remedial activities completed to date have adequately addressed all exposure pathways that could result in unacceptable risk. There are not current exposures to contaminated groundwater originating from the site; the landfill cap continues to be an effective remedy; a long-term monitoring program is in place; and institutional controls have been recorded. However, in order for the remedy to be protective in the long-term, the following actions need to be taken: 1) repair the northeastern portion of the landfill perimeter fence; 2) fill in animal burrows and repair drainage features on the cap; 3) select analytical methods to ensure laboratory reporting limits meet all COC cleanup goals for groundwater and ecological benchmarks for surface water and sediment; 4) perform the sediment hazard index analysis to evaluate compliance with sediment Remedial Action Objectives (RAOs); 5) as the current estimate to achieve cleanup goals will not be met, verify that monitored natural attenuation processes continue to be effective and develop a revised estimate of time to achieve cleanup goals, and continue to maintain the ELURs; and 6) include drinking water samples from the new “Garage Well” into the long-term monitoring plan.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Barkhamsted-New Hartford Landfill		
EPA ID: CTD980732333		
Region: 1	**State:** CT	**City/County:** Barkhamsted & New Hartford/ Litchfield County

SITE STATUS	
NPL Status: Final	
Multiple OUs? No	**Has the site achieved construction completion?** Yes

REVIEW STATUS
Lead agency: EPA **If "Other Federal Agency" was selected above, enter Agency name:** Click here to enter text.
Author name (Federal or State Project Manager): Almerinda Silva
Author affiliation: U.S. EPA Region I
Review period: 4/1/13 – 9/30/13
Date of site inspection: 4/18/13
Type of review: Statutory
Review number: 3
Triggering action date: September 2008
Due date *(five years after triggering action date)*: September 2013

Five-Year Review Summary Form (continued)

Issues/Recommendations

Issues and Recommendations Identified in the Five-Year Review:

OU(s): 01	**Issue Category: Site Access/Security**			
	Issue: The northeastern portion of the landfill perimeter fence was damaged			
	Recommendation: Repair the damaged fence			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA/State	September 2014

OU(s): 01	**Issue Category: Operations and Maintenance**			
	Issue: Animal burrows noted on the landfill cap and drainage features were damaged			
	Recommendation: Fill animal burrows, and repair damaged drainage features, if deemed necessary			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA/State	September 2014

Five-Year Review Summary Form (continued)

OU(s): 01	**Issue Category: Monitoring**			
	Issue: ~~The analytical quantitation limits for several groundwater COCs, including arsenic, TCE, are often not sufficient to document attainment of cleanup objectives. The surface water and sediment sample quantitation limits should be examined against the anticipated ecological screening concentrations to ensure that appropriate data are obtained. A sediment hazard index analysis to evaluate compliance with the RAO has yet to be performed.~~The analytical quantitation limits for several groundwater COCs, including arsenic and TCE, are often not sufficient to document attainment of cleanup objectives. The surface water and sediment sample quantitation limits should be examined against the anticipated ecological screening concentrations to ensure that appropriate data are obtained. A sediment hazard index analysis to evaluate compliance with sediment RAOs has yet to be performed.			
	Recommendation: Evaluate selected analytical methods to ensure that the laboratory reporting limits meet the groundwater cleanup goals and ecological benchmarks for surface water and sediment; Once additional data are obtained, perform the sediment hazard index analysis to evaluate compliance with the RAO.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA/State	September 2014

OU(s): 01	**Issue Category: Monitoring**
	Issue: Although the RRDD intends to collect regular samples from the new RRDD drinking water well located southeast of the Site, it is not currently identified as part of the Long-Term Monitoring program.
	Recommendation: Modify the long-term monitoring plan to include

	collection of drinking water samples from the new "Garage Well". It is recommended that samples be analyzed for the same parameters as the remaining drinking water samples			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA/State	September 2014

Five-Year Review Summary Form (continued)

OU(s): 01	**Issue Category: Remedy Performance**			
	Issue: Achievement of the groundwater cleanup goals is not likely within the timeframe stated in the ROD.			
	Recommendation: Continue to verify that the MNA process remains on-going, and develop a revised estimate of time required to achieve cleanup goals.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA/State	September 2016

Five-Year Review Summary Form (continued)

Protectiveness Statement(s)

Operable Unit:	*Protectiveness Determination:*	*Addendum Due Date (if applicable):*
01	Short-term Protective	Click here to enter date.

Protectiveness Statement:

The remedy at the Barkhamsted-New Hartford Landfill Site currently protects human health and the environment because remedial activities completed to date adequately addressed all exposure pathways that could result in unacceptable risk. There are no current exposures to contaminated groundwater originating from the site; the landfill cap continues to be an effective remedy; a long-term monitoring program is in place; and institutional controls have been recorded. However, in order for the remedy to be protective in the long-term, the following actions need to be taken: 1) repair the northeastern portion of the landfill perimeter fence; 2) fill in animal burrows and repair drainage features on the cap; 3) select analytical methods to ensure laboratory reporting limits meet all COC cleanup goals for groundwater and ecological benchmarks for surface water and sediment; 4) perform the sediment hazard index analysis to evaluate compliance with sediment RAOs; 5) as the current estimate to achieve cleanup goals will not be met, verify that monitored natural attenuation processes continue to be effective and develop a revised estimate of time to achieve cleanup goals, and continue to maintain the ELURs; and 6) include drinking water samples from the new "Garage Well" into the long-term monitoring plan.

1.0 INTRODUCTION

The purpose of this third Five-Year Review is to determine if the remedy selected for the Barkhamsted-New Hartford Landfill Superfund Site (Site) in Barkhamsted and New Hartford, Connecticut is protective of human health and the environment. This report summarizes the five-year review process and remedial actions undertaken at the Site; evaluates the monitoring data collected; reviews for changes in any standards specified in the Record of Decision (ROD) and the risk assessment conclusions used as the basis for the remedy; discusses any issues identified during the review; and presents recommendations to address those issues.

The United States Environmental Protection Agency, Region 1 (EPA) prepared this five-year review pursuant to the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) Section 121 and the National Contingency Plan (NCP). The five-year review requirement, as stated in the NCP, 40 CFR §300.430(f)(4)(ii) is as follows:

> *"If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action."*

Nobis Engineering, Inc. (Nobis) supported EPA in completion of this five-year review under EPA Contract No. EP-S1-06-03, Task Order 0086-FR-FE-01B8. Work on this review was undertaken between April 2013 and September 2013. The review was completed in accordance with USEPA Guidance OSWER No. 9355.7-03B-P with clarifications provided in OSWER Document Nos. 9355.7-21, 9355.7-18, and 9200.2-111.

This is the third Five-Year Review for the Site. The two prior Five-Year Reviews were completed in 2003, and 2008. The triggering action for this policy review was the completion of the second Five-Year Review in 2008. The Five-Year Review is required since contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure.

A listing of the documents reviewed during this Five-Year Review is found in Appendix A.

2.0 SITE CHRONOLOGY

The chronology of Site events pertinent to this five year review is provided below in Table 2-1.

Table 2-1
Chronology of Site Events
Barkhamsted-New Hartford Landfill
Barkhamsted, New Hartford, Connecticut
Page 1 of 3

Event	Date
Regional Refuse Disposal District No. 1 (RRDD) was formed.	September 1970
RRDD received Connecticut Department of Environmental Protection (CTDEP) soil waste permit #005-2L. The RRDD purchased the Barkhamsted property from the Town of Barkhamsted.	September 1972
Operation of chemical pit that received oily sludge with metal grindings and degreasers.	1970's
Modification to the RRDD solid waste permit was issued.	January 1974
The landfill became operational.	April 1974
CTDEP solid waste reports document lack of daily cover material; additional issues include ponding of water on landfill surface and encroachment of brush and bulky waste onto 50-foot buffer zone.	1974-1979
Barkhamsted landfill Site was used for the disposal of solid waste.	April 1974-August 1988
CTDEP inspection of the Site.	1980
EPA conducted a preliminary assessment for the Site.	1981
CTDEP requests RRDD to remove hazardous waste from the facility.	March 1981
CTDEP formerly approved disposal of metal grinding waste at Site.	July 1981
Two complaints received concerning the presence of a large number of drums; CTDEP requests that 25 drums containing suspect motor oil be re-located to a paved area on-Site.	1983
Thirty drums discovered near the scrap metal area (north of toe of landfill and NW of garage).	November 1983
A modification to the landfill operating permit was issued.	December 16, 1983
Requirement for a new metals grindings cell. Metal grindings were stored on Site in 55-gallon drums.	1984
CTDEP acknowledges handling of waste oil and batteries for recycling.	September 1986
NUS Corporation conducts site inspection, on behalf of EPA –	March 1987
Disposal of solid waste at the Site because CRRA mid-Connecticut Waste to Energy Plant was inoperable.	November – December 1988
Disposal of bulky and non-processable waste only.	August 1988 – October 1993
CTDEP document states that one half of the barrels received at the Site contained unspecified amounts of chlorinated hydrocarbons or methyl ethyl ketone.	1988
Barkhamsted Site listed on NPL.	October 5, 1989
Minor amendment was granted to the RRDD solid waste permit allowing landfill to accept dewatered sludge from Winsted's publicly owned treatment works (POTW).	February 1990

Table 2-1
Chronology of Site Events
Barkhamsted-New Hartford Landfill
Barkhamsted, New Hartford, Connecticut
Page 2 of 3

Event	Date
CTDEP Administrative order to investigate waste materials; determine extent of impact and potential impact to soil, surface water and groundwater	1990
CERCLA Administrative Order to Conduct Remedial Investigation/Feasibility Study (RI/FS) (Docket No. I-91-1128).	October 4, 1991
Limited Field Investigation (LFI) conducted by O'Brien & Gere Engineers, Inc.	Dec 1991-Jan 1992
Scope of Study completed by Fuss & O'Neill per CTDEP Administrative Order No. 666.	December 1991
Landfill closure implemented. CTDEP revise permit # SW-0005-2L to address water quality monitoring plan.	November 1992
Facility ceases acceptance of waste for on-Site disposal.	October 1993
Engineering Evaluation/Cost Analysis (EE/CA) addressing NTCRA.	April 1994
EPA approves NTCRA; EPA and CTDEP enter into Consent Order requiring RRDD to design and implement NTCRA.	September 26, 1994
Landfill cover (2-ft thick) installed.	October 1994
CTDEP approves landfill closure.	January 1995
Remedial Investigation (RI) by O'Brien & Gere Engineers, Inc. (1996).	February 1996
Draft NTCRA Remedial Action Plan (RAP).	September 1996
NTCRA completed; implementation of leachate collection system; capping of landfill and Site restoration.	1998
Feasibility Study Report, O'Brien & Gere Engineers, Inc. (2001a).	June 2001
EPA Record of Decision (ROD) (EPA, 2001b).	September 28, 2001
Operations and Maintenance Manual; Landfill Closure	October 2001
USA and the State of Connecticut v Regional Refuse Disposal District No. 1, et. al., Consent Decree U.S. District Court – Connecticut	Signed in September 2002, adjudicated in January 2003
Environmental Land Use Restriction (ELUR) public notice; 30-day comment period from 11/19/02 to 12/19/02.	November 19, 2002
Sampling of Site groundwater monitoring wells, residential potable water wells, surface water and sediment sampling per the ROD and Consent Decree begins.	April to June 2003
Drilling to install additional monitoring wells MW-120S and MW-120B.	July 2003
The on-Site ELUR, dated July 24, 2003, was recorded at the Barkhamsted Land Records in Volume 124, Page 140.	August 23, 2003
First Five-Year Review.	September 2003

Table 2-1
Chronology of Site Events
Barkhamsted-New Hartford Landfill
Barkhamsted, New Hartford, Connecticut
Page 3 of 3

Event	Date
The off-Site Town Garage ELUR, dated December 22, 2003, was recorded in Volume 126, Page 347. The off-Site MDC ELUR, dated December 22, 2003, was recorded in Volume 126, Page 357.	January 22, 2004
The off-Site ELUR for the Morris property dated January 4, 2004 was recorded at the Barkhamsted Land Record in Volume 126, Page 689.	February 24, 2004
EPA Site inspection discovers a downchute failure in one of the downchutes.	August 2005
Downchute repair conducted and completed.	October - November 2005
Public notice that a Five-Year Review is to be conducted.	April 19, 2008
Second Five-Year Review	September 2008
Town Garage located north of the landfill was reconstructed requiring modifications to monitoring wells MW-120S/B and MW-103S/B.	July 2011 – December 2011
Third Five-Year Review.	September 2013

3.0 BACKGROUND

This section contains information pertaining to the Site's physical characteristics, current and prior land use at the property, and waste identification and characterization information. This information has been obtained through a review of historical information, previous investigations, zoning and flood maps, and a site visit.

3.1 Physical Characteristics

The Barkhamsted Landfill is located within a 97.8-acre parcel of land situated along the western side of New Hartford Road (Route 44), and straddles the municipal borders of Barkhamsted and New Hartford, Litchfield County, Connecticut (see Figure 1). The Site is located on the northern slope of a hill within the Farmington River Valley and is currently used as a transfer station and recycling center for the Regional Refuse Disposal District No. 1 (RRDD). Of the 97.8 acres, approximately 13 acres consists of the capped landfill and appurtenances; the remaining acreage is either undeveloped woodlands, or occupied by the transfer station and maintenance and office buildings (see Figure 2).

The Site is abutted to northeast by the Barkhamsted Town Garage facility and in other directions by both developed and undeveloped private properties. This includes residential properties to the east and southeast that use private wells for potable water.

3.2 Land Use History

In September 1972, the RRDD purchased the Barkhamsted Landfill parcel from the Town of Barkhamsted, and received Solid Waste Permit No. 005-2L to operate the landfill. The permit was modified in January 1974, and the landfill became operational in April of that year. The landfill accepted municipal solid waste for disposal between April 1974 and August 1988. In addition to municipal solid waste, the landfill accepted industrial wastes including: metal grinding waste; oily sludge with metal grinding and degreasers; and barrels containing unspecified amounts of chlorinated hydrocarbons, methyl-ethyl-ketone (MEK), and keratin. Between August 1988 and November 1988, the landfill accepted only bulky non-processable waste for disposal. In November and December 1988, the landfill again accepted municipal solid waste due to operational problems at a nearby waste-to-energy plant. In December 1988, the landfill reverted back to accepting only bulky waste for disposal, which continued until October 1993. During this time, sewage sludge generated by the Winstead Publically Owned Treatment Works (POTW) was incorporated into cover material.

The landfill stopped accepting any waste for disposal in October 1993. In 1993, the RRDD established a waste transfer station and recycle center at the Site. The transfer station and recycle center continue to operate at the Site. A Non-Time-Critical Response Action (NTCRA) was initiated in 1994 which included among other items the installation of a landfill cap and a leachate collection system.

In January 1998, the Connecticut Department of Environmental Protection (CTDEP), now known as the Connecticut Department of Energy and Environmental Protection (CTDEEP) approved landfill closure.

3.3 Current Land and Resource Use

The Site is currently used as a waste transfer station and recycling area, which consists of waste repositories and maintenance/office buildings. The capped landfill is fenced. The current

use for the surrounding area is residential, commercial and recreational. The Metropolitan District Commission (MDC) owns undeveloped land along the Farmington River, which is used for recreational purposes, including fishing, swimming and boating.

One surface water body, designated as the “Unnamed Brook”, originates south of the Site and flows along the western portion of the landfill area. Beyond the landfill, the brook proceeds to the northeast and flows under Route 44, where it enters the Farmington River floodplain and a series of small beaver ponds. The brook eventually discharges to the Farmington River, located approximately 0.25 miles southeast of the Site. The Farmington River is a Class B River for recreational fishing and boating. Connecticut designates Class B waters for: fish and wildlife habitat; agricultural and industrial supply; recreation and navigation.

The aquifer underlying the Site is currently not used as a drinking water source. Nearby commercial and residential properties (including a well installed in late 2012 to supply the RRDD and Town garage) use both the overburden and bedrock aquifer as a potable water supply. These off-Site potable wells are not within the zone of Site-related groundwater plumes. Groundwater at the Site is estimated to flow to the northeast. Downgradient of the Site, groundwater flow is more easterly toward the Farmington River. Because of the contaminated groundwater at the Site, Environmental Land Use Restrictions (ELURs) were placed on the Site and nearby parcels to prohibit groundwater use for drinking or other purposes (see Figure 3).

In September 2004, EPA completed a Reuse Assessment of the Barkhamsted Landfill property. The assessment recommended that storage facilities, office, or light industrial/commercial uses would be appropriate under the Site conditions as they do not use much water. No further recommendations were presented.

In 2009, the RRDD purchased a small parcel of land located southeast of the landfill. A new drinking water well was installed in November 2012 to supply the Town Garage with potable water. The well is located outside of the ELUR.

3.4 History of Contamination

The Site was used for the disposal of solid waste (including municipal and industrial wastes) between April 1974 and August 1988. The property is owned and operated by the RRDD.

RRDD is a corporate entity that was established on May 25, 1970 upon the adoption of its charter by the Towns of Barkhamsted, Colebrook, New Hartford and Winchester, Connecticut. On September 21, 1972, RRDD received a permit from the CTDEP approving the establishment of a solid waste disposal area. The Site began operating as a landfill in 1974.

After August 1988, the landfill was used only for the disposal of bulky and non-processable waste with the exception of a period during November and December 1988 when the Connecticut Resources Recovery Authority (CRRA) Mid-Connecticut Waste to Energy Plant was inoperable.

Historical wastes accepted at the landfill included the following:

- Municipal solid waste;
- Industrial wastes, including metal grinding waste, oily sludge with metal grinding and degreasers; barrels containing unspecified amounts of chlorinated hydrocarbons and methyl-ethyl-ketone (MEK or 2-butanone) and keratin; and
- Dry metal grinding waste.

In 1981, EPA conducted a Site inspection, based on previous findings by Connecticut officials. EPA's 1981 inspection included collection and analysis of Site groundwater samples. Laboratory analytical results of Site groundwater indicated concentrations of xylenes, toluene, 1,1-dichloroethane (1,1-DCA), 4-methyl-2-pentatnone and vinyl chloride (VC). The EPA inspection report also indicated the presence of metals at the Site (including cadmium, chromium, copper, lead, manganese, nickel and zinc) attributed to the historical disposal of oily metal grinding sludges. Additionally, leachate was observed discharging from the landfill into the Unnamed Brook.

Subsurface investigations conducted from 1992 to 2000 are documented in the 1996 Remedial Investigation (RI) and the 2001 Feasibility Study (FS) reports. These investigations indicated the following:

- Soil sampling analytical results indicated concentrations of volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides and polychlorinated

biphenyls (PCBs). The 2001 FS Report identifies contaminants of potential concern (COPCs), including VOCs, SVOCs and inorganics.

- Surface water sampling and leachate seep sediment sampling results indicated concentrations of SVOCs, pesticides and PCBs. Sediment samples collected from hydrogeologically downgradient locations (relative to the landfill) and leachate seep sediment samples indicated concentrations of VOCs, SVOCs, metals, pesticides and PCBs.

Prior to the RI, 31 groundwater monitoring wells were installed at the Site. Twenty-two additional wells were installed during the RI. COCs based on groundwater investigations include 15 VOCs, 3 SVOCs and 4 inorganics.

3.5 Initial Response

Pursuant to Section 105(8)(b) of CERCLA, the Site was proposed for inclusion on the National Priorities List (NPL) on June 21, 1988 and was subsequently listed on the NPL on October 5, 1989. Administrative Orders of Consent were issued by CTDEP in 1990 and EPA in 1991 to investigate waste materials and disposal activities on the Site, along with the extent of impact to soil, groundwater and surface water, and to conduct a RI and a FS.

In April 1994, a NTCRA Engineering Evaluation/Cost Analysis (EE/CA) was performed. In September 1994 a Consent Order was entered into between EPA and CTDEP, and RRDD which required RRDD to design and implement the approved NTCRA. The NTCRA, which included re-location of impacted soil and sediment to areas of the Site to be capped, installation of a leachate collection system and underground storage tank (UST), construction of a low-permeability landfill cap, relocation of an existing stream, vertical extension of existing monitoring wells, site restoration, and installation of perimeter fencing was completed in 1998. A risk assessment was prepared prior to NTCRA implementation to assess post-NTCRA risks to human and ecological receptors. Groundwater was deemed as the only medium requiring remediation.

3.6 Basis for Taking Action

EPA completed a baseline human health risk assessment in February 1996 and updated it in April 2000. Using EPA's risk assessment guidance, potential human health effects associated with exposure to COCs were estimated for various exposure scenarios. Of these scenarios, only future groundwater exposure presented an unacceptable risk. The total cancer risk from dermal and oral exposure via drinking water was $5x10^{-4}$, which was primarily driven by the presence of arsenic. Additionally, Hazard Indices (HI) of greater than 1 were calculated for several target endpoints.

A post-NTCRA Ecological Risk Assessment was performed in 2000. The result of this assessment suggested that the NTCRA had mitigated the pre-NTCRA ecological risks, or would likely mitigate them in the future. The assessment suggested long-term monitoring of leachate seeps and sediment will assist in determining whether ecological risks continue to decrease.

Based upon the results of the Human Health and Ecological Risk Assessments, the only medium that potentially poses an unacceptable risk is groundwater.

The COCs for groundwater, as described in the ROD, include the following:

- VOCs - 1,2-dichloroethane, 1,2-dichloropropane, 1,4-dichlorobenzene, 4-methyl-2-pentanone, MEK, acetone, benzene, chloroethane, chloroform, chloromethane, dibromochloromethane , methylene chloride, toluene, trichloroethene (TCE), and vinyl chloride (VC);
- SVOCs - 2,4-dimethylphenol, 4-methylphenol, and bis(2-ethyl hexyl) phthalate; and
- Metals - Arsenic, Chromium (total), Lead , and Manganese.

4.0 REMEDIAL ACTION

This section describes the remedial actions selected for and implemented at the Site.

4.1 Remedy Selection

For the purpose of this Five-Year Review, the NTCRA is considered a component of the selected remedy.

The ROD for the Site was signed on September 28, 2001. Monitored natural attenuation (MNA) was selected as the preferred remedial option to reduce groundwater impacts at the Site. The remedy at this Site is designed to protect human health and the environment by eliminating, reducing or controlling exposures to human and environmental receptors through monitored natural reductions in toxicity, and engineering controls and institutional controls. More specifically, groundwater cleanup levels will be achieved through natural attenuation processes and exposures are controlled through the installation of the engineered landfill cap. ELURs would prohibit residential use of the Site, use of groundwater for drinking or any other purpose, and avoid disturbance of the landfill cap installed under the NTCRA.

Remedial action objectives (RAOs) were developed to aid in the development and screening of alternatives. These RAOs were developed to mitigate and prevent existing and future potential threats to human health and the environment. The RAOs for the selected remedy include:

<u>Groundwater</u>

- Prevent ingestion or dermal contact with groundwater having constituent concentrations exceeding EPA Safe Drinking Water Act Maximum Contaminant Levels (MCLs), or in their absence, the more stringent of an excess cancer risk of $1x10^{-6}$ for each carcinogen or a hazard quotient of 1 for each non-carcinogenic substance.

- Restore groundwater beyond the compliance boundary (limits of the landfill) to MCLs or any more stringent Connecticut Remediation Standards (background concentrations), or in their absence, the more stringent of an excess cancer risk of $1x10^{-6}$ for each carcinogen or a hazard quotient of 1 for each non-carcinogenic substance.

<u>Sediment</u>

- Protect benthic invertebrates and mammals from ingesting contaminated prey from direct contact with, or ingestion of, sediment having constituent concentrations exceeding a hazard index of 1.

- Prevent releases of constituents from sediments that would result in surface water levels exceeding federal Ambient Water Quality Criteria, Connecticut Water Quality Standards, or in their absence, a hazard index of 1.

The 2001 ROD stated that approximately 15.6 years would be required to achieve RAOs in overburden groundwater, and approximately 6 years to achieve RAOs in the bedrock aquifer.

4.1.1 Components of the Selected Remedy

The major components of the remedy selected in the ROD include:

- NTCRA;
- Long-term monitoring of groundwater, surface water (including seeps), and sediment;
- Restoration of contaminated groundwater via natural attenuation;
- Environmental land use restrictions (ELURs);
- Public education program; and
- Five-year reviews.

4.2 Remedy Implementation

This section describes the completion of the tasks required by the ROD, the results of which were intended to support the selection of a final remedy.

In 1992, landfill closure was implemented in accordance with the Landfill Closure Plan. In January 1998 the NTCRA was completed. For the purpose of this Five-Year Review, the NTCRA is considered a source control component of the selected remedy.

The source control was addressed by the NTCRA, which included re-location of impacted soil and sediment to below a paved portion of the Site, along with installation of a leachate collection system and landfill cap. During the performance of the NTCRA, an approximate 340-foot reach of the Unnamed Brook was relocated on the west side of the landfill, with the former section of the brook being covered with soil. Moreover, sediments were excavated from an approximately 70-foot reach of the brook and placed beneath the cap during the NTCRA construction. The components of the NTCRA were presented in Section 3.5 of this Five-Year Review.

A Consent Decree (CD) (United States v. Regional Refuse Disposal District No. 1, et al.) was entered in court between the government and PRPs in May 2003. The CD required that the Settling Defendants contract with a capable supervising contractor, develop and implement a Remedial Action Work Plan (RAWP) and modify it as needed, establish suitable sampling and quality control requirements, grant access to government representatives and contractors, and establish institutional controls as necessary. The CD also established EPA review and approval criteria.

In spring of 2003, pursuant to the terms of the CD, RRDD initiated the long-term monitoring at the Site. Since 2003, groundwater, surface water, and sediment monitoring samples have been collected in support of restoration of contaminated groundwater via monitored natural attenuation, and to monitor the continued effectiveness of the NTCRA. Figures 4, 5 and 6 provide the current monitoring locations.

Drinking water samples have been collected as part of the long-term monitoring, from nearby potable supply wells (5 and 9 New Hartford Road, and the adjacent Connecticut Department of Transportation salt shed) (see Figure 5). The results of these samples are submitted to the residents as part of the remedy's public education requirement.

The ELURs attached to the property deeds of four parcels are summarized as follows:

<u>RRDD Property</u>

- Recorded in Barkhamsted Land Records Volume 124, Page 140 and New Hartford Land Records Volume 217, Page 1019 on August 27, 2003

- Property is divided into Subject Areas A and B, where Subject Area A is the entire property and Subject Area B involves the limits of the landfill only

- Restrictions applicable to Subject Area A include:

    - No residential use of the property

    - Groundwater beneath the property shall not be used for drinking or other purposes

- Restrictions applicable to Subject Area B include:

    - All Subject Area A restrictions
    - The engineered control shall not be disturbed by excavation, demolition, erosion, plant root growth, or other activities
    - No buildings shall be constructed

Barkhamsted Town Garage Property

- Recorded in Barkhamsted Land Records Volume 126, Page 347 on January 22, 2004
- The only restriction set forth in the ELUR states that groundwater beneath the property shall not be used for drinking or other purposes

Morris Property

- Recorded in Barkhamsted Land Records Volume 126, Page 689 on February 24, 2004
- The only restriction set forth in the ELUR states that groundwater beneath the property shall not be used for drinking or other purposes

Metropolitan District Commission Property

- Recorded in Barkhamsted Land Records Volume 126, Page 357 on January 22, 2004
- The only restriction set forth in the ELUR states that groundwater beneath the property shall not be used for drinking or other purposes

These ELURs will remain effective until it has been determined, to the satisfaction of Commissioner of CTDEEP, that the affected parcels have been remediated in accordance with state regulations.

Prior to this Five-Year Review, two other reviews were completed in 2003 and 2008.

4.3 Operations and Maintenance

RRDD is conducting long-term monitoring of the remedy, and operations and maintenance activities associated with the NTCRA. Long-term monitoring of the remedy is primarily overseen by the EPA, and operations and maintenance of the NTCRA are overseen by CTDEEP.

4.3.1 Selected Remedy Operations and Maintenance

The operations and maintenance of the remedy includes:

- Performance of long-term monitoring of groundwater, surface water, and sediment to evaluate changes over time and to evaluate the success of the remedial action;
- Regular monitoring well maintenance;
- Maintenance of warning signs at the perimeter of the Site;
- Submission of monitoring analytical results, associated field notes and measurements, maps depicting analytical results and groundwater elevations, and a comparison of the results to ARARs and the analytical model developed in the FS; and
- Conduct a public education program involving informational meetings and/or mailings to discuss potential site hazards; this has included the submission of drinking water sample results to the respective homeowners.

Quarterly long-term monitoring of the groundwater, surface water, and sediment was initiated in 2003. Sample frequency was changed to semi-annually after two years and continues to date. The long-term monitoring of the selected remedy is coupled with that of the completed NTCRA (Landfill Closure), described subsequently in Section 4.3.2.

A modification to the long-term monitoring program was made in 2005 where sampling frequency for leachate seep samples was reduced from quarterly to semi-annually. A second modification to the program was made in 2009 in which sediment sampling frequency was reduced from annually to once every five years in the year prior to the scheduled Five-Year Review; and landfill leachate seep sampling frequency was reduced from semi-annually to annually in the spring.

Appendix B summarizes the long-term monitoring program and sampling points are depicted on Figures 4, 5, and 6.

Monthly progress reports are submitted to EPA and CTDEEP.

Public outreach performed between 2008 and 2013 by RRDD was limited to communication of potable water supply well analytical results to the respective property owners. In several circumstances, the analytical results were submitted via certified mail; however, the addressee did not acknowledge receipt. That homeowner has since passed away, and the property is currently part of the estate.

Aside from the difficulty in delivering the potable water supply well analytical results, few problems were encountered when implementing the remedy between 2008 and 2013. The minor difficulties encountered included:

- Reconstruction of the Town Garage required modifications to monitoring well riser pipes (MW-120S, MW-120B, MW-103S, and MW-103B) and additional elevation surveys; and
- Monitoring well MW-120S was almost dry and only enough volume for a VOC sample could be collected.

4.3.2 Completed NTCRA (Landfill Closure) Operations and Maintenance

The landfill post-closure Operation and Maintenance Manual (OMM) was completed in October 2001. The OMM required activities include the following:

- Routine inspection and maintenance of constructed features, including the landfill cap, gas venting system, leachate collection and storage system, surface water runoff facilities, the in-stream sedimentation basin, access roads, groundwater monitoring system and physical Site security;
- Mowing of the cap;
- Performance of a Long-term monitoring program including groundwater, surface water (including seeps) and sediment (coupled with the selected remedy long-term monitoring (as described previously in Section 4.3.1);
- Response to leachate tank alarms and unforeseen circumstances;
- Coordination of leachate removal and disposal; and

- Evaluation of operations and monitoring activities and identification of proposed changes to the OMM or procedures/policies that would provide a safer and/or more cost-effective operation.

Visual inspections of the landfill occur on an approximately quarterly basis. The inspections evaluate the condition of the landfill cap (for erosion, thinning vegetation, excess vegetation, drainage problems, settlement problems, slope instability, burrowing animals, and seepage), the gas venting system, the leachate collection system, surface water runoff structures, the access road, the groundwater monitoring system, the physical site security, the sedimentation basins, and the condition of the unnamed brook.

The visual inspections indicated that the overall landfill conditions were good. The landfill cap appeared to be in good condition with no differential settlement, holes, cracks, erosion, or other evidence of failure. Vegetation was removed when required, and landfill mowing was performed on a regular basis. The following provides a summary of issues noted by the landfill inspector:

- An area of fencing along the northeastern landfill perimeter was damaged, but is not breached. No repair to the fence has been made;
- Monitoring well casings within the landfill cap were not locked;
- In December 2011 the landfill inspector stated that portions of the landfill cap had been rutted and de-vegetated by the machines used to mow the cap. After experimenting with several modifications to the mowing method, a track-mounted skid-type loader with mower attachment was selected for the work. This revision to the mowing operation has resulted in no further problems; and
- Recommended vegetation removal from a variety of areas, all of which occurred within a reasonable timeframe.

RRDD collected surface water samples as part of the general industry stormwater permit No. 000205, which was issued in 2011. The samples were analyzed for geochemical parameters and aquatic toxicity, and the results were reported to the CTDEEP. The results of these samples reported that the stormwater discharge from the Site is generally below target benchmarks. Parameters including total suspended solids, chemical oxygen demand, and zinc, sporadically exceeded benchmark criteria.

No significant changes to the operations/maintenance of the landfill have occurred. Additionally, no significant operational or maintenance difficulties were encountered by RRDD between 2008 and 2013. The RRDD administrator noted during an interview conducted for this Five-Year Review that the volume of leachate generated by the landfill has been declining in recent years. He said that approximately 6,000 gallons of leachate were being removed to an off-site treatment/disposal facility every 18 months, where in previous years annual leachate removals of approximately 18,000 gallons were more common.

5.0 PROGRESS SINCE LAST FIVE-YEAR REVIEW

This is the third Five-Year Review for the Site. The second Five-Year Review concluded that the selected remedy was functioning as intended. The remedy was expected to be protective of human health and the environment when cleanup goals are achieved.

The second Five-Year Review recommended that several actions be taken to enhance the remedy. The summary below outlines the recommendations included in the second Five-Year Review and the outcome/resolution of recommendations.

1. Increase awareness of cap downchute failure detection during quarterly landfill inspections.

    - No evidence of erosion was noted during the Site inspection for this Five-Year Review. No evidence of erosion was noted in landfill inspection reports from between 2008 through 2012.

2. Based on the decreasing size of the plume and declining COC concentrations, a revised sampling plan to optimize the remedy is recommended. This includes changes in wells to be sampled and the frequency of the sampling.

    - A modification to the program was made in 2009 in which: sediment sampling frequency was reduced from annually to once every five years in the year prior to the scheduled Five-Year Review; and landfill leachate seep sampling frequency was reduced from semi-annually to annually in the spring.

3. Ensure that laboratory performance is improved such that reporting/quantitation limits for compliance samples are low enough to meet cleanup goal limits.

    - Laboratory reporting limits between 2008 and 2012 have varied. The reporting limits for several VOCs failed to achieve quantitation limits below cleanup criteria in 2008 and 2009. It appeared that adjustments were made to the analytical program in 2010 and 2011 as the reporting limits for many of these VOCs improved to meet cleanup goals.

    - The laboratory reporting limits for acetone, arsenic, and TCE failed to achieve quantitation limits below cleanup criteria; however, positive detections below the reporting limits were reported as estimates.

    - Surface water reporting limits in 2012 samples for several analytes, including Site COC arsenic, failed to achieve quantitation limits below ecological screening criteria. It is noted that the ecological screening criteria is not specified in the ROD.

    - Sediment sample laboratory reporting limits in 2012 samples for several analytes, including Site COC 2,4-dimethylphenol (all four samples), and bis(2-ethylhexyl)phthalate (one of four samples) failed to achieve quantitation limits below ecological screening criteria. It is noted that the ecological screening criteria are not specified in the ROD.

    - The recommended analytical improvements in reporting limits were achieved for many of the analytes, particularly in groundwater. However, some reporting limits still remain higher than cleanup goals or screening criteria.

The effectiveness of natural attenuation processes at the Site was evaluated using the techniques published by EPA in Wilson (2011) and Pope et al. (2004). The following is a summary of the MNA evaluation findings, and a more detailed discussion of this evaluation is provided in Appendix C.

MNA has not restored groundwater beyond the compliance boundary to below cleanup goals. The COCs that remain above the applicable cleanup goals include benzene, methylene

chloride, toluene, TCE, chloroethane, 2,4-dimethylphenol, 1,4-dichlorobenzene, arsenic, and manganese.

Based on current attenuation rates, residual concentrations of benzene at monitoring wells MW-101S, MW-1S, and MW-4R; TCE at monitoring well MW-120B; 2,4-dimethylphenol at monitoring well MW-1S; arsenic at monitoring well MW-101S; and manganese at monitoring wells MW-101S, MW-101B, MW-4S, MW-4R, MW-5S, MW-5B, and S-3 may not reach the respective cleanup goals before December 31, 2017. These monitoring wells are located within the landfill footprint and immediately downgradient; they are not located near identified human or ecological receptors. The original time estimate for groundwater concentrations to reach applicable cleanup goals (approximately 16 years) was based on only two COCs (4-methylphenol and 2-butanone), and did not adequately estimate the time needed for all COCs to reach applicable cleanup goals. Additionally, naturally occurring arsenic and manganese commonly are found within subsurface soils, and elevated concentrations in groundwater may occur as a result of other landfill associated processes.

6.0 FIVE-YEAR REVIEW PROCESS

This section provides a summary of the Five-Year Review process and the actions taken by EPA to complete the review.

6.1 Administrative Components

EPA, the lead agency for this Five-Year Review, notified CTDEEP and the property owner in the winter of 2012 that the Five-Year Review would be completed. The CTDEEP Site representative is Maurice Hamel. A draft copy of this review has been provided to CTDEEP for their review and comment.

6.2 Community Notification and Involvement

A press release was published in the local newspaper on December 9, 2012. The press release summarized the Site activities, and stated that the results of this Five-Year Review would be available. A copy of the press release is included in Appendix D.

According to previous investigations, interviews with Town officials, and the previous Five-Year Review, there has been limited public interest in the Site.

6.3 Document Review

This Five-Year Review consisted of a review of relevant documents including decision documents and monitoring reports (see reference document list provided in Appendix A).

6.4 Data Review

A summary of relevant data regarding the components of the Site remedy is presented below. The data reviewed were collected as part of the long-term monitoring program between 2003 and 2012. The results of these sampling events are summarized below by media. Analytical results summaries are presented below and the 2003, 2008, and 2012 sampling rounds are presented on Figures 7 through 12. Similar depictions for the remaining monitoring years are provided in Appendix E.

6.4.1 Groundwater

In general, the COC reporting limits for a majority of the groundwater samples have been sufficient to meet groundwater cleanup objectives. However, non-detect results were reported on different occasions for acetone, arsenic, 1,2-dichloropropane, chloroform, dibromochloromethane, and TCE with quantitation limits that exceeded cleanup goals.

<u>Overburden</u>

The interpreted overburden groundwater flow direction is north and northeast, toward the Farmington River (Figure 4). The current long-term monitoring program appears to be sufficient to evaluate groundwater contamination status.

Overburden groundwater COC concentrations continued to decline between 2008 and 2012 (see Appendix E). The limit of overburden groundwater contamination that remains above cleanup criteria remains beyond the limit of the landfill (i.e., the compliance boundary). The following table presents a summary of the overburden groundwater monitoring locations with 2012 COC concentrations above the ROD cleanup goals.

Table 6-1
Summary of 2012 Overburden Groundwater Monitoring Locations Exceeding ROD Cleanup Goals
Barkhamsted-New Hartford Landfill
Barkhamsted, New Hartford, Connecticut

Monitoring Location	Analytes and ROD Cleanup Goal (µg/L)							
	1,4-DCB	**2,4-DMP**	**Benz.**	**CE**	**MC**	**Tol.**	**As**	**Mn**
	10	10	0.5	1	2	0.5	5	50
	Federal MCL (µg/L)							
	75	NL	5	NL	5	1,000	10	50
MW-101S	**12**	**800**	**14**	**<4.2**	**14**	**17**	**9.9**	**81**
MW-103S	<0.4	<1.38	<0.4	<0.42	<2	<0.4	**<10**	**91**
MW-106S	<0.4	<1.92	<0.4	<0.42	<2	<0.4	**<10**	**82**
MW-115S	<0.4	<1.9	<0.4	<0.42	<2	<0.4	**<10**	**3,700**
MW-120S	<0.4	<1.32	<0.4	<0.42	<2	<0.4	**<10**	**700**
MW-1S	4.1 J	**100**	**7.8**	**<2.2**	**<8**	**2.7 J**	**<20**	45
MW-4S	<2	<1.94	**2.4 J**	**<1.68**	**<10**	**<2**	**8.8 J**	**1,100**
MW-5S	<0.4	<1.92	**1.7**	1 J	<2	<0.4	**<10**	**1,700**
S-3	1.1	<1.9	**1.1**	<0.42	<2	<0.4	4.4 J	**2,500**

Notes:

All concentrations presented are in µg/L.
The maximum values from spring and fall 2012 samples are presented.
Shaded values exceed cleanup goals.
1,4-DCB – 1,4-Dichlorobenzene
2,4-DMP – 2,4-Dimethylphenol
Benz. – Benzene
CE – Chloroethane
MC – Methylene chloride
Tol. – Toluene
As – Arsenic
Mn – Manganese
MCL – Federal Maximum Contaminant Level for drinking water. Provided for evaluation of current cleanup goals specified in the ROD. The presented MCL for Manganese is a non-enforceable secondary drinking water standard.
NL – Not listed
< – Less than the value presented.
J – Presented value is an estimate.

As shown above on Table 6-1, much of the organic contamination is focused within and slightly downgradient of the landfill, and decreases with distance downgradient of the landfill. Although

reporting limits for arsenic remain above the cleanup goals, the detectable inorganic contamination above cleanup goals is primarily manganese. Similar to the organic contamination, the manganese contamination is focused near the landfill, with lower concentrations present at a distance from the landfill. Trace elements arsenic, iron, and manganese are commonly found within subsurface soils, and elevated concentrations of these naturally occurring elements in groundwater are often the result of microbial activity affecting landfill chemistry and altering groundwater pH. Additionally, it is noted that the 2012 total dissolved solid concentrations reported in excess of drinking water criteria were collected from monitoring wells MW-101S, MW-103S, MW-1S, and MW-5S. These wells contained low arsenic and manganese concentrations, and therefore does not appear to correlate with the total dissolved solids results. The 2012 total suspended solids results from these monitoring wells also did not correlate with the arsenic and manganese concentrations. Therefore the concentrations were not likely associated with native turbidity in the groundwater samples.

Bedrock

The interpreted bedrock groundwater flow direction is north and northeast, toward the Farmington River (Figure 5). The current long-term monitoring program appears to be sufficient to evaluate groundwater contamination status.

Bedrock groundwater COC concentrations continued to decline between 2008 and 2012 (see Appendix E). The limit of bedrock groundwater contamination remaining above cleanup criteria remains beyond the landfill compliance boundary. The following table presents a summary of the bedrock groundwater monitoring locations with 2012 COC concentrations above the ROD cleanup goals.

Table 6-2
Summary of 2012 Bedrock Groundwater Monitoring Locations
Exceeding ROD Cleanup Goals
Barkhamsted-New Hartford Landfill
Barkhamsted, New Hartford, Connecticut

Monitoring Location	Analytes and ROD Cleanup Goal (µg/L)					
	Benz.	**CE**	**MC**	**As**	**Pb**	**Mn**
	0.5	1	2	5	3	50
	Federal MCL (µg/L)					
	5	NL	5	10	15TT	50
MW-101B	**4.3**	**<2.2**	**<8**	**<10**	3	**4,200**
MW-102B	<0.4	<0.42	<2	**<10**	1.3	**540**
MW-103B	<0.4	<0.42	<2	**<20**	Not Listed	**1,900**
MW-111I	<0.4	**1.1 J**	<2	**<10**	0.36 J	9.6 J
MW-111B	<0.4	0.78 J	<2	**<10**	<1	**67**
MW-120B	**0.78 J**	**1.4 J**	<2	**6.4 J**	2 B	35
MW-4R	**2.9 J**	**<1.68**	**<8**	5 J	**3.1**	**4,100**
MW-5B	**0.6 J**	0.89 J	<2	**<10**	1.7	**2,500**

Notes:

All concentrations presented are in µg/L.
The maximum values from spring and fall 2012 samples are presented.
Shaded values exceed cleanup goals.

Benz. – Benzene
CE – Chloroethane
MC – Methylene chloride
As – Arsenic
Pb – Lead
Mn – Manganese

MCL – Federal Maximum Contaminant Level for drinking water. Provided for evaluation of current cleanup goals specified in the ROD. The presented MCL for Manganese is a non-enforceable secondary drinking water standard
TT - The presented value is a treatment technique rather than an MCL standard.
NL – Not listed
< – Less than the value presented.
B – Analyte was detected in a blank sample.
J – Presented value is an estimate.

As shown above on Table 6-2, much of the organic contamination is focused within and slightly downgradient of the landfill, and decreases with distance downgradient of the landfill. Although reporting limits for arsenic remain above the cleanup goals, the detectable inorganic contamination above cleanup goals is primarily manganese. As with the organic contamination, the manganese contamination is focused near the landfill, with lower concentrations present at a distance from the landfill.

Drinking Water

Between 2008 and 2012, no organic analytes detected as detections in the three drinking water sample locations, DW-001, DW-002, and DW-003. Of the inorganic detections, sporadic lead concentrations have exceeded the ROD cleanup goal of 3 µg/L (which is well below the EPA Safe Drinking Water Act Maximum Contaminant Level Treatment Technique value of 15 µg/L). The elevated lead concentrations are as follows:

- DW-01 – October 2012, 3.7 µg/L
- DW-02 – April 2009, 53 µg/L
- DW-03 – October 2012, 3.1 µg/L

The lead concentrations (specifically in DW-02) are not consistently detected. The spring and fall 2012 lead concentrations in samples from DW-02 were 1 and 1.1 µg/L, respectively. These lead detections likely are not associated with releases from the landfill. Based on these results, the landfill does not appear to be having an impact on current drinking water wells.

A new 400-foot deep drinking water well was installed in September 2012 (Figure 5). The reported well yield is 1.5 gallons per minute, and the well pump was installed at 375 feet below grade. Drinking water samples collected in fall 2012 and spring 2013 did not contain detectable concentrations of VOCs, SVOCs, and the detected metals concentrations were well below established standards. As part of the communication between RRDD and their environmental consultant, RRDD mentioned they had heard the owners of 9 New Hartford Road may install a new bedrock drinking water well. This well would be located outside of the ELUR.

6.4.2 Surface Water

Surface water samples collected in 2012 contained several metals that exceed either the National Recommended Ambient Water Quality Criteria (AWQCs) or other suitable screening value (Oak Ridge National Laboratory Risk Assessment Program Preliminary Remediation Goals for Ecological Endpoints; Secondary Chronic Criteria). The following table summarizes these exceedances.

Table 6-3
Summary of 2012 Surface Water Sample Results
Exceeding Screening Benchmarks
Barkhamsted-New Hartford Landfill
Barkhamsted, New Hartford, Connecticut

Chemical	SW-3 (Upstream)	SW-16 (Adjacent to Site)	SW-9 (Downstream)	Screening Benchmark	Benchmark Source
Aluminum	**200**	**460**	80	87	(2)
Barium	**12**	**11**	**22**	4	(2)
Iron	120	390	**1,200**	1,000	(1)
Manganese	**240**	42	**220**	120	(2)

Notes:

All results presented in µg/L.
Results presented are the maximum values for each sample location for which samples were collected in 2012.
Shaded values exceed Screening Benchmark.
1 – National Recommended Ambient Water Quality Criteria-Aquatic Life Chronic scenario
2 – Oak Ridge National Laboratory Risk Assessment Program Preliminary Remediation Goals for Ecological Endpoints; ES/ER/TM-162/R2. August 1997. Secondary Chronic Criteria

As with previous surface water sampling performed at the Site, the laboratory reporting limits for numerous substances failed to achieve benchmark criteria. The following table summarizes the substances with reporting limits in excess of surface water screening values:

Table 6-4
Summary of Non-Detect 2012 Surface Water Sample Results with Reporting Limits Exceeding Surface Water Quality Benchmarks
Barkhamsted-New Hartford Landfill
Barkhamsted, New Hartford, Connecticut

Chemical	Number of Reporting Limits in Excess of Surface Water Quality Benchmarks	Is the Chemical Identified as a Site COC in the ROD?
1,1-Dichloropropene	8 (2)	N
Aluminum	2 (2)	N
Arsenic	8 (1)	Y
Beryllium	8 (2)	N
Heptachlor	8 (2)	N
Methoxychlor	8 (2)	N
Selenium	8 (2)	N
Silver	8 (2)	N

Notes:

1 – Surface Water Criteria used for evaluation the National Ambient Water Quality Criteria as of 2013
2 – Oak Ridge National Laboratory Risk Assessment Program Preliminary Remediation Goals for Ecological Endpoints; ES/ER/TM-162/R2. August 1997. Secondary Chronic Criteria.

6.4.3 Sediment

No cleanup goals for sediment and surface water were developed in the ROD. The RAOs for sediment specified in the ROD include:

- Protect invertebrates and mammals ingesting contaminated prey from direct contact with, or ingestion of, sediment having constituent concentrations exceeding a hazard index of 1.

- Prevent releases of constituents from sediments that would result in surface water levels exceeding federal AWQCs, Connecticut Water Quality Standards (WQS), or in their absence, a hazard index of 1.

To evaluate the compliance with the ROD RAOs, a comparison of the 2012 sediment and surface water analytical results was performed against AWQCs/WQSs, or other suitable screening value.

The sediment results indicate that one (SED-3) of the four samples contained COC, bis(2-ethylhexyl)phthalate at a concentration (590 µg/kg) above a sediment screening value (180 µg/kg – derived from the EPA Region III Freshwater Sediment Screening Benchmarks). This sample is located approximately 400 feet upstream of the Site, and likely is not associated with a Site-related release. Additionally, only one sediment sample from a downstream area (SED-9) collected in 2003 contained a detectable bis(2-ethylhexyl)phthalate concentration of 590 µg/kg. No other detectable concentrations of COCs were reported in sediment samples.

As with previous sediment sampling performed at the Site, the laboratory reporting limits for numerous chemicals were not below ecological screening criteria. The following table summarizes the substances with reporting limits in excess of sediment screening values:

Table 6-5
Summary of Non-Detect 2012 Sediment Sample Results with Reporting Limits Exceeding Sediment Benchmarks
Barkhamsted-New Hartford Landfill
Barkhamsted, New Hartford, Connecticut

Chemical	Number of Reporting Limits in Excess of Sediment Benchmarks(1)	Is the Chemical Identified as a Site COC in the ROD?
4,4'-DDD	1	N
4,4'-DDE	4	N
Aldrin	4	N
beta-BHC	3	N
Dieldrin	4	N
Endosulfan I	4	N
Endrin	4	N
gamma-BHC (Lindane)	4	N
Heptachlor epoxide	4	N
Toxaphene	4	N
2,4-Dimethylphenol	4	Y
2-Methylnaphthalene	4	N
Bis(2-ethylhexyl)phthalate	1	Y
Naphthalene	1	N
PCBs	4	N

Notes:

1 – Sediment benchmarks used for evaluation are EPA Region III Freshwater Sediment Screening Benchmarks: http://www.epa.gov/reg3hwmd/risk/eco/btag/sbv/fwsed/screenbench.htm#download

Because the reporting limits for many of the COCs are above the sediment benchmarks, an evaluation of the hazard index cannot be performed.

6.4.4 Leachate Seep

Seep samples S1, S3, and S6, are collected annually each spring, unless the seeps are dry. Between 2008 and 2012, S1 was dry and no samples were collected. S6 was dry in 2012; therefore no samples were collected from S6 in 2012.

Sporadic detections of several VOCs, SVOCs, and one pesticide were reported in seep samples between 2008 and 2012. In general these detections were low and below the groundwater cleanup goals established for the Site; however, consistent detections of 2,4-dimethylphenol and benzene were noted in seep sample location S3.

The benzene detections in seep sample location S3 between 2008 and 2011 decreased from 0.94 J µg/L to non-detect at 0.4 µg/L in 2011. The reporting limit for benzene at this location in 2012 was 4 µg/L, which is well above the groundwater cleanup goal. Therefore it is not possible to determine if this downward trend continues.

Detections of 2,4-dimethylphenol in seep location S3 between 2008 and 2012 have increased from a non-detect of 5.4 µg/L to 12 µg/L, which is above the groundwater cleanup goal (10 µg/L).

Major inorganic components of typical municipal solid waste landfills include antimony, iron, manganese, and zinc. Seep sample concentrations of iron and manganese dominate the remaining inorganic constituents. Results of monitoring performed between 2008 and 2012 suggest that the iron and manganese concentrations in seep samples are relatively consistent or possibly declining. An evaluation of the seep sample iron and manganese results from the initiation of monitoring in 2003 to the most-recent round April 2012 indicate that the concentrations are increasing slightly.

The anticipated outcome of the seep monitoring after landfill capping was that the seeps were expected to dry out. Since the landfill was capped, many of the seeps have dried; however, seep location S3 remains.

6.5 Site Inspection

A Site Inspection was performed on April 18, 2013 (see Appendix F). The following bullets summarize the observations and findings made during the Site Inspection (see Figure 13):

- No development has been undertaken at the Site since the previous Five-Year Review. The Town Garage located downgradient of the landfill and along New Hartford Road was reconstructed in 2011. No other developments were noted at or near the Site.

- An area of damaged fence was noted along the northeastern landfill perimeter.

- No evidence of trespassing was noted on the landfill cap.

- The landfill appeared to be in satisfactory condition. No erosion, settlement, slope failures, or oversized vegetation was observed on the landfill. A small animal burrow was noted in the north central portion of the landfill; however, this burrow did not penetrate the vegetated drainage layer. According to the 1999 Landfill Operations and Maintenance Manual Section 2.1.3, evidence of a burrowing animal requires traps to be set to remove the animal.

- A broken drainage pipe was observed in the center of the landfill. Additionally, a nearby drainage pipe was pitched in the wrong direction. Neither of these conditions appeared to have resulted in erosion or other damage.

- An apparent iron-stained seep was observed in a drainage channel located along the southwestern perimeter of the landfill. This seep was approximately 40 feet long.

- Monitoring wells included in the long-term monitoring program were locked and in good condition. Non-critical monitoring wells MW-114S and MW-114B were not secured. Non-critical monitoring well MW-119F could not be located.

6.6 Interviews

Interviews were conducted with the Town of Barkhamsted First Selectman (Mr. Donald Stein), RRDD Administrator (Mr. Jim Hart), CTDEEP Project Manager (Mr. Maurice Hamel), and nearby residents. The interviews are summarized below and are presented in detail in Appendix G.

The following is a summary of the Town of Barkhamsted interview:

- The Town received no complaints regarding the Site since it was converted from a landfill to a transfer station;
- No adjustment to the municipal zoning of the Site and nearby properties was made;
- The newly constructed Town Garage is supplied with water from a drinking water supply well recently installed southeast of the Site and outside of the ELUR;
- The Town was unaware of any new wells or changes to existing wells within the ELUR;
- The Town was not notified of any issues pertaining to the Site; and
- The Town was adequately informed regarding the Site, and had no need to contact anyone outside of RRDD to obtain information.

The following is a summary of the interview with the RRDD Administrator:

- RRDD believes that the remedy is working well, and that no one in the Town pays it much heed;

- RRDD is not currently pursuing development of the property or adjacent parcels. Several years ago, RRDD considered development of unimpacted property; however, it determined that the necessary infrastructure improvements would limit development options and scrapped the idea. RRDD is examining the possibility of constructing a solar array on the landfill; however, this is in very preliminary discussions and not imminent;

- The landfill did not encounter significant operational issues, but experienced a lower than normal flow of leachate into the collection and storage system. In recent years the volume of leachate removed from the storage tank amounted to approximately 6,000

gallons every 18 months. In prior years, approximately 18,000 gallons of leachate removed annually;

- No trespassing or vandalism was noted at the Site; and

- RRDD installed a new drinking water well on property located southeast of the landfill that was purchased from the Connecticut Department of Transportation (CTDOT). The well was installed in November 2012 and went on-line in December 2012. Samples of the water were collected prior to initiating use as a potable supply. The sample results indicated that no VOCs or SVOCs were detected above reporting limits and minimal concentrations of metals were detected, none of which exceeded groundwater cleanup goals. RRDD intends to instruct their contractor to include the new drinking water well in their regular long-term monitoring approach.

The following is a summary of the interview with Mr. Hamel of CTDEEP:

- No issues were brought to the department's attention regarding the Site;

- Although the CTDEEP is in the process of making modifications to its regulations, none of the proposed changes will impact the protectiveness of the remedy;

- Although the CTDEEP received occasional progress reports, none of the reports included analytical monitoring results. In order to allow the public access to updated Site data, CTDEEP suggests that analytical data be included in the progress reports, when samples are collected; and

- Mr. Hamel did mention in subsequent correspondence (August 8, 2013) with Almerinda Silva, EPA Remedial Project Manager that the Town has inquired about development of a portion of the property within the footprint of the land use restriction. CTDEEP responded to questions from the Town's environmental attorney regarding the potential for modifications to the land use restrictions to allow the construction of ball fields.

7.0 TECHNICAL ASSESSMENT

This section provides a technical assessment of the remedy implemented at the Site, as outlined in the *Comprehensive Five-Year Review Guidance*. The remedy was evaluated based on its function in accordance with decision documents, its adherence to valid risk data and scenarios, its adherence to Applicable or Relevant and Appropriate Requirements (ARARs), and any other information that could have affected the remedy's protectiveness.

7.1 Question A: Is the Remedy Functioning as Intended by the Decision Documents?

Yes, the remedy is functioning as intended. A review of relevant documentation, ARARs, risk assumptions, and the result of the Site Inspection suggest that the remedy is functioning as intended. Landfill operations and maintenance were initiated shortly after completion of the NTCRA, and have since been continued. Long-term groundwater monitoring was initiated in 2003 and has continued on a semi-annual basis since that time. Between 2003 and 2004, ELURs were placed on several parcels on and near the landfill property.

Remedial Action Performance and Monitoring Results. The selected remedy for the Site is MNA and long-term monitoring. Since initiation of the monitoring program, groundwater contaminant concentrations have decreased, and the plume limits have retracted; however, the limit of the groundwater contamination exceeding cleanup goals extends beyond the limit of the landfill (i.e., the compliance boundary).

The effectiveness of natural attenuation processes at the Site was evaluated using the techniques published by EPA in Wilson (2011) and Pope et al. (2004). The 2011 guidance details the use of statistical methods for projecting whether long-term remedial goals (i.e., RAOs) will be met based on recent concentration trends for COCs in groundwater. These statistical methods were used in conjunction with the 2004 guidance, which identifies eight methods to demonstrate MNA progress in achieving remedial objectives:

1. Demonstrate that natural attenuation is occurring according to expectations using temporal trends in individual wells, an estimate of contaminant mass reduction, comparison of observed contaminant distributions with predicted milestones or comparison of field-scale attenuation rates;

2. Detect changes in environmental conditions that may reduce the efficacy of any natural attenuation processes by reviewing geochemical or hydrogeological parameters;
3. Identify any potentially toxic and/or mobile transformation products;
4. Verify that the plume is not expanding downgradient, laterally or vertically;
5. Verify no unacceptable impacts to downgradient receptors;
6. Detect new releases of contaminants, if applicable;
7. Demonstrate the efficacy of institutional controls; and
8. Verify attainment of remediation objectives.

Appendix C describes the detailed evaluation using the above methodologies. Based on current attenuation rates, residual concentrations of benzene at monitoring wells MW-101S, MW-1S, and MW-4R; TCE at monitoring well MW-120B; 2,4-dimethylphenol at monitoring well MW-1S; arsenic at monitoring well MW-101S; and manganese at monitoring wells MW-101S, MW-101B, MW-4S, MW-4R, MW-5S, MW-5B, and S-3 may not reach the respective cleanup goals before December 31, 2017. These monitoring wells are located within the landfill footprint and immediately downgradient; they are not located near any identified human or ecological receptors. The original estimated time for groundwater concentrations to reach applicable cleanup goals (approximately 16 years) was based on only two COCs (4-methylphenol and 2-butanone), and did not account for the time needed for all COCs to reach applicable cleanup goals. Additionally, naturally occurring arsenic and manganese commonly are found within subsurface soils, and elevated concentrations in groundwater may occur as a result of other landfill associated processes.

Operations and Maintenance Costs. Operations and maintenance costs were not available for this Five-Year Review.

Indicators of Remedy Problems. The remedy has partially achieved RAOs; however, additional reductions in groundwater COC concentrations are needed before groundwater RAOs are achieved. Additionally, the estimated time to cleanup originally anticipated in the ROD likely will not be achieved for several COCs in several monitoring locations. Although it appears that the remedy is functioning, and that environmental conditions continue to favor the continued natural attenuation of COCs, the time to achieve remediation goals will not be achieved. Based on the MNA analyses included in Appendix C, several compliance wells will require at least 10 additional years of MNA prior to achieving cleanup goals. The inorganic

constituents, arsenic and manganese likely will continue to remain above cleanup goals until the organic contaminant mass has been exhausted.

Implementation of Institutional Controls. The ELURs attached to the property deeds of four parcels are summarized in Section 4.2 of this report. No unauthorized uses of any of these properties were observed during the Site visit or documented during interviews of local and state officials with knowledge of the Site.

Based upon the April 2012 groundwater sample dataset, the limit of COC-contaminated groundwater in the shallow overburden and bedrock aquifers is within the boundaries of the ELURs, and is considered in compliance with the remedy.

7.2 Question B: Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives Used at the Time of the Remedy Selection Still Valid?

Yes, the exposure assumptions (pathways) and toxicity data used at the time of the remedy selection for some media remain valid. In some cases, specific pathways were not considered. However, impacts from any changes are minimal as described below.

Toxicity values, exposure pathways, and methods of evaluating risk have changed since the time of the remedy selection. Potential inhalation of VOCs during household water use, ingestion of and dermal contact with surface water and sediment, inhalation of dust, and the vapor intrusion pathway have not been evaluated previously. Vapor intrusion was not evaluated at the time of the RI, but the location of nearby occupied structures is upgradient or cross gradient and at some distance from the Site. In addition, the evaluation in the 2008 Five-Year Review of data from wells near the on-Site office building indicates that this pathway is not currently of concern. Although toxicity values and methods of evaluating risk have changed since the time of the remedy selection and the newly identified potential pathways of inhalation of VOCs during household water use, ingestion of and dermal contact with surface water and sediment, and inhalation of dust have not been evaluated previously; these changes do not impact the protectiveness of the remedy. See below for more detailed clarification.

The groundwater clean-up levels selected at the time of the remedy selection remain valid. The ROD established background concentrations as groundwater cleanup levels for the Site, per Connecticut Remediation Standard Regulations (RSRs), Section 22a-133k-3(a) and compliance with federal maximum contaminant levels (MCLs), federal maximum contaminant level goals (MCLGs), Connecticut RSRs, and Connecticut Water Quality Standards as ARARs. Each of the background concentrations selected as groundwater cleanup levels in the ROD are less than or equal to the listed ARARs.

The RAOs used at the time of the remedy selection are still valid. The RAOs established in the ROD are to protect benthic invertebrates and mammals ingesting contaminated prey from direct contact with, or ingestion of, contaminated sediment, prevent releases of constituents from sediments that would result in contaminated surface water, prevent the ingestion of or dermal contact with contaminated groundwater, and restore groundwater beyond the compliance boundary (limits of the landfill).

The remedial actions at this site address these RAOs through the landfill cap and leachate collection system, which prevents contact with contaminated soil and prevents migration of contamination; institutional controls that prevent contact with contaminated soil and groundwater; and MNA, which is demonstrating progress in reducing the area of the plume.

<u>Changes in Standards or To-Be-Considered Requirements (TBCs)</u>

The 2001 ROD set forth the following chemical-specific ARARs for the selected remedy.

- Safe Drinking Water Act (SDWA);
  - MCLs
  - MCLGs
- Connecticut Water Quality Standards;
- Connecticut RSRs; and
- Connecticut Standards for Quality and adequacy of Public Drinking Water.

There have been no changes to the ARARs requirements identified in the 2001 ROD that affect the cleanup standards for the remedy. Although the MCLs were updated in 2009, Connecticut Water Quality Standards were updated in 2011, and revised Connecticut RSRs were for

promulgated in 2013; the changes therein do not affect cleanup action or levels at the Site. The ROD established background concentrations as groundwater cleanup levels for the Site, per Connecticut RSRs, Section 22a-133k-3(a). Each of the background concentrations selected as cleanup levels in the ROD were less than or equal to the listed ARARs.

Changes in Exposure Pathways

The human health exposure pathways considered in the 1995 Human Health Risk Assessment (HHRA) performed during the RI included: (1) ingestion and dermal contact with soil and (2) ingestion and dermal contact with groundwater as drinking water.

Potential inhalation of dust was not evaluated previously in the RI. The presence of the properly maintained cap precludes this exposure pathway.

Potential inhalation of volatiles during household water use was not evaluated previously in the RI. No individuals are currently exposed to contaminated groundwater on-Site. Nearby commercial and residential areas use off-Site wells for potable water. These off-Site potable wells are not within the zone of Site-related groundwater plumes. See Figures 7 through 12. Groundwater at the Site is estimated to flow to the northeast. Downgradient of the Site, groundwater flow is more easterly toward the Farmington River. Because of the affected groundwater at the Site, an ELUR was placed on the Site to document the groundwater contamination, which was recorded at the Barkhamsted Land Record on February 24, 2004. In addition, the ELUR noted that groundwater is not to be used for drinking or other purposes, that there is to be no building on the cap or residential use immediately downgradient, that there is no disturbance to the cap and it is to be properly maintained to prevent exposure.

Additional ELURs were recorded on the property deeds of several downgradient parcels (see Section 4.2) to prevent the use of groundwater for drinking or other purposes. Based upon the most-recent dataset (2012), the limit of VOC-contaminated groundwater in the shallow aquifer was within the boundaries of the ELURs, and is considered in compliance with the remedy.

The HHRA did not evaluate ingestion of and dermal contact with to surface water and sediment. However, there was no evidence of human activity along the Unnamed Brook or at the

Unnamed Pond. Trespasser presence is unlikely because the area is not easily accessible. The area is remote with the only access through the landfill.

From the evaluation of additional human exposure pathways discussed above, a re-evaluation of the current remedy is not necessary, since the remedy relies on preventing exposures to soil and groundwater and prevents or reduces migration of contaminants to nearby water bodies (thereby prevents migration of contaminants to surface water and sediment). The landfill cap, and leachate collection system, security fence, and institutional controls all address both the exposure scenarios identified in the HHRA and the additional pathways identified above.

The vapor intrusion pathway was not evaluated in the HHRA. However, the 2008 Five-Year Review included an evaluation of vapor intrusion for the on-Site office building. No occupied buildings currently exist on the landfill. The nearest homes are located cross-gradient from the Site and an institutional control is in place preventing construction of new buildings at the landfill as well as the surrounding RRDD-owned property. The only enclosed structures located on-Site, or downgradient of the landfill, are the on-Site office building of the recycling area and the Town Garage office. The 2008 Five-Year Review evaluation of vapor intrusion for the on-Site office building reviewed data from wells near this building and concluded that the vapor intrusion pathway was not of concern. Recent sampling of wells near both the on-Site office building and the Town Garage office indicated the plume receded such that it does not underlie these structures, (see Figures 7 though 12) confirming that the vapor intrusion pathway is not a concern. If land use changes, vapor intrusion would need to be re-evaluated.

The Baseline Ecological Risk Assessment in the RI evaluated risks posed to wildlife and aquatic organisms from exposures to sediment and surface water in the Unnamed Brook and Unnamed Pond as well as soil in seeps. Receptors included fish, benthic invertebrates, amphibians, mammals, birds, and soil invertebrates. After completion of the Baseline Ecological Risk Assessment, in 1998 the landfill cap and leachate collection system were completed as a NTCRA. In 2000, EPA updated the ecological risk assessment using post-NTCRA sampling data. The assessment concluded that ecological risks had been reduced and that the only possible remaining ecological risks were to benthic invertebrates from potential exposures to sediment. During the Site visit, there was some evidence of iron-stained seeps beyond the limits of the landfill cap, indicating the leachate collection system is not 100% effective in preventing contaminant migration. On-going monitoring of sediment and surface water for the protection of

aquatic organisms is conducted annually. The analytical results suggest that the remedy is largely successful at preventing contaminants from migrating to sediments and surface water. Several substances (primarily metals) exceeded ecological benchmarks, and the laboratory quantitation limits for several substances failed to meet ecological criteria.

Changes in Toxicity and Other Contaminant Characteristics

Since the time of the 1995 HHRA in the RI, new toxicological studies and information have become available for many chemicals. EPA has updated toxicity information for several contaminants evaluated for the Site. At the time of the 1995 HHRA, oral Cancer Slope Factors (CSFs) and Reference Doses (RfDs) were used to evaluate ingestion and dermal exposures. EPA continues to use CSFs and RfDs for evaluating ingestion and dermal exposures. However, the oral values for several of the contaminants evaluated for the Site have been updated since 1995 and EPA has issued the *Risk Assessment Guidance for Superfund (RAGS): Volume I Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment)* (EPA, 2004), which provided guidance on developing dermal toxicity factors. Tables 7-1 and 7-2 present toxicity values that have changed since the HHRA and the likely impacts of these changes to risk. As shown on these tables, the changes to the toxicity values are likely to increase for some contaminants and decrease for others. In general, the Site risks will change based on the changes of toxicity values.

Table 7-1
Summary of Cancer Toxicity Factor Changes
Barkhamsted-New Hartford Landfill
Barkhamsted, New Hartford, Connecticut

Chemical	Oral Cancer Slope Factor in HHRA/ROD	Current Applicable Oral Cancer Slope Factor	Impacts to Risk	Dermal Cancer Slope Factor in HHRA/ROD	Current Applicable Dermal Cancer Slope Factor[1]	Impacts to Risk
	$(mg/Kg\text{-}d)^{-1}$	$(mg/Kg\text{-}d)^{-1}$		$(mg/Kg\text{-}d)^{-1}$	$(mg/Kg\text{-}d)^{-1}$	
Arsenic	1.5	1.5	NC	1.5	1.5	NC
Chromium (VI)	NE	0.5[3]	increase	NE	0.0125	increase
1,4-Dichlorobenzene	0.024	0.0054[2]	decrease	0.024	0.0054	decrease
Benzene	0.29	0.055	decrease	0.29	0.055	decrease
1,2-Dichloroethane	0.091	0.091	NC	0.091	0.091	NC
1,2-Dichloropropane	0.068	0.036[2]	decrease	0.068	0.036	decrease
Chloroethane	0.0029	withdrawn	decrease	0.0029	withdrawn	decrease
Chloroform	0.0061	0.031[2]	increase	0.0061	0.031	increase
Chloromethane	0.013	withdrawn	decrease	0.013	withdrawn	decrease
Dibromochloro-methane	0.084	0.084	NC	0.084	0.084	NC
Methylene chloride	0.0075	0.002	decrease	0.0075	0.002	decrease
Trichloroethene	0.011	0.046	increase	0.011	0.046	increase
Vinyl chloride	1.9	0.72	decrease	1.9	0.72	decrease
Bis(2-ethylhexyl) phthalate	0.014	0.014	NC	0.014	0.014	NC

Notes:

NE – Not evaluated in the HHRA.
NC – No change.
Current oral cancer slope factors were obtained from EPA's Integrated Risks Information System database (IRIS), 2013 unless otherwise noted.
1 – Dermal cancer slope factors derived by multiplying the oral cancer slope factor times the GI absorption factor (EPA, 2004).
2 –The California Environmental Protection Agency (OEHHA) Office of Environmental Health Hazard Assessment's Cancer Potency Values from July 21, 2009.
3 – The New Jersey Department of Environmental Protection (NJDEP).
mg/Kg-d - Milligrams per kilogram per day

Table 7-2
Summary of Non-Cancer Toxicity Factor Changes
Barkhamsted-New Hartford Landfill
Barkhamsted, New Hartford, Connecticut

Chemical	Oral Reference Dose in HHRA/ROD	Current Applicable Oral Reference Dose	Impacts to Risk	Dermal Reference Dose in HHRA/ROD	Current Applicable Dermal Reference Dose	Impacts to Risk
	mg/Kg-d	mg/Kg-d		mg/Kg-d	mg/Kg-d	
Arsenic	0.0003	0.0003	NC	0.0003	0.0003	NC
Chromium (VI)	0.003	0.003	NC	0.003	0.000075	increase
Manganese	0.024	0.024	NC	0.024	0.00096	increase
Acetone	0.1	0.9	decrease	0.1	0.9	decrease
Benzene	0.003	0.004	decrease	0.003	0.004	decrease
2-Butanone	0.6	0.6	NC	0.6	0.6	NC
1,2-Dichloroethane	0.03	0.006[2]	increase	0.03	0.006	increase
1,2-Dichloropropane	0.0011	0.09[3]	decrease	0.0011	0.09[3]	decrease
Chloroethane	0.4	withdrawn	decrease	0.4	withdrawn	decrease
Chloroform	0.01	0.01	NC	0.01	0.01	NC
Dibromochloro-methane	0.02	0.02	NC	0.02	0.02	NC
4-Methyl-2-pentanone	0.08	0.08	NC	0.08	0.08	NC
Methylene chloride	0.06	0.006	increase	0.06	0.006	increase
Toluene	0.2	0.08	increase	0.2	0.08	increase
Trichloroethene	0.006	0.0005	increase	0.006	0.0005	increase
Vinyl chloride	NE	0.003	increase	NE	0.003	increase
Bis(2-ethylhexyl) phthalate	0.02	0.02	NC	0.02	0.02	NC
1,4-Dichlorobenzene	0.03	0.07[3]	decrease	0.03	0.07[3]	decrease
2,4-Dimethylphenol	0.02	0.02	NC	0.02	0.02	NC
4-Methylphenol	0.005	0.1[3]	decrease	0.005	0.1[3]	decrease

Notes:

NE – Not evaluated in the HHRA.
NC – No change.
Current oral reference doses were obtained from EPA's Integrated Risks Information System database (IRIS), 2013 unless otherwise noted.
1 – Dermal reference doses derived by multiplying the oral reference dose times the GI absorption factor (EPA, 2004).
2 – The Provisional Peer Reviewed Toxicity Values (PPRTVs) derived by EPA's Superfund Health Risk Technical Support Center (STSC) for the EPA Superfund program.
3 –The Agency for Toxic Substances and Disease Registry (ATSDR) minimal risk levels (MRLs).
mg/Kg-d - Milligrams per kilogram per day

Although re-calculation of risks using current toxicity factors may differ from those previously estimated; the remedy, by preventing exposures, remains protective for the pathways evaluated in the HHRA.

Changes in Risk Assessment Methods

Since the 1995 HHRA and the 2001 ROD, there are some changes in calculating risks from exposures to soil, water, and air. Recommendations for dermal permeability factors and revised guidance on dermal exposure evaluations have changed. EPA *Risk Assessment Guidance for Superfund (RAGS): Volume I Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment)* (EPA, 2004) recommends developing dermal toxicity factors from oral toxicity factors with chemical-specific adjustment factors to convert the administered toxicity factors to absorbed toxicity factors. The dermal guidance also provides chemical-specific dermal absorption factors and recommended exposure assumptions to aid in estimation of dermal dose estimates. In 2009, EPA finalized the *Risk Assessment Guidance for Superfund (RAGS): Volume I Human Health Evaluation Manual (Part F, Supplemental Guidance for Inhalation Risk Assessment)* (EPA, 2009) recommending the use of inhalation unit risk factors and reference concentrations in conjunction with average daily concentration estimates for evaluating inhalation exposures.

Methods for calculating risks for specific contaminants or groups of contaminants have changed; including evaluating early childhood cancer risks from contaminants that act via a mutagenic mode of action (EPA's *Guidelines for Carcinogen Risk Assessment* and *Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens*). Among the Site contaminants of concern, TCE and vinyl chloride are considered to act via a mutagenic mode of action. Applying this new method of evaluating cancer risk to TCE and vinyl chloride would result in higher risks from exposures to these two contaminants at the Site.

Although using current risk assessment methods may result in higher estimated risks from exposures to contaminants at the Site than risks previously estimated in the 1995 HHRA, the remedy remains protective for the pathways evaluated in the HHRA by preventing exposures.

New/Emerging Contaminants and/or Contaminant Sources

No new contaminant sources have been identified since the remedy was established.

Expected Progress Towards Meeting RAOs

The 2001 ROD established the following RAOs:

- Protect benthic invertebrates and mammals ingesting contaminated prey from direct contact with, or ingestion of, sediment having constituent concentrations exceeding a hazard index of 1.

- Prevent releases of constituents from sediments that would result in surface water levels exceeding federal AWQCs, CT WQS, or in their absence, a hazard index of 1.

- Prevent the ingestion or dermal contact with groundwater having constituent concentrations exceeding USEPA Safe Drinking Water Act MCLs, or in their absence, the more stringent of an excess cancer risk of $1x10^{-6}$ for each substance or a hazard quotient of 1 for each non-carcinogenic substance.

- Restore groundwater beyond the compliance boundary (limits of the landfill) to MCLs or any more stringent Connecticut RSRs (background concentrations), or in their absence, the more stringent of an excess cancer risk of 1×10^{-6} for each substance or a hazard quotient of 1 for each non-carcinogenic substance.

The remedial actions at this Site address these RAOs through the landfill cap and leachate collection system, which prevent contact with contaminated soil and prevent migration of contamination; institutional controls that prevent contact with contaminated soil and groundwater; and monitored natural attenuation, which is demonstrating progress in reducing the area of the plume.

As noted in Question A, although monitored natural attenuation is demonstrating reducing concentrations and receding extent of the plume, the time to reach the cleanup goals, before December 31, 2017, along the compliance boundary (limits of the landfill) is longer than

expected at the time of the ROD. Based on the MNA analyses included in Appendix C, several compliance wells will require at least 10 additional years of MNA prior to achieving cleanup goals. The inorganic constituents, arsenic and manganese will likely continue to remain above cleanup goals until the organic contaminant mass has been exhausted.

7.3 Question C: Has Any Other Information Come To Light That Could Call Into Question the Protectiveness of the Remedy?

No. Potable supply well samples collected from nearby drinking water supply wells did not indicate the presence of Site-related contamination. A hydrogeologic model for the Site was not constructed during the performance of previous investigations/assessments, and no model is presented herein. Without a hydrogeologic model for the Site, the impact of the installation of the new RRDD potable supply well on Site contamination cannot be fully evaluated. An April 2013 sample from the RRDD potable supply well contained no detectable concentrations of VOCs or SVOCs, and detected metals concentrations were well below cleanup goals and MCLs. It may be concluded that at the time of the sample collection, the new well has not been impacted by Site-related contamination. The new drinking water well should be included in future long-term monitoring events. Additionally, anecdotal evidence provided by RRDD suggests that the new owners of 9 New Hartford Road may install a bedrock drinking water well. This well would be outside the ELUR. If installed, this new well should be included in the monitoring program.

To date, groundwater samples collected from monitoring wells MW-102B and MW-115B (easternmost currently monitored bedrock monitoring wells) have not identified COC concentrations in excess of ROD Cleanup Goals. Thus, the current bedrock monitoring program is adequate to monitor the groundwater between the landfill and the drinking water wells, including any new well installed at 9 New Hartford Road.

7.4 Technical Assessment Summary

The discussions related to Questions A, B, and C above indicate that, in general, the remedy for the Site is protective under current and future exposure assumptions. The basis for this conclusion is summarized below.

Question A: The remedy is functioning as intended. A review of relevant documentation, ARARs, risk assumptions, and information gathered during the Site Inspection suggest that the remedy is functioning as intended. Landfill operations and maintenance were initiated shortly after completion of the NTCRA, and have since been continued. Long-term groundwater monitoring was initiated in 2003 and has continued on a semi-annual basis since that time. Between 2003 and 2004, ELURs were placed on several parcels on and near the landfill property. No development within the ELURs has been undertaken which would call into question the protectiveness of the remedy.

The effectiveness of natural attenuation processes at the Site was evaluated using the techniques published by EPA in Wilson (2011) and Pope et al. (2004). The following is a summary of the MNA evaluation findings, and a more detailed discussion of this evaluation is provided in Question A.

MNA has not restored groundwater beyond the compliance boundary to below cleanup goals. The COCs that remain above the applicable cleanup goals include benzene, methylene chloride, toluene, TCE, chloroethane, 2,4-dimethylphenol, 1,4-dichlorobenzene, arsenic, and manganese.

Based on current attenuation rates, residual concentrations of benzene at monitoring wells MW-101S, MW-1S, and MW-4R; TCE at monitoring well MW-120B; 2,4-dimethylphenol at monitoring well MW-1S; arsenic at monitoring well MW-101S; and manganese at monitoring wells MW-101S, MW-101B, MW-4S, MW-4R, MW-5S, MW-5B, and S-3 may not reach the respective cleanup goals before December 31, 2017.

Question B: Toxicity values, exposure pathways, and methods of evaluating risk have changed since the time of the remedy selection. Although exposure pathways, methods of evaluating risk, and toxicity data have changed since the time of the remedy selection, the remedial actions at this Site address these changes through prevention and/or reduction of potential exposures.

The groundwater clean-up levels selected at the time of the remedy selection remain valid. The ROD established background concentrations as groundwater cleanup levels for the Site. Each

of the background concentrations selected as groundwater cleanup levels in the ROD is less than or equal to the listed ARARs.

The RAOs used at the time of the remedy selection are still valid.

The remedial actions at this Site address these RAOs through the landfill cap and leachate collection system, which prevents contact with contaminated soil and prevents migration of contamination; institutional controls that prevent contact with contaminated soil and groundwater; and MNA, which is demonstrating progress in reducing the area of the plume.

Question C: With the exception of the installation of a drinking water supply well by RRDD on property located southeast of the Site (and outside of the ELUR), no changes have occurred at the Site or on nearby properties.

8.0 ISSUES

This section provides a summary of the issues identified during this third Five-Year Review. Recommendations and follow-up actions are presented in Section 9.0. Table 8-1 provides a summary of the issues and the protectiveness associated with them.

Table 8-1
Issues
Barkhamsted-New Hartford Landfill
Barkhamsted, New Hartford, Connecticut

Issues	Affects Current Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
Minor Landfill Repairs	N	Y
Long-Term Monitoring Analytical Quantitation Limits	N	Y
Long-Term Monitoring Modifications	N	Y
The groundwater remedy will likely not achieve cleanup goals within the timeframe stated in the ROD	N	Y

9.0 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

In conclusion, the physical site conditions remain essentially unchanged from those observed during the previous Five-Year Reviews. The RRDD does not currently have plans to modify the Site conditions. The following recommendations are offered:

Table 9-1
Recommendations/Follow-up Actions
Barkhamsted-New Hartford Landfill
Barkhamsted, New Hartford, Connecticut

Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Follow-up Actions: Affects Protectiveness (Y/N)	
				Current	Future
Repair the damaged perimeter fencing in the northeast portion of the landfill, fill animal burrows and inspect for additional burrows, repair drainage features if necessary	RRDD	EPA and CTDEEP	Sept. 2014	N	Y
Evaluate selected analytical methods to ensure that the laboratory reporting limits meet the groundwater cleanup goals and ecological benchmarks for surface water and sediment. Once sufficient sediment data has been collected, perform a sediment hazard index analysis to evaluate compliance with sediment RAOs.	RRDD	EPA and CTDEEP	Sept. 2014	N	Y
Modify the long-term monitoring plan to include collection of drinking water samples from the new “Garage Well”. It is recommended that samples be analyzed for the same parameters as the remaining drinking water samples.	RRDD	EPA and CTDEEP	Sept. 2014	N	Y
Continue to verify that the MNA process remains on-going, and develop a revised estimate of time required to achieve cleanup goals.	RRDD	EPA and CTDEEP	Sept. 2016	N	Y

Notes:

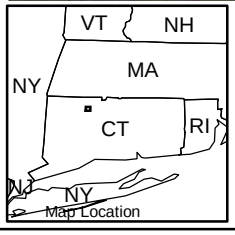
RRDD – Regional Refuse Disposal District 1
EPA – U.S. Environmental Protection Agency
CTDEEP – Connecticut Department of Energy and Environmental Protection

10.0 PROTECTIVENESS STATEMENTS

The remedy at the Site currently protects human health and the environment because remedial activities completed to date adequately addressed all exposure pathways that could result in unacceptable risk. There are no current exposures to contaminated groundwater originating from the site; the landfill cap continues to be an effective remedy; a long-term monitoring program is in place; and institutional controls have been recorded. However, in order for the remedy to be protective in the long-term, the following actions need to be taken: 1) repair the northeastern portion of the landfill perimeter fence; 2) fill in animal burrows and repair drainage features on the cap; 3) select analytical methods to ensure laboratory reporting limits meet all COC cleanup goals for groundwater and ecological benchmarks for surface water and sediment; 4) perform the sediment hazard index analysis to evaluate compliance with sediment RAOs; 5) as the current estimate to achieve cleanup goals will not be met, verify that monitored natural attenuation processes continue to be effective and develop a revised estimate of time to achieve cleanup goals, and continue to maintain the ELURs; and 6) include drinking water samples from the new “Garage Well” into the long-term monitoring plan.

11.0 NEXT REVIEW

A fourth Five-Year Review for the Barkhamsted Landfill Site will be conducted in 2018.



USGS Topographic Map
New Hartford, Connecticut
1956; Photorevised 1984

0 500 1,000 2,000
Feet
1 inch = 2,000 feet

N

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FIGURE 1

SITE LOCUS
BARKHAMSTED LANDFILL
BARKHAMSTED, CONNECTICUT

PREPARED BY: DFM
CHECKED BY: BA
PROJECT NO. 80086
DATE: JUNE, 2013

Path: R:\80000 Task Orders\80086 Barkhamsted FYR\Technical Data\GIS\Maps_and_Figures\MSR\Draft\Figure_01_Site_Locus.mxd Date Printed: 8/28/2013

Notes:

1.Location of all features is approximate. Map is for reference purposes only. Nobis Engineering, Inc. makes no claims, warranties, representations, expressed or implied, relating to the completeness, accuracy, or reliability of the data shown.

Legend

Unnamed Stream

Regional Refuse Disposal District Property Boundary

0 250 500 1,000
Feet

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FIGURE 2

SITE PLAN
BARKHAMSTED LANDFILL
BARKHAMSTED/NEW LONDON, CONNECTICUT

PREPARED BY: DFM	CHECKED BY: BA
PROJECT NO. 80086	DATE: JUNE 2013 Rev 00

Path: R:\80000 Task Orders\80086 Barkhamsted FYR\Technical Data\GIS\Maps_and_Figures\MSR\Draft\Figure_02_Site_Plan.mxd Date Printed: 8/28/2013

Legend

- Unnamed Stream
- Regional Refuse Disposal District Property Boundary
- Environmental Land Use Restriction Limits

Notes:

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0 250 500 1,000
Feet

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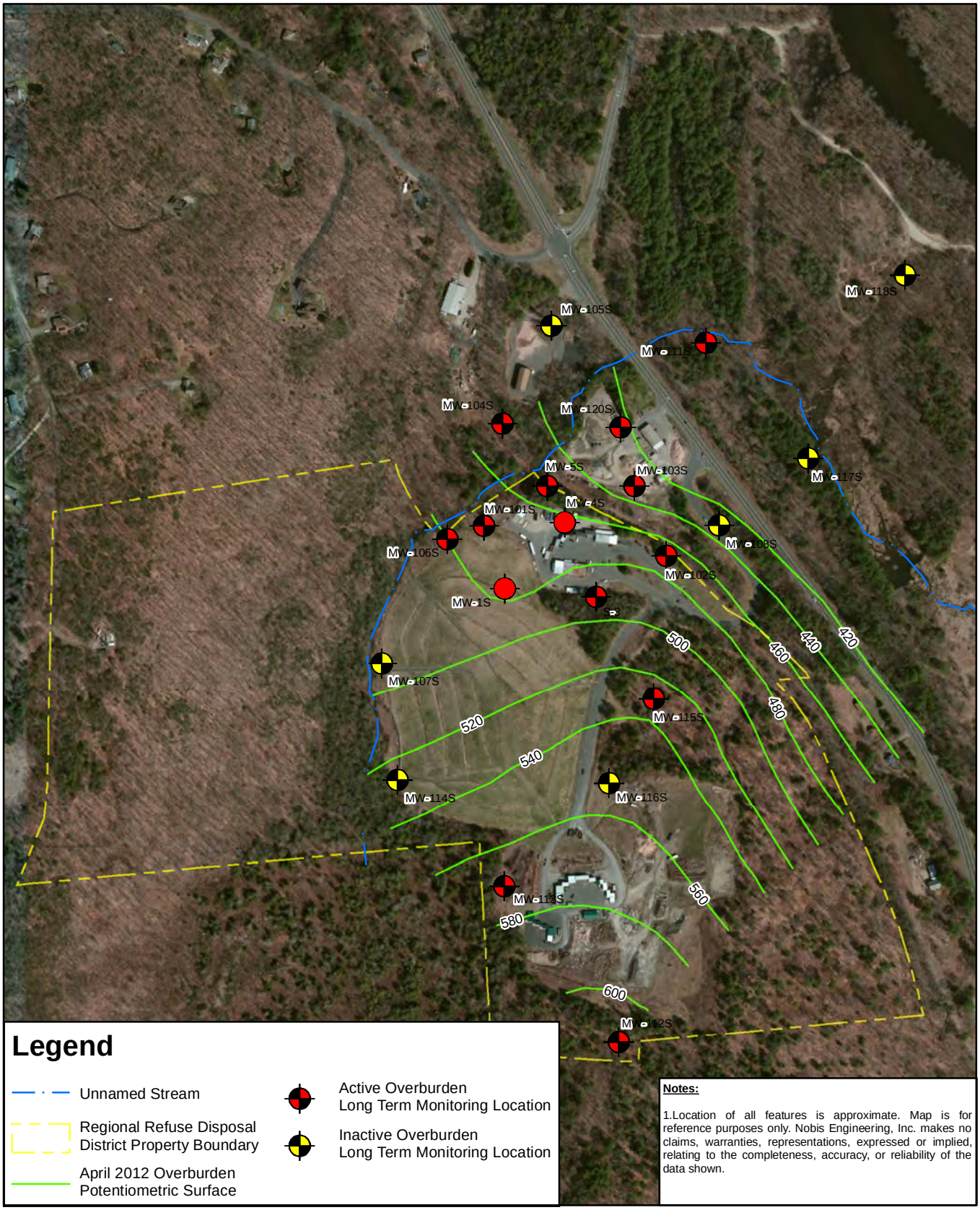
FIGURE 3

ELUR LOCATIONS
BARKHAMSTED LANDFILL
BARKHAMSTED/NEW LONDON, CONNECTICUT

PREPARED BY: DFM	CHECKED BY: BA
PROJECT NO. 80086	DATE: JUNE 2013 Rev 00

Path: R:\80000 Task Orders\80086 Barkhamsted FYR\Technical Data\GIS\Maps_and_Figures\MSR\Draft\Figure_03_ELUR_Locations.mxd Date Printed: 8/28/2013



Legend

- Unnamed Stream
- Regional Refuse Disposal District Property Boundary
- April 2012 Overburden Potentiometric Surface
- Active Overburden Long Term Monitoring Location
- Inactive Overburden Long Term Monitoring Location

Notes:

1.Location of all features is approximate. Map is for reference purposes only. Nobis Engineering, Inc. makes no claims, warranties, representations, expressed or implied, relating to the completeness, accuracy, or reliability of the data shown.

0 250 500 1,000
Feet

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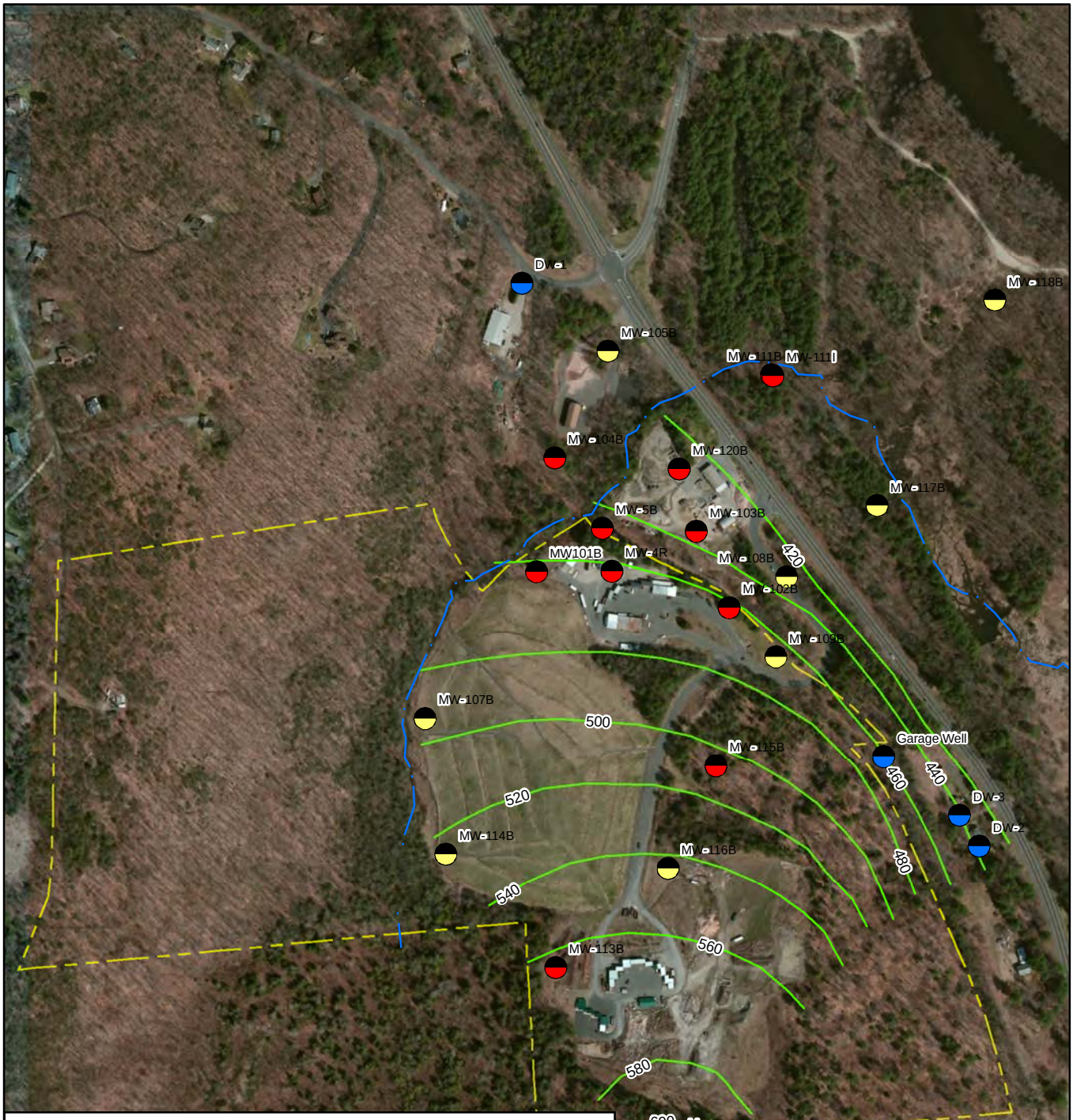
FIGURE 4

OVERBURDEN POTENTIOMETRIC SURFACE BARKHAMSTED LANDFILL BARKHAMSTED/NEW LONDON, CONNECTICUT

PREPARED BY: DFM	CHECKED BY: BA
PROJECT NO. 80086	DATE: JUNE 2013 Rev 00

Path: R:\80000 Task Orders\80086 Barkhamsted FYR\Technical Data\GIS\Maps_and_Figures\MSR\Draft\Figure_04_Overburden_Locations.mxd Date Printed: 8/28/2013



Legend

- Unnamed Stream
- Regional Refuse Disposal District Property Boundary
- April 2012 Bedrock Potentiometric Surface
- Active Bedrock Long Term Monitoring Location
- Inactive Bedrock Long Term Monitoring Location
- Active Bedrock Drinking Water Long Term Monitoring Location

Notes:

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0 250 500 1,000
Feet

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FIGURE 5

BEDROCK
POTENTIOMETRIC SURFACE
BARKHAMSTED LANDFILL
BARKHAMSTED/NEW LONDON,
CONNECTICUT

PREPARED BY: DFM	CHECKED BY: BA
PROJECT NO. 80086	DATE: JUNE 2013 Rev 00

Path: R:\80000 Task Orders\80086 Barkhamsted FYR\Technical Data\GIS\Maps_and_Figures\MSR\Draft\Figure_05_Bedrock_Locations.mxd Date Printed: 8/28/2013

Legend

- Unnamed Stream
- Regional Refuse Disposal District Property Boundary
- Seep Sample Location
- Sediment & Surface Water Sampling Location

Notes:

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0 250 500 1,000
Feet

1 inch = 500 feet

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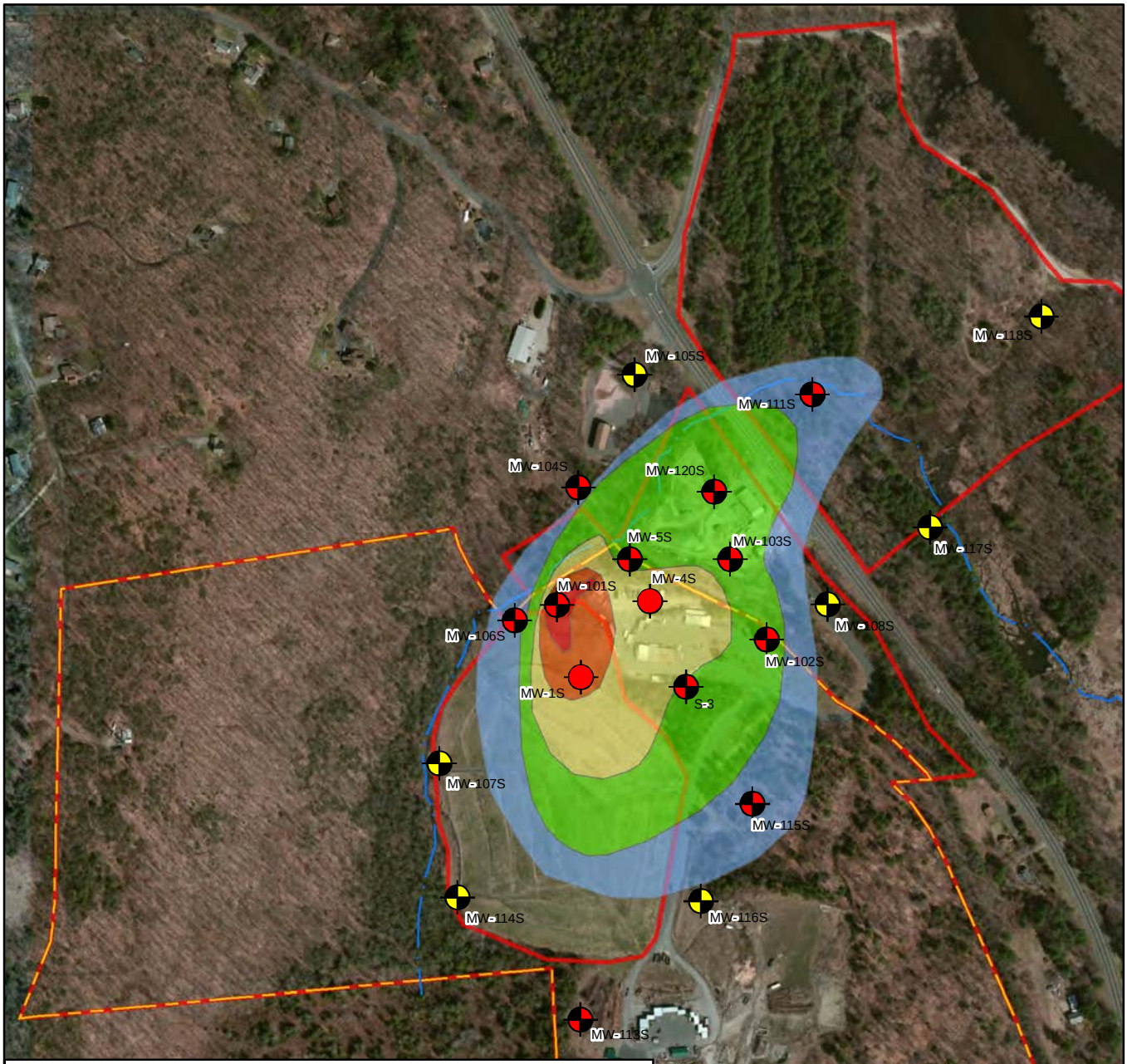
FIGURE 6

SEDIMENT, SURFACE WATER & SEEP SAMPLE LOCATIONS
BARKHAMSTED LANDFILL
BARKHAMSTED/NEW LONDON, CONNECTICUT

PREPARED BY: DFM	CHECKED BY: BA
PROJECT NO. 80086	DATE: JUNE 2013 Rev 00

Path: R:\80000 Task Orders\80086 Barkhamsted FYR\Technical Data\GIS\Maps_and_Figures\MSR\Draft\Figure_06_SW_SED_SEEP_Locations.mxd Date Printed: 9/28/2013



Legend

- Active Overburden Long Term Monitoring Location
- Inactive Overburden Long Term Monitoring Location
- Unnamed Stream
- Regional Refuse Disposal District Property Boundary
- Environmental Land Use Restriction Locations

Total VOC/SVOCs (ug/L)

- 1
- 10
- 100
- 1000
- 10000

Notes:

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0 250 500 1,000
Feet

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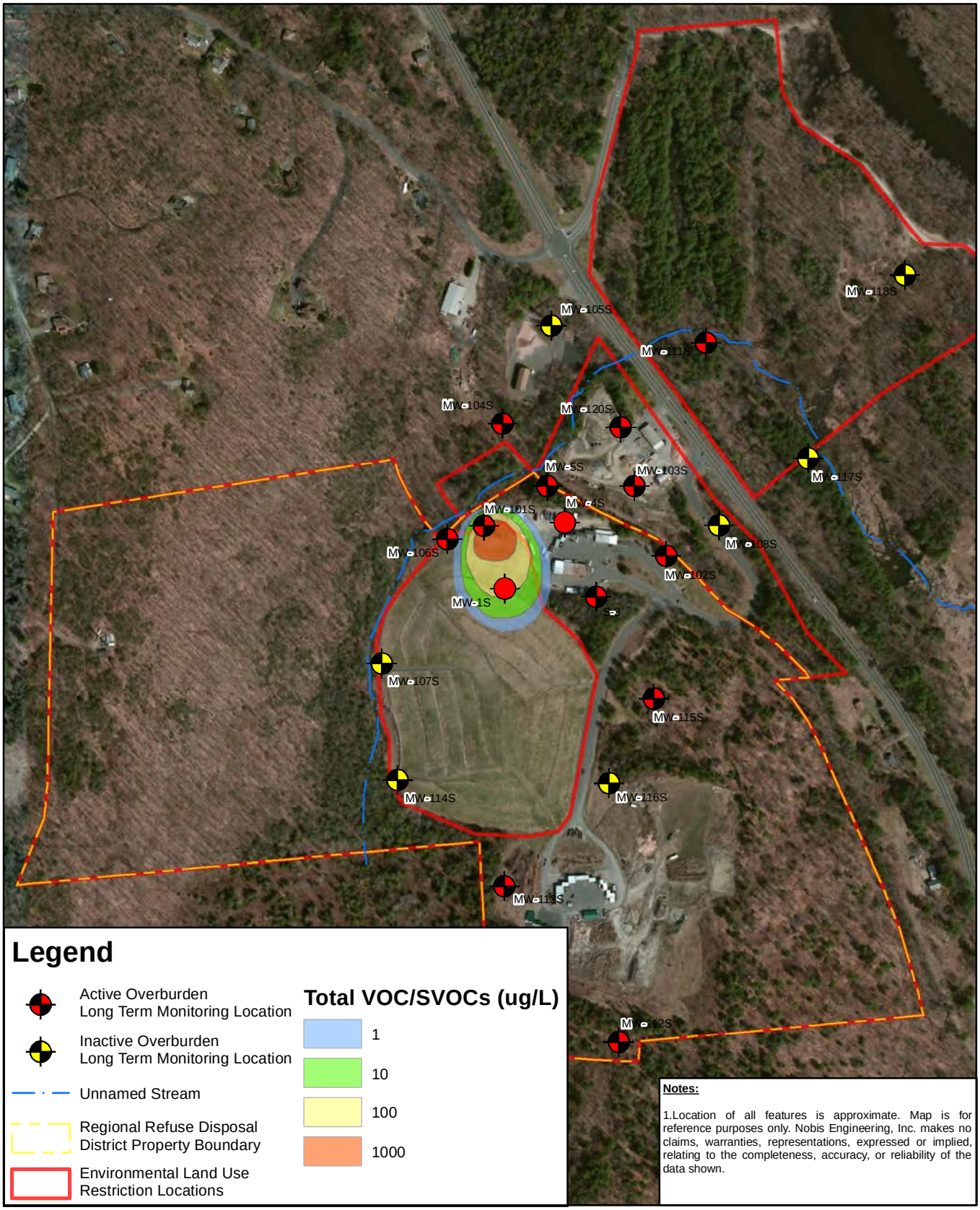
FIGURE 7

APRIL 2003 OVERBURDEN GROUNDWATER VOC/SVOC LIMITS
BARKHAMSTED LANDFILL
BARKHAMSTED/NEW LONDON, CONNECTICUT

PREPARED BY: DFM	CHECKED BY: BA
PROJECT NO. 80086	DATE: JUNE 2013 Rev 00

Path: R:\80000 Task Orders\80086 Barkhamsted FYR\Technical Data\GIS\Maps_and_Figures\MSR\Draft\Figure_07_Overburden_2003_VOC_SVOC.mxd Date Printed: 8/28/2013



Legend

- Active Overburden Long Term Monitoring Location
- Inactive Overburden Long Term Monitoring Location
- Unnamed Stream
- Regional Refuse Disposal District Property Boundary
- Environmental Land Use Restriction Locations

Total VOC/SVOCs (ug/L)

- 1
- 10
- 100
- 1000

Notes:

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0 250 500 1,000
Feet

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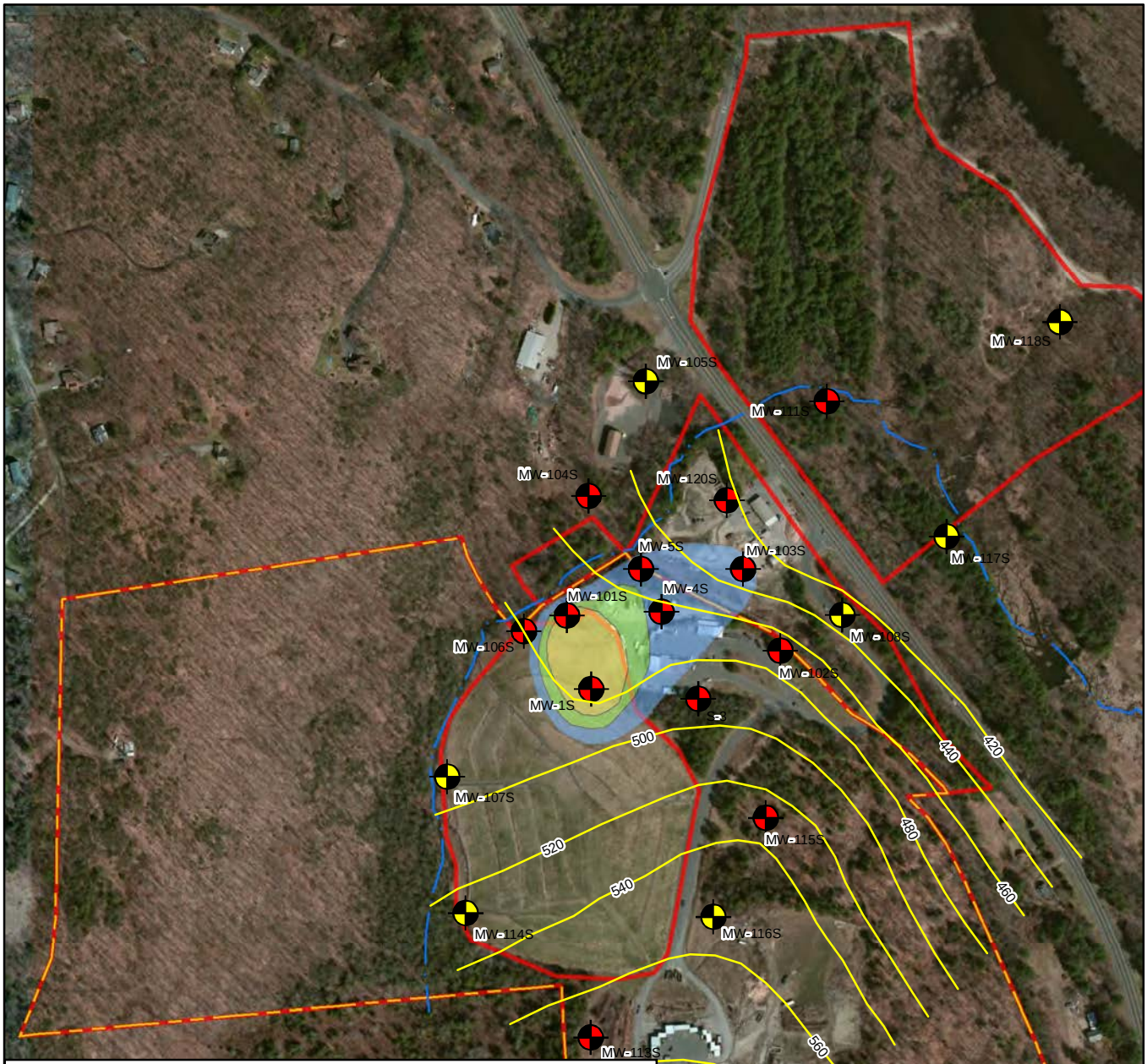
FIGURE 8

APRIL 2008 OVERBURDEN GROUNDWATER VOC/SVOC LIMITS
BARKHAMSTED LANDFILL
BARKHAMSTED/NEW LONDON, CONNECTICUT

PREPARED BY: DFM	CHECKED BY: BA
PROJECT NO. 80086	DATE: JUNE 2013 Rev 00

Path: R:\80000 Task Orders\80086 Barkhamsted FYR\Technical Data\GIS\Maps_and_Figures\MSR\Draft\Figure_08_Overburden_2008_VOC_SVOC.mxd Date Printed: 8/28/2013



Legend

- Unnamed Stream
- Groundwater Elevations (approx. ft. MSL)
- Regional Refuse Disposal District Property Boundary
- Environmental Land Use Restriction Locations
- Active Overburden Long Term Monitoring Location
- Inactive Overburden Long Term Monitoring Location

Total VOC/SVOCs (ug/L)

- 1
- 10
- 100

Notes:

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0 250 500 1,000
Feet

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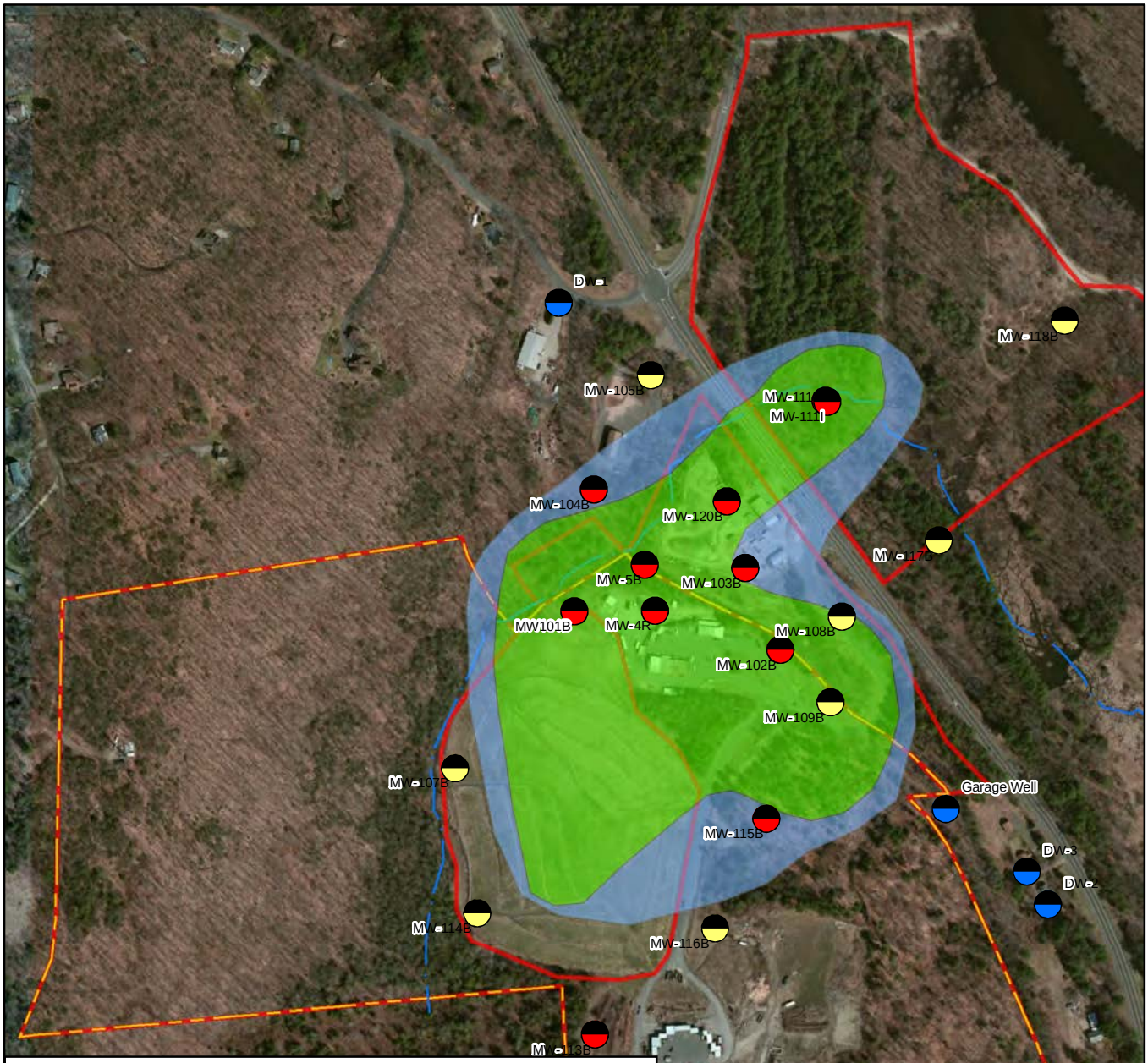
FIGURE 9

APRIL/OCT. 2012 OVERBURDEN GROUNDWATER VOC/SVOC LIMITS
BARKHAMSTED LANDFILL
BARKHAMSTED/NEW LONDON, CONNECTICUT

PREPARED BY: DFM	CHECKED BY: BA
PROJECT NO. 80086	DATE: JUNE 2013 Rev 00

Path: R:\80000 Task Orders\80086 Barkhamsted FYR\Technical Data\GIS\Maps_and_Figures\MSR\Draft\Figure_09_Overburden_2012_VOC_SVOC.mxd Date Printed: 8/28/2013



Legend

- Unnamed Stream
- Regional Refuse Disposal District Property Boundary
- Environmental Land Use Restriction Locations
- Active Bedrock Long Term Monitoring Location
- Inactive Bedrock Long Term Monitoring Location
- Active Bedrock Drinking Water Long Term Monitoring Location

Total VOC/SVOCs (ug/L)

- 1
- 10

Notes:

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0 250 500 1,000
Feet

1 inch = 500 feet

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FIGURE 10

APRIL 2003 BEDROCK GROUNDWATER VOC/SVOC LIMITS
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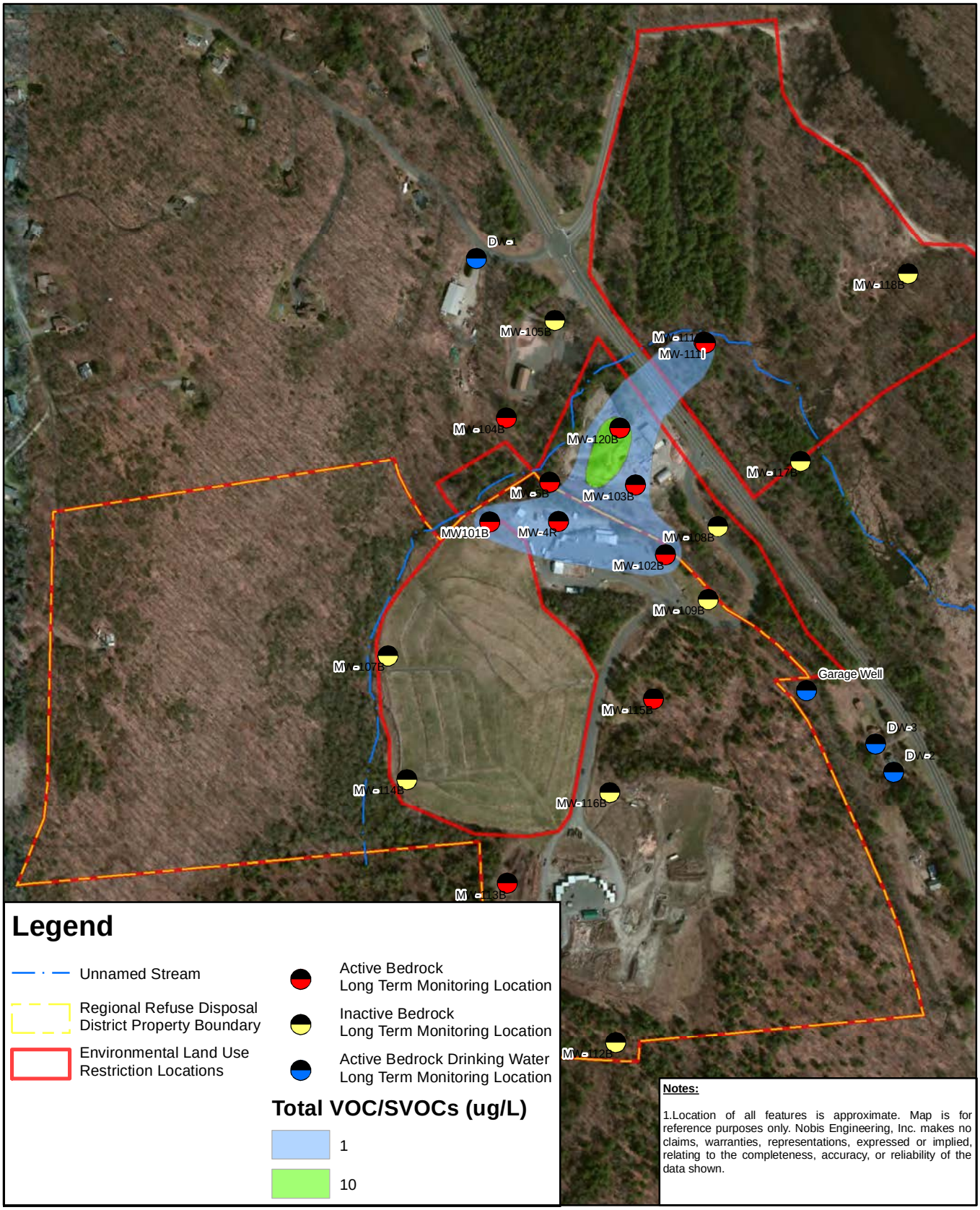
BARKHAMSTED/NEW LONDON, CONNECTICUT

PREPARED BY: DFM	CHECKED BY: BA
PROJECT NO. 80086	DATE: JUNE 2013 Rev 00

Path: R:\80000 Task Orders\80086 Barkhamsted FYR\Technical Data\GIS\Maps_and_Figures\MSR\Draft\Figure_10_Bedrock_2003_VOC_SVOC.mxd Date Printed: 8/28/2013



Notes:

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0 250 500 1,000
Feet

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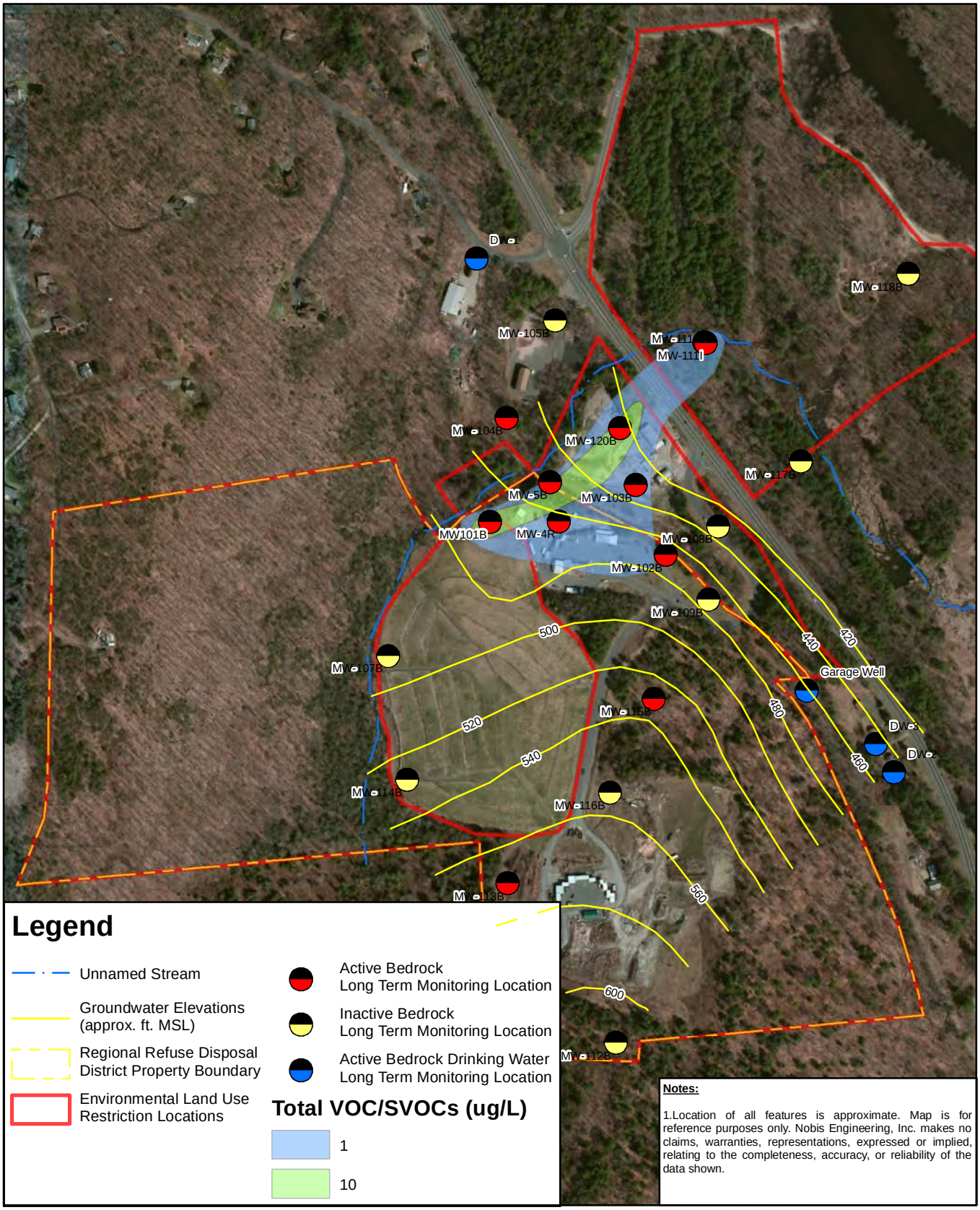
FIGURE 11

APRIL 2008 BEDROCK GROUNDWATER VOC/SVOC LIMITS
BARKHAMSTED LANDFILL
BARKHAMSTED/NEW LONDON, CONNECTICUT

PREPARED BY: DFM	CHECKED BY: BA
PROJECT NO. 80086	DATE: JUNE 2013 Rev 00

Path: R:\80000 Task Orders\80086 Barkhamsted FYR\Technical Data\GIS\Maps_and_Figures\MSR\Draft\Figure_11_Bedrock_2008_VOC_SVOC.mxd Date Printed: 8/28/2013



Legend

- Unnamed Stream
- Groundwater Elevations (approx. ft. MSL)
- Regional Refuse Disposal District Property Boundary
- Environmental Land Use Restriction Locations
- Active Bedrock Long Term Monitoring Location
- Inactive Bedrock Long Term Monitoring Location
- Active Bedrock Drinking Water Long Term Monitoring Location

Total VOC/SVOCs (ug/L)

- 1
- 10

Notes:

1.Location of all features is approximate. Map is for reference purposes only. Nobis Engineering, Inc. makes no claims, warranties, representations, expressed or implied, relating to the completeness, accuracy, or reliability of the data shown.

0 250 500 1,000
Feet

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FIGURE 12

APRIL/OCT. 2012 BEDROCK GROUNDWATER VOC/SVOC LIMITS
BARKHAMSTED LANDFILL
BARKHAMSTED/NEW LONDON, CONNECTICUT

PREPARED BY: DFM	CHECKED BY: BA
PROJECT NO. 80086	DATE: JUNE 2013 Rev 00

Path: R:\80000 Task Orders\80086 Barkhamsted FYR\Technical Data\GIS\Maps_and_Figures\MSR\Draft\Figure_12_Bedrock_2012_VOC_SVOC.mxd Date Printed: 8/28/2013

Notes:

1.Location of all features is approximate. Map is for reference purposes only. Nobis Engineering, Inc. makes no claims, warranties, representations, expressed or implied, relating to the completeness, accuracy, or reliability of the data shown.

Legend

Regional Refuse Disposal District Property Boundary

Unnamed Stream

0 250 500 1,000

Feet

1 inch = 500 feet

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FIGURE 13

SITE INSPECTION OBSERVATIONS
BARKHAMSTED LANDFILL
BARKHAMSTED/NEW LONDON, CONNECTICUT

PREPARED BY: DFM	CHECKED BY: BA
PROJECT NO. 80086	DATE: JUNE 2013 Rev 00

Path: R:\80000 Task Orders\80086 Barkhamsted FYR\Technical Data\GIS\Maps_and_Figures\MSR\Draft\Figure_13_Site_Observations.mxd Date Printed: 8/28/2013

APPENDIX A

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APPENDIX B

Table B-1
Selected Remedy Long-Term Monitoring Program
Barkhamsted-New Hartford Landfill
Barkhamsted, New Hartford, Connecticut
Page 1 of 4

Sample Location	Frequency	MNA Monitoring Type	Analytical Parameters
Groundwater			
S-3	Semi-Annual	Detection	VOCs, SVOCs, Metals - Total, Landfill leachate indicators
MW-1S*	Semi- Annual	Detection	VOCs, SVOCs, Metals - Total, Landfill leachate indicators
MW-4S	Semi- Annual	Detection	VOCs, SVOCs, Metals - Total, Landfill leachate indicators
MW-4R	Semi- Annual	Detection	VOCs, SVOCs, Metals - Total, Landfill leachate indicators
MW-5S*	Semi- Annual	Performance	MNA Parameters, VOCs, SVOCs, Metals - Total, Landfill leachate indicators
MW-5B*			

Table B-1
Selected Remedy Long-Term Monitoring Program
Barkhamsted-New Hartford Landfill
Barkhamsted, New Hartford, Connecticut
Page 2 of 4

Sample Location	Frequency	MNA Monitoring Type	Analytical Parameters
Groundwater (cont.)			
MW-101S*	Semi- Annual	Performance	MNA Parameters, VOCs, SVOCs, Metals - Total, Landfill leachate indicators
MW-101B*			
MW-102S*	Semi- Annual	Detection	VOCs, SVOCs, Metals - Total, Landfill leachate indicators
MW-102B*			
MW-103S*	Annual	Detection	VOCs, SVOCs, Metals - Total, Landfill leachate indicators
MW-103B*			
MW-104S	Annual	Detection	VOCs, SVOCs, Metals - Total, Landfill leachate indicators
MW-104B			
MW-106S*	Semi- Annual	Detection	VOCs, SVOCs, Metals - Total, Landfill leachate indicators
MW-111S*	Semi- Annual	Detection	VOCs, SVOCs, Metals - Total, Landfill leachate indicators
MW-111I	Annual	Detection	MNA Parameters, VOCs, SVOCs, Metals - Total, Landfill leachate indicators

Table B-1
Selected Remedy Long-Term Monitoring Program
Barkhamsted-New Hartford Landfill
Barkhamsted, New Hartford, Connecticut
Page 3 of 4

Sample Location	Frequency	MNA Monitoring Type	Analytical Parameters
Groundwater (cont.)			
MW-111B*	Semi- Annual	Detection	MNA Parameters, VOCs, SVOCs, Metals - Total, Landfill leachate indicators
MW-112S	Annual	Ambient	VOCs, SVOCs, Metals - Total,
MW-113S*	Semi- Annual	Ambient	MNA Parameters, VOCs, SVOCs, Metals - Total,
MW-113B*			Landfill leachate indicators
MW-115S*	Semi- Annual	Ambient	VOCs, SVOCs, Metals - Total,
MW-115B*			Landfill leachate indicators
MW-120S	Annual	Detection or Performance	MNA Parameters, VOCs, SVOCs, Metals – Total,
MW-120B	Semi- Annual		Landfill leachate indicators
Surface Water			
SW-3*	Semi- Annual	N/A	VOCs SVOCs Metals – Total Hardness
SW-16*			Pesticides
SW-9*			Landfill leachate indicators

Table B-1
Selected Remedy Long-Term Monitoring Program
Barkhamsted-New Hartford Landfill
Barkhamsted, New Hartford, Connecticut
Page 4 of 4

Sample Location	Frequency	MNA Monitoring Type	Analytical Parameters
Sediment			
SED-3	Spring of every 5th year prior to the Five-Year Review	N/A	VOCs Metals - Total, SVOCs PCBs Pesticides
SED-16			
SED-9			
Residential Potable Supply Wells			
DW-1*	Semi- Annual	N/A	VOCs, Acetone, MEK SVOCs, Metals - Total, Landfill leachate indicators
DW-2*			
DW-3*			
Leachate Seeps			
S6*	Annual (Spring)	N/A	VOCs, SVOCs, Metals - Total, Total sulfate Pesticides
S3*			
S1*			

Notes:

1 * denotes sample locations specified by the OMM Plan or the landfill.

2 N/A = not applicable.

3 Groundwater samples will be collected from different depths based on the well identification as follows:
S = overburden well, B or R = shallow bedrock, I = intermediate bedrock, D = deep bedrock.

4 Landfill leachate indicators (per Landfill OMM and amendments) include: alkalinity, ammonia, chemical oxygen demand COD), chloride, nitrate, total dissolved solids (TDS), total suspended solids (TSS), specific conductivity, hardness, pH and total sulfate.

APPENDIX C

APPENDIX C

Monitored Natural Attenuation Evaluation

The effectiveness of natural attenuation processes at the Site was evaluated using the techniques published by EPA in Wilson (2011) and Pope et al. (2004). The 2011 guidance details the use of statistical methods for projecting whether long-term remedial goals (i.e., RAOs) will be met based on recent concentration trends for COCs in groundwater. These statistical methods were used in conjunction with the 2004 guidance, which identifies eight methods to demonstrate MNA progress in achieving remedial objectives:

1. Demonstrate that natural attenuation is occurring according to expectations using temporal trends in individual wells, an estimate of contaminant mass reduction, comparison of observed contaminant distributions with predicted milestones or comparison of field-scale attenuation rates;
2. Detect changes in environmental conditions that may reduce the efficacy of any natural attenuation processes by reviewing geochemical or hydrogeological parameters;
3. Identify any potentially toxic and/or mobile transformation products;
4. Verify that the plume is not expanding downgradient, laterally or vertically;
5. Verify no unacceptable impacts to downgradient receptors;
6. Detect new releases of contaminants, if applicable;
7. Demonstrate the efficacy of institutional controls; and
8. Verify attainment of remediation objectives.

The statistical evaluation detailed by Wilson (2011) was used to demonstrate natural attenuation effectiveness and estimate time frames to reach cleanup goals. This statistical approach evaluates the temporal concentration trends during this five-year review period (spring 2008 through fall 2012). A range of field-observed degradation rates are calculated using a linear regression approach and predetermined confidence levels (e.g., 80% and 95%). These degradation rates are used in conjunction with an interim remedial goal and current concentration data to determine if the final remedial goal is likely to be met within the given remedial timeframe.

1. Demonstrate that natural attenuation is occurring according to expectations

Groundwater modeling conducted during the FS estimated that natural attenuation would achieve the groundwater cleanup goal in the overburden in approximately 16 years and in the bedrock aquifer in approximately 6 years. The model simulated groundwater flow with the migration and attenuation of two COCs: 4-methylphenol and 2-butanone. These compounds at the time of modeling were present in relatively high concentrations in groundwater. Therefore, the cleanup times for these compounds were considered to represent conservative estimates of the time for remediation of all groundwater COCs.

The evaluation of MNA effectiveness conducted in the second Five-Year Review Report (2008) included a graphical representation of the groundwater concentrations over time for these COCs in representative groundwater monitoring wells. During the third five-year review period (spring 2008 through fall 2012), groundwater concentrations of these COCs were not detected above laboratory reporting limits in the groundwater monitoring wells sampled. Based on these data, continued use of these COCs as representative trends for the larger affected groundwater is not warranted. Therefore, the groundwater monitoring data collected from spring 2008 through fall 2012 were reviewed using methods presented in Wilson, 2011. The following screening criteria were used to identify representative COCs and groundwater monitoring wells for consideration.

1. Duplicate samples, bottle blanks, equipment blanks, trip blanks and other laboratory-related samples were excluded.

2. Only groundwater samples were considered; all other media were excluded.

3. Groundwater monitoring wells must have been sampled annually or semi-annually throughout the entire reporting period (spring 2008 through fall 2012).

4. The 2008 through 2012 COC data set at each groundwater monitoring well were required to have ≥75% of values above the laboratory reporting limit and ≥50% of values above the applicable cleanup goals.

5. All laboratory-estimated concentrations (J-flag) were taken as the reported value.

6. All concentrations below the laboratory reporting limit (U-flag) were taken as the laboratory reporting limit. Values not detected above the laboratory reporting limit were also considered below the applicable cleanup goal.

This data screening process identified benzene; toluene; TCE; chloroethane, 2,4-dimethylphenol, 1,4-dichlorobenzene, arsenic, and manganese for further evaluation at groundwater monitoring wells MW-1S, MW-4S, MW-4R, MW-5S, MW-5B, MW-101S, MW-101B, MW-102B, MW-103S, MW-103B, MW-106S, MW-111I, MW-120S, MW-120B and/or S-3, depending on the COC.

For purposes of this evaluation, it was assumed that the COC concentrations must reach the cleanup goals by December 31, 2017, approximately 16 years from the date of the ROD. Following Wilson's (2011) methodology, an interim remedial goal was calculated and compared to a statistical confidence belt on the regression line fit to the entire dataset. Confidence belts of 80% and 95% were chosen for this evaluation and describe the rates of attenuation that are faster than the regression line. If the confidence belt is higher than the value of the interim goal, then the rate of natural attenuation over the time period represented in the regression is too slow to attain the cleanup goal by the time specified at that level of confidence (Wilson 2011).

There was no evidence at 80% or 95% confidence levels that the attenuation rate was inadequate to attain the remedial cleanup goal by December 2017 for benzene at monitoring wells MW-4S, MW-5S, MW-5B, and S-3; toluene at monitoring well MW-101S and MW-1S; chloroethane at monitoring well MW-111I; 2,4-dimethylphenol at monitoring well MW-101S; 1,4-dichlorobenzene at monitoring well MW-101S; arsenic at monitoring wells MW-1S, MW-4S, and MW-4R; and manganese at monitoring wells MW-102B, MW-103S, MW-103B, MW-106S, MW-120S, and MW-120B. These monitoring wells located within the source area, as well as downgradient of the source area are expected to reach clean up goals by December 31, 2017.

The following table summarizes those wells where the rate of attenuation is likely inadequate to meet the expected remedial goals at 80% or 95% confidence levels.

Table C-1
Summary of Monitoring Wells and Contaminants Not Expected to Meet Groundwater Cleanup Goals within the ROD-Specified Timeframe
Barkhamsted-New Hartford Landfill
Barkhamsted, New Hartford, Connecticut

Monitoring Well	Benzene	Trichloroethylene	2,4-Dimethylphenol	Arsenic	Manganese
Overburden					
MW-1S*	X		X		
S-3					X
MW-101S	X			X	X
MW-4S					X
MW-5S					X
Bedrock					
MW-101B					X
MW-4R	X				X
MW-5B					X
MW-120B		X			

Notes:

* - Monitoring well is located within the landfill footprint
X – Chemical concentration is not expected to achieve groundwater cleanup goals in the indicated monitoring well within the ROD-specified timeframe. A blank cell indicates that the chemical is expected to meet groundwater cleanup goals within the ROD-specified timeframe.

These monitoring wells are located within the landfill footprint and immediately downgradient; but are not near identified human or ecological receptors.

The original 16 year estimate for groundwater concentrations to achieve applicable cleanup goals was based on only two readily degradable COCs (4-methylphenol and 2-butanone), and excluded other COCs. Trace elements arsenic, iron, and manganese are commonly found within subsurface soils, and elevated concentrations of these naturally occurring elements in groundwater are often the result of microbial activity affecting landfill chemistry and altering groundwater pH. The graphs included in at the end of this appendix show that these COCs will not reach cleanup goals in the near future at the present rate of degradation.

2. Detect changes in environmental conditions that may reduce the efficacy of any natural attenuation processes

Geochemical data reviewed during the second five-year review indicated subsurface conditions are amenable to microbially-mediated degradation. Geochemical data gathered during this third five-year review period indicate similar subsurface conditions, including:

- an abundance of dissolved organic carbon that can be used as a carbon source (electron donor) by microbes, particularly near the source area;
- anaerobic conditions within the plume core that sustain reductive dechlorination of residual concentrations of chlorinated compounds with more aerobic conditions downgradient (e.g., MW-111 series) that prevent transport of metals;
- low nitrate and sulfate concentrations within the plume compared to background, suggesting utilization of these ions as electron acceptors;
- increased alkalinity in the plume compared to background suggesting that the plume is biologically active;
- decreases in oxidation-reduction potential in the plume compared to background, suggesting reducing geochemical conditions within the plume due to biological activity;
- the presence of methane suggesting reducing conditions that favor microbial degradation; and
- groundwater pH ranges suitable for microbial populations (generally 6 to 8 standard units).

Contaminant concentrations in groundwater are low upgradient of the landfill, increase within the landfill and decrease downgradient of the landfill. Indicator parameter patterns are consistent, with DO and nitrate decreasing in the landfill as a result of biological activity, and rebounding downgradient, while COD, methane and ferrous iron increase within the landfill footprint and then tend to attenuate downgradient of the landfill. The peak concentrations of most COCs show a marked decrease from 2008 to 2012, consistent with the overall decline in COC concentrations within the plume.

Routinely measured hydrogeological data (i.e., groundwater elevation and direction) indicate no significant change in the hydrogeologic characteristics of the subsurface. In particular, the groundwater flow direction has not changed significantly over time.

It is therefore concluded that the hydrogeological and geochemical environment that exists at the Site is amenable to the MNA process, and no changes in this environment are expected to inhibit MNA.

3. Identify any potentially toxic and/or mobile transformation products

A common concern when chlorinated solvents are present in groundwater is the production of VC as part of microbially-mediated reductive dechlorination of TCE to ethene. While low levels of TCE remain in groundwater, concentrations of VC were not detected above the cleanup goal (1 µg/L) within this five-year reporting period. Therefore, elevated concentrations of VC are not anticipated to be a concern in the future as residual TCE concentrations continue to decrease.

Similar to TCE and other COCs, metals can be reduced under anaerobic groundwater conditions. The reduced form of some metals (e.g., iron, arsenic, manganese) is more mobile in groundwater than the oxidized form(s), which typically are bound to the aquifer soils and not detected in groundwater analyses. The elevated concentrations of manganese present in groundwater are likely due to direct reduction of naturally occurring manganese within the aquifer soil matrix by indigenous microorganisms while elevated concentrations of anthropogenic arsenic are likely due to the shift from aerobic/oxidizing conditions to anaerobic/reducing conditions. Some of the arsenic may be from naturally occurring minerals, similar to the manganese. No matter the origin, the presence of these metals in groundwater is short-lived. As groundwater geochemistry becomes more aerobic/oxidizing at downgradient monitoring wells (e.g., MW-111 series), groundwater concentrations of manganese and arsenic decrease due to abiotic adsorption to aquifer material (arsenic) or microbially-mediated transformation (manganese).

4. Verify that the plume is not expanding downgradient, laterally, or vertically

Although COCs were detected within the landfill and in nearby downgradient areas of the Site, groundwater concentrations of COCs at most downgradient locations were below the laboratory reporting limit or the cleanup goals.

5. Verify no unacceptable impacts to downgradient receptors

The primary downgradient receptors for groundwater migration of COCs are three private drinking water wells and a new Town Garage drinking water well. The three private drinking water wells are sampled as part of the routine monitoring program; the new Town Garage well will be added to the program. The spring 2008 through fall 2012 groundwater monitoring results indicate concentrations of COCs were below the applicable cleanup goals at each of these locations, except for lead detected in samples from DW-001 in October 2012 (3.7 µg/L), DW-002 in April 2009 (53 µg/L) and DW-003 in October 2012 (3.1 µg/L).

Additionally, comparisons of detected concentrations of all constituents, not just identified COCs, were made to the applicable EPA Safe Drinking Water Act non-zero MCLGs or MCLs. Concentrations of thallium and iron were detected above the applicable MCLGs or MCLs of 0.5 µg/L and 300 µg/L, respectively.

6. Detect new releases of contaminants

In general, most contaminants were detected at their highest levels early in the remedial history of the Site, prior to the NTCRA and landfill capping in 1998. The cessation of waste disposal at the facility and protection given by the landfill cap suggest that no new releases of contaminants are expected to occur at the Site. The current suite of analyses performed on samples collected routinely from the Site would detect the presence of additional contaminants in groundwater, surface water, stream sediments, or seeps. To date, no additional COCs have been identified.

7. Demonstrate the efficacy of institutional controls

A detailed discussion of the in-place institutional controls is presented in a subsequent section of this report.

8. Verify attainment of remediation objectives

Groundwater was identified in the ROD as the only media requiring action. The following RAOs are identified in the ROD:

- Prevent ingestion or dermal contact with groundwater having constituent concentrations exceeding EPA Safe Drinking Water Act non-zero MCLGs or MCLs, or in their absence, the more stringent of an excess cancer risk of 1 x 10^{-6} for each substance or a hazard quotient of 1 for each non-carcinogenic substance.

- Restore groundwater beyond the compliance boundary to MCLs or other more stringent CT Remediation Standards (background concentrations), or in their absence, the more stringent of an excess cancer risk of 1 x 10^{-6} for each substance or a hazard quotient of 1 for each non-carcinogenic substance.

Remedial actions conducted at the Site have prevented ingestion or dermal contact with groundwater having constituent concentrations exceeding EPA Safe Drinking Water Act non-zero MCLGs or MCLs, or in their absence, the more stringent of an excess cancer risk of $1x10^{-6}$ for each substance or a hazard quotient of 1 for each non-carcinogenic substance.

MNA has not restored groundwater beyond the compliance boundary to below cleanup goals. The COCs that remain above the applicable cleanup goals include benzene, methylene chloride, toluene, TCE, chloroethane, 2,4-dimethylphenol, 1,4-dichlorobenzene, arsenic, and manganese. As demonstrated previously in the statistical analysis, concentrations of toluene, chloroethane, and 1,4-dichlorobenzene are expected to decrease to below the respective cleanup goals at all groundwater monitoring well locations by December 31, 2017. Similarly, groundwater concentrations of benzene, TCE, 2,4-dimethylphenol, arsenic, and manganese are expected to decrease to below the respective cleanup goals at most, but not all, groundwater monitoring well locations.

Based on current attenuation rates, residual concentrations of benzene at monitoring wells MW-101S, MW-1S, and MW-4R; TCE at monitoring well MW-120B; 2,4-dimethylphenol at monitoring well MW-1S; arsenic at monitoring well MW-101S; and manganese at monitoring wells MW-101S, MW-101B, MW-4S, MW-4R, MW-5S, MW-5B, and S-3 may not reach the respective cleanup goals before December 31, 2017. These monitoring wells are located within the landfill footprint and immediately downgradient; they are not located in proximity of identified human or ecological receptors. The original estimated time for groundwater concentrations to decrease to below the applicable cleanup goals (approximately 16 years) was based on only two COCs (4-methylphenol and 2-butanone), it may not adequately estimate the time needed

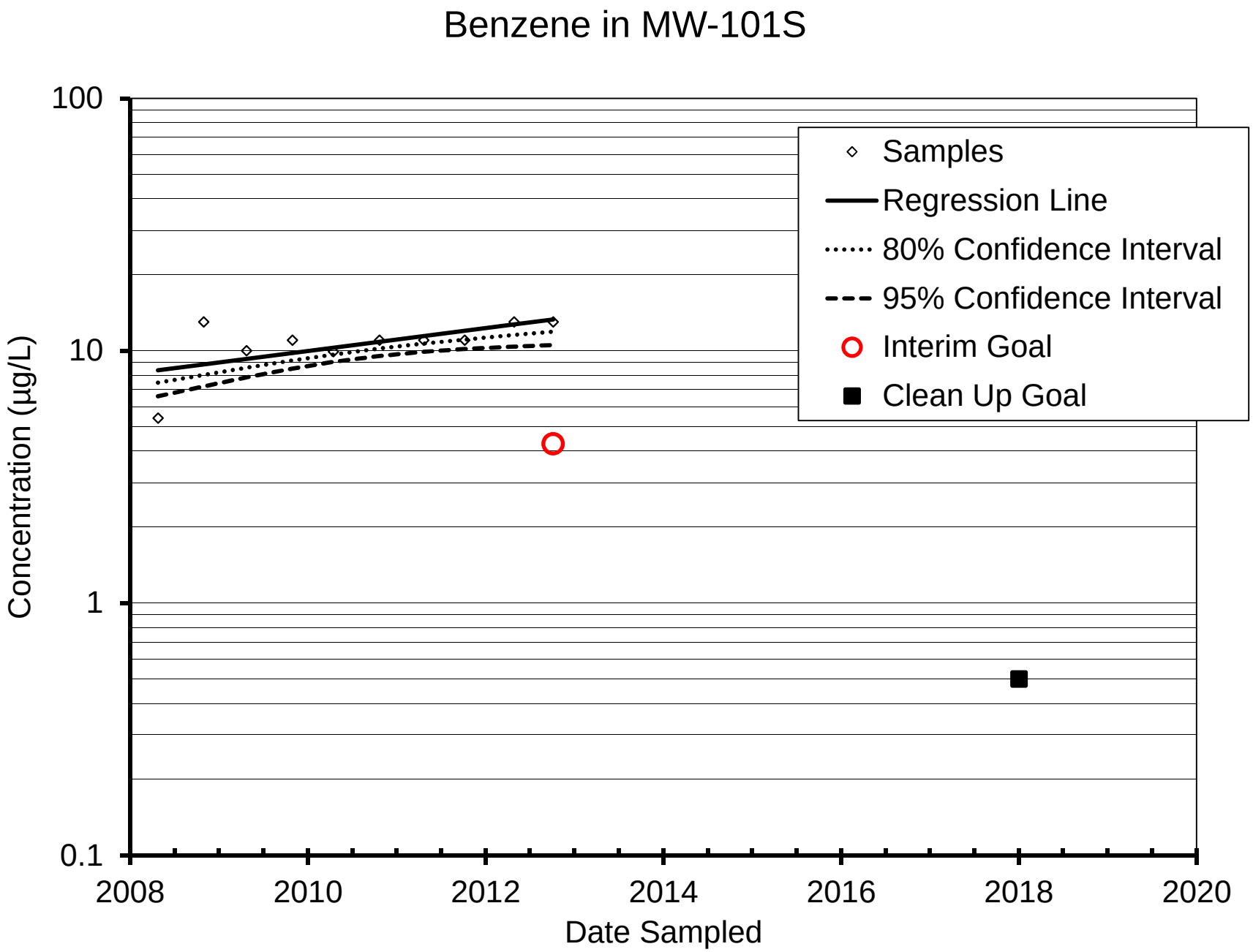
Summary of Statistical Analysis of Groundwater Analytical Data

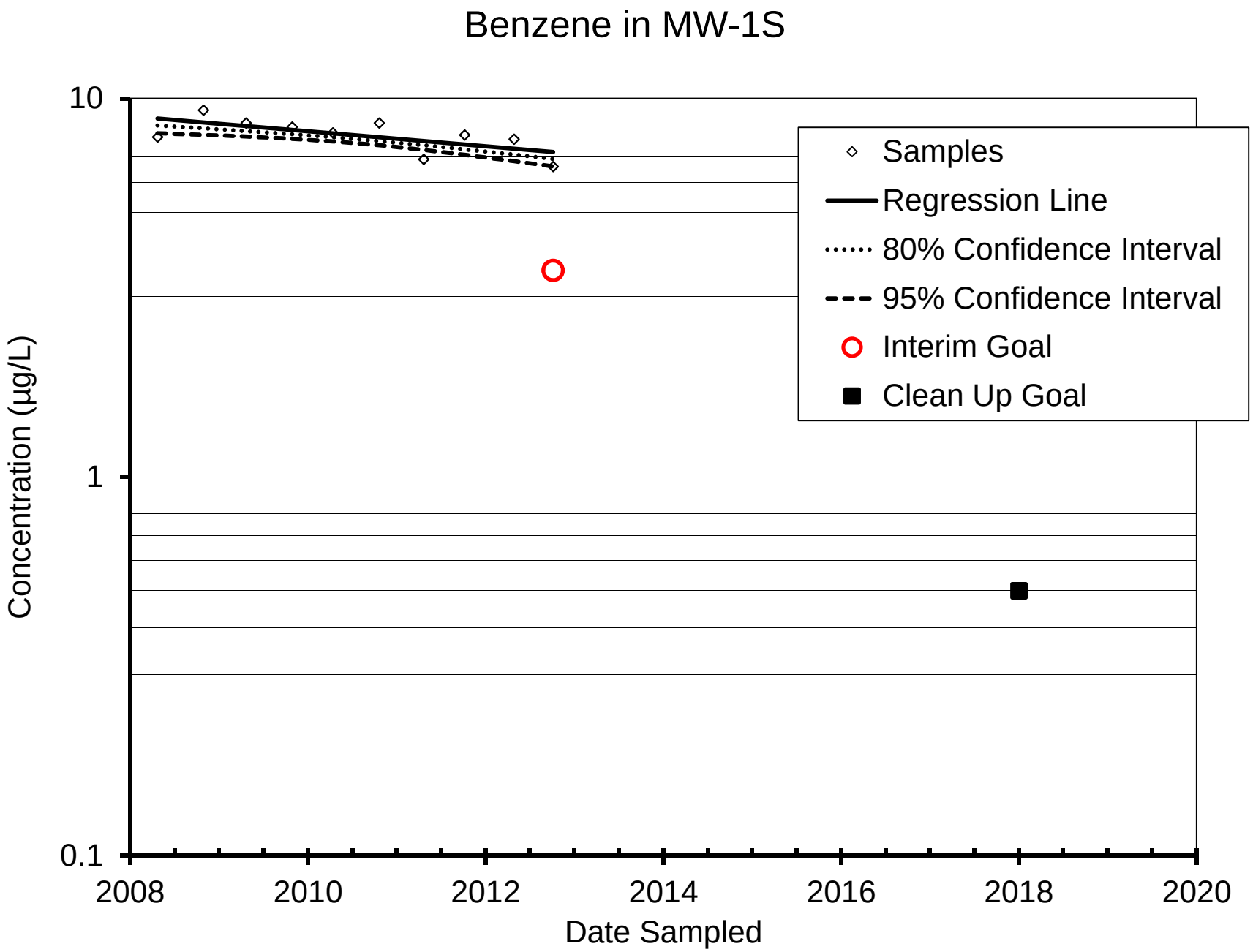
Third Five-Year Review Report
for the Barkhamsted-New Hartford Landfill
Barkhamsted-New Hartford, Connecticut

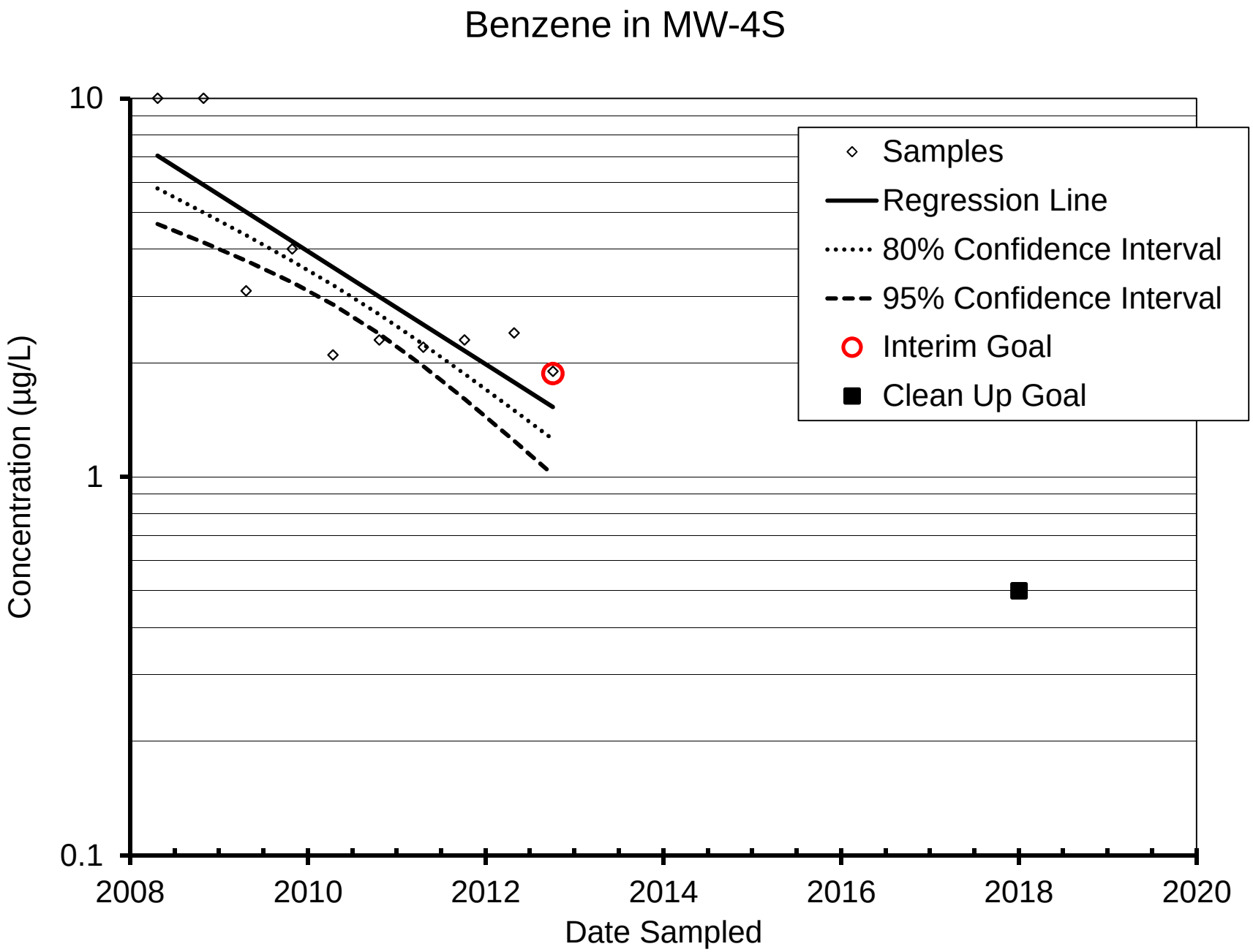
Constituent	Well	Remedial Action Objective (µg/L)[1]	Data Summary						Statistical Analysis Summary				
			Minimum Concentration (µg/L)	Maximum Concentration (µg/L)	Concentration Measured Most Recently (µg/L)	Number of Data Points	Start Date	End Date	Interim Goal (µg/L)	Regression Line Above or Below Interim Goal	80% Confidence Line Above or Below Interim Goal	95% Confidence Line Above or Below Interim Goal	Projected to Meet Remedial Action Objective
Benzene	MW-101S	0.5	5.4	13	13	10	4/24/2008	10/4/2012	4.3	Above	Above	Above	No
Benzene	MW-1S	0.5	*0.4*	9.3	6.6	10	4/22/2008	10/4/2012	3.5	Above	Above	Above	No
Benzene	MW-4S	0.5	1.9	*10*	1.9	10	4/22/2008	10/3/2012	1.9	Below	Below	Below	Yes
Benzene	MW-4R	0.5	2.3	*5.0*	2.3	9*	4/22/2008	10/3/2012	1.9	Above	Above	Above	No
Benzene	MW-5S	0.5	*0.67*	*5.0*	1.7	10	4/23/2008	10/3/2012	1.0	Below	Below	Below	Yes
Benzene	MW-5B	0.5	0.48	*5.0*	0.6	10	4/23/2008	10/3/2012	0.7	Below	Below	Below	Yes
Benzene	S-3	0.5	0.29	1.1	1.1	10	4/22/2008	10/2/2012	0.6	Below	Below	Below	Yes
Toluene	MW-101S	0.5	9.2	72.0	9.8	10	4/24/2008	10/4/2012	8.6	Above	Below	Below	Yes
Toluene	MW-1S	0.5	2.2	*10*	2.2	10	4/22/2008	10/4/2012	2.3	Below	Below	Below	Yes
Trichloroethene	MW-120B	0.5	0.77	1.1	0.87	10	4/23/2008	10/3/2012	0.7	Above	Above	Above	No
Chloroethane	MW-111I	1	*0.4*	40	1.1	10	4/24/2008	10/2/2012	1.1	Below	Below	Below	Yes
2,4-Dimethylphenol	MW-101S	10	1.9	1,000	1.9	10	4/24/2008	10/4/2012	99.3	Below	Below	Below	Yes
2,4-Dimethylphenol	MW-1S	10	63	260	63	10	4/22/2008	10/4/2012	63.3	Above	Above	Above	No
1,4-Dichlorobenzene	MW-101S	10	*5.0*	16	11	10	4/24/2008	10/4/2012	11.2	Above	Below	Below	Yes
Arsenic	MW-101S	5	6.3	50	*20*	10	4/24/2008	10/4/2012	9.2	Above	Above	Above	No
Arsenic	MW-1S	5	5.3	*20*	*20*	10	4/22/2008	10/4/2012	6.6	Above	Above	Below	Yes
Arsenic	MW-4S	5	*4.4*	12	8.8	10	4/22/2008	10/3/2012	7.3	Below	Below	Below	Yes
Arsenic	MW-4R	5	1.8	7.8	5	9*	4/22/2008	10/3/2012	5.1	Below	Below	Below	Yes
Manganese	MW-101S	50	79	100	81	10	4/24/2008	10/4/2012	72.7	Above	Above	Above	No
Manganese	MW-101B	50	3,300	5,300	4,200	10	4/24/2008	10/4/2012	1,180	Above	Above	Above	No
Manganese	MW-102B	50	69	1,000	540	10	4/22/2008	10/3/2012	228.8	Below	Below	Below	Yes
Manganese	MW-103S	50	18	630	91	5	4/23/2008	4/25/2012	78.8	Below	Below	Below	Yes
Manganese	MW-103B	50	43	1,900	1,900	5	4/23/2008	4/25/2012	111.7	Above	Above	Below	Yes
Manganese	MW-106S	50	65	170	82	10	4/22/2008	10/4/2012	95.3	Below	Below	Below	Yes
Manganese	MW-120S	50	700	2,400	700	5	4/23/2008	4/25/2012	634.7	Above	Above	Below	Yes
Manganese	MW-120B	50	23	330	35	10	4/23/2008	10/3/2012	119.0	Below	Below	Below	Yes
Manganese	MW-4S	50	960	1,600	990	10	4/22/2008	10/3/2012	461.1	Above	Above	Above	No
Manganese	MW-4R	50	3,700	5,000	3,700	9*	4/22/2008	10/3/2012	1,254.8	Above	Above	Above	No
Manganese	MW-5S	50	1,000	1,900	1,700	10	4/23/2008	10/3/2012	558.3	Above	Above	Above	No
Manganese	MW-5B	50	60	3,000	2,500	10	4/23/2008	10/3/2012	641.2	Above	Above	Above	No
Manganese	S-3	50	1,100	2,500	2,500	10	4/22/2008	10/2/2012	590.2	Above	Above	Above	No

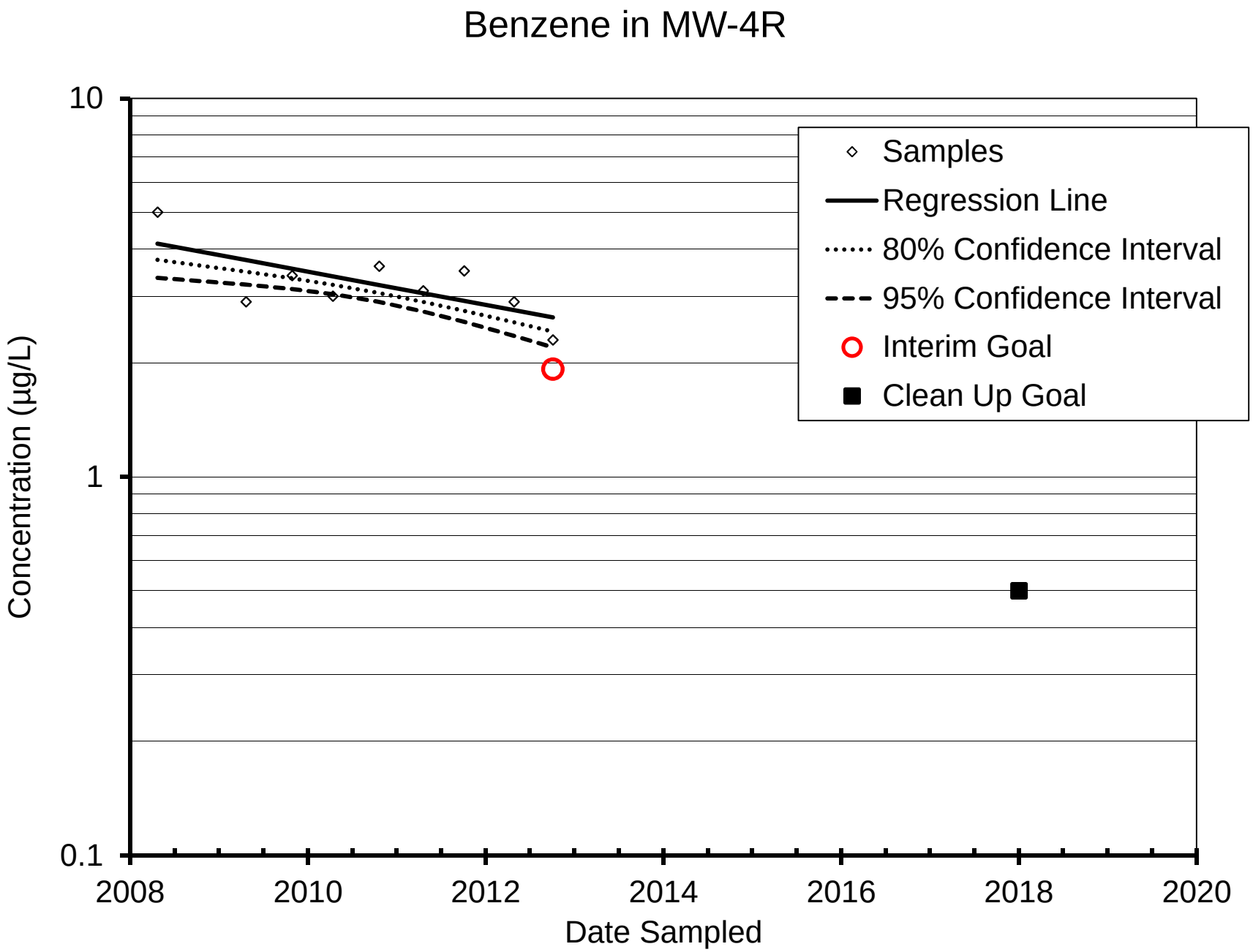
[1] Source: 2001 Record of Decision
Italicized values were not detected above the laboratory reporting limit; value is the reporting limit
Groundwater monitoring locations with 5 data points have been sampled annually since 2008 while locations with 10 data points have been sampled semi-annually.

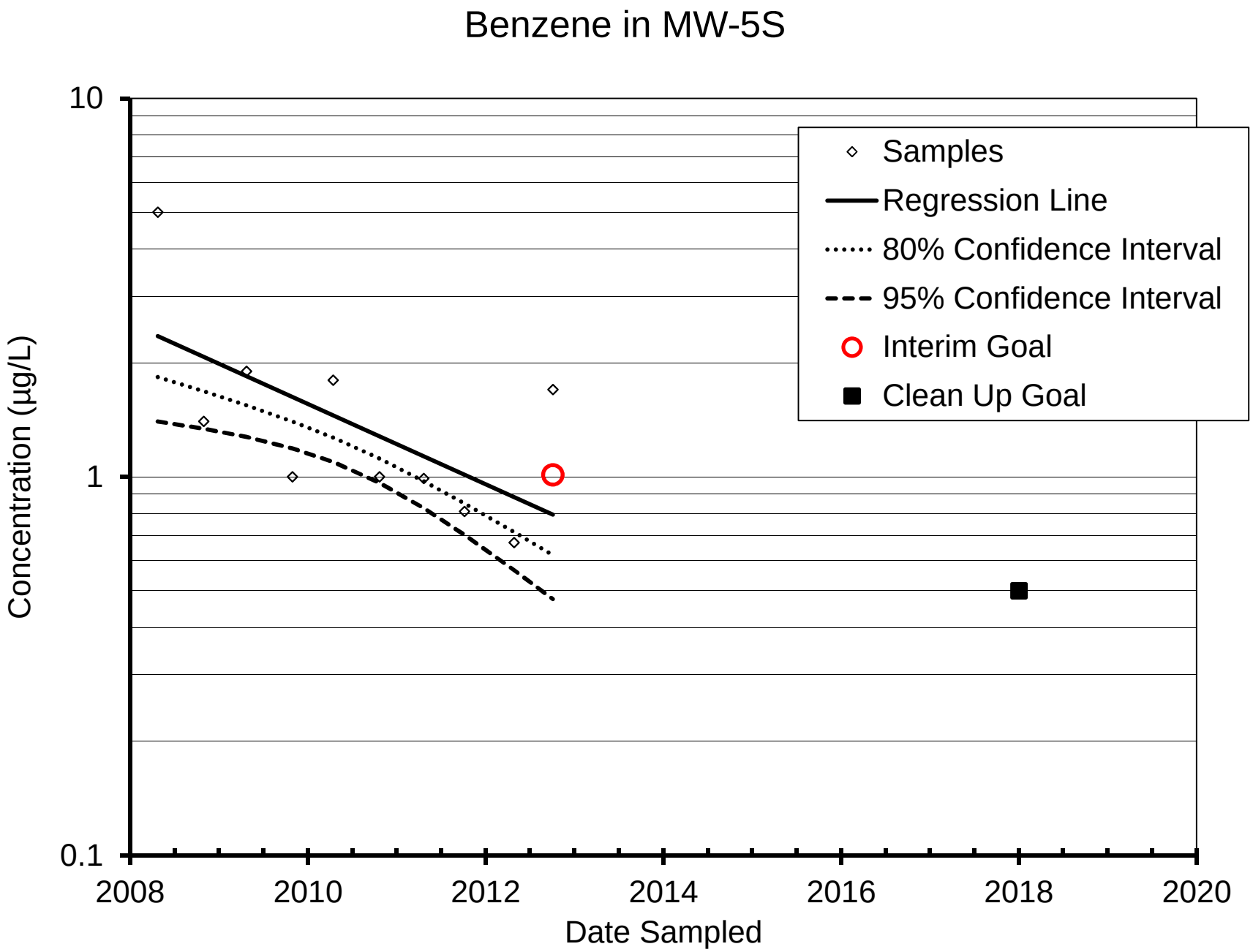
* Groundwater monitoring well MW-4R has been sampled semi-annually since 2008 except in October 2008.

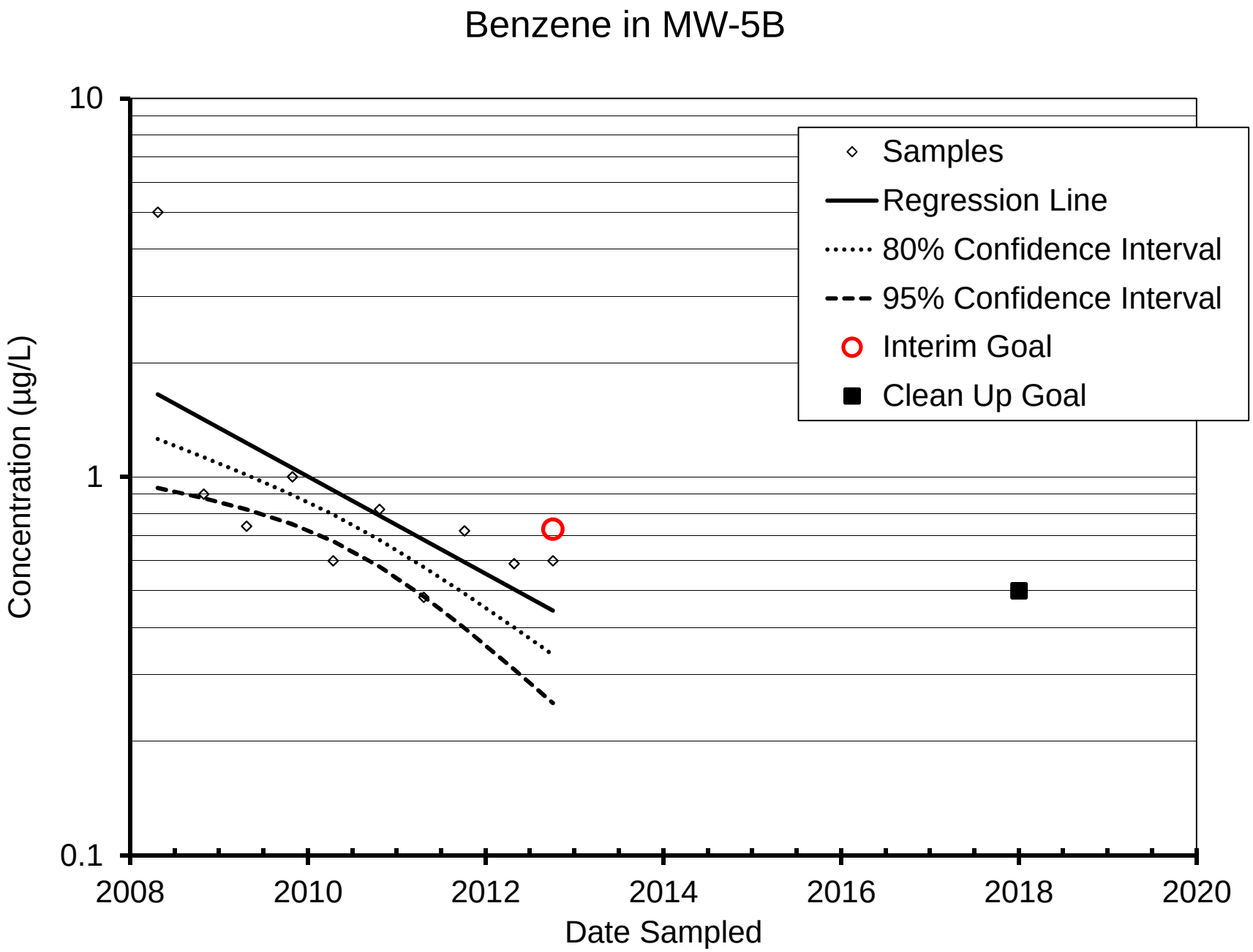

Benzene in MW-101S
100
10
1
0.1
Concentration (µg/L)
2008
2010
2012
2014
2016
2018
2020
Date Sampled
Samples
Regression Line
80% Confidence Interval
95% Confidence Interval
Interim Goal
Clean Up Goal

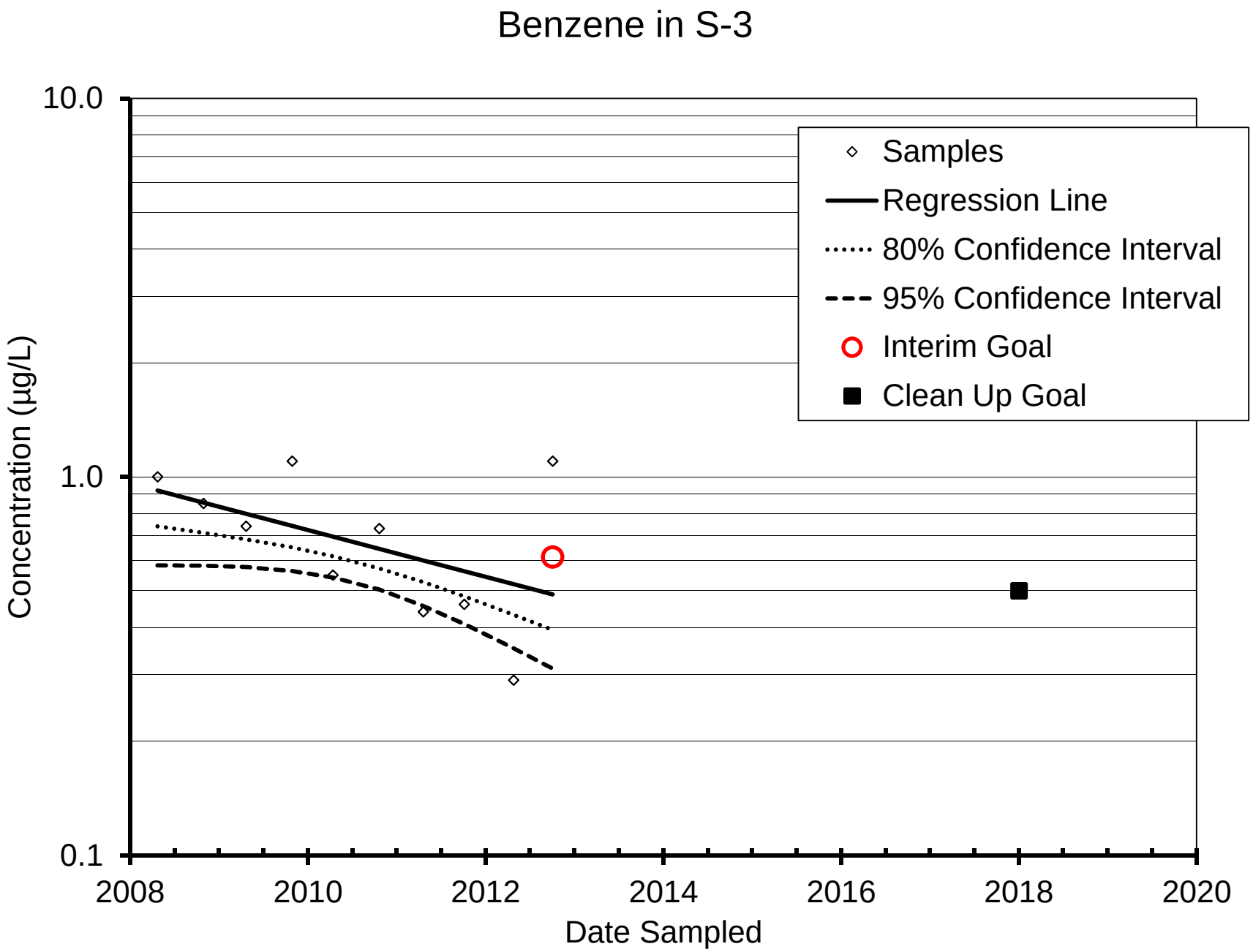

Benzene in MW-1S
10
1
0.1
Concentration (µg/L)
2008
2010
2012
2014
2016
2018
2020
Date Sampled
Samples
Regression Line
80% Confidence Interval
95% Confidence Interval
Interim Goal
Clean Up Goal

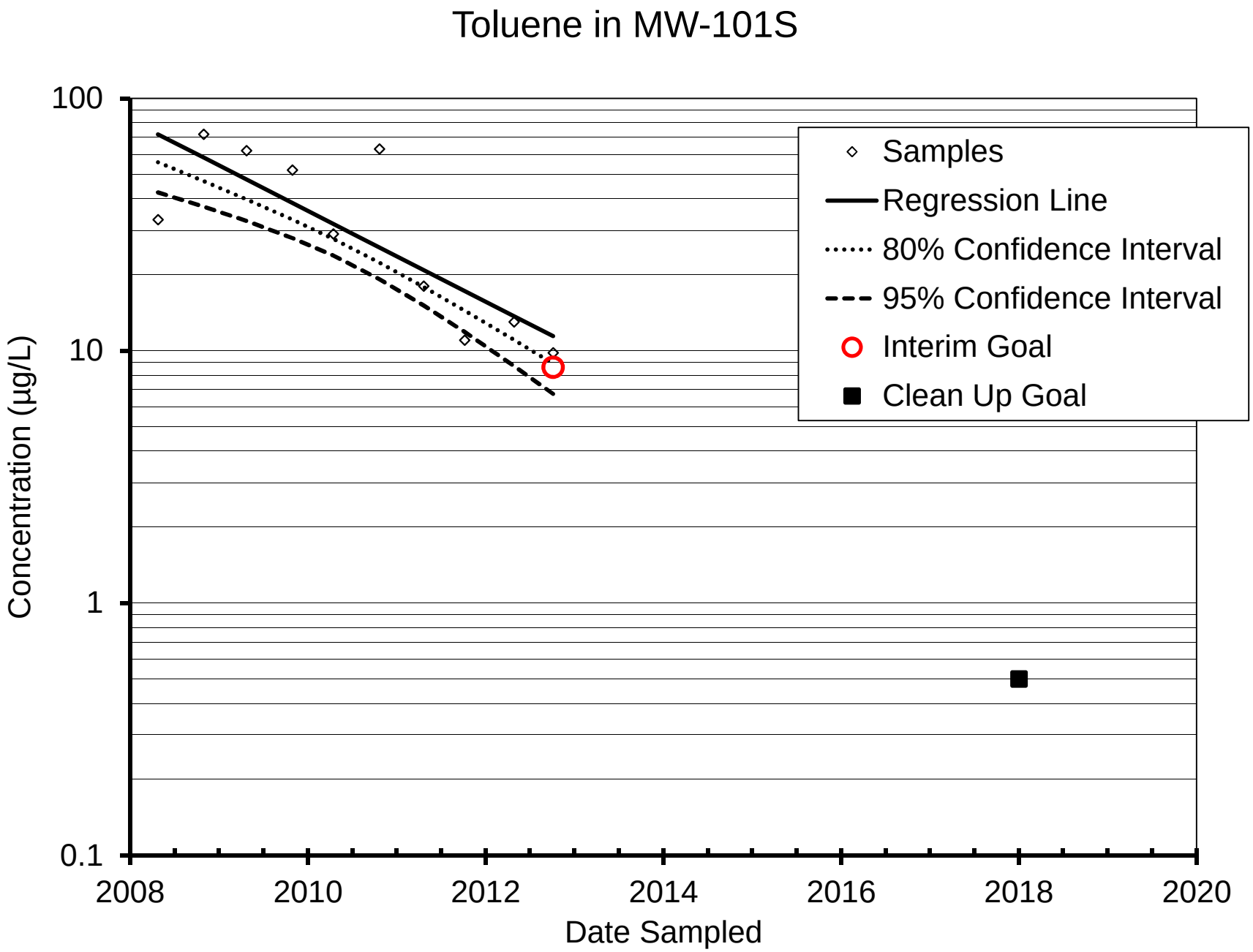

Benzene in MW-4S
10
1
0.1
Concentration (µg/L)
2008
2010
2012
2014
2016
2018
2020
Date Sampled
Samples
Regression Line
80% Confidence Interval
95% Confidence Interval
Interim Goal
Clean Up Goal

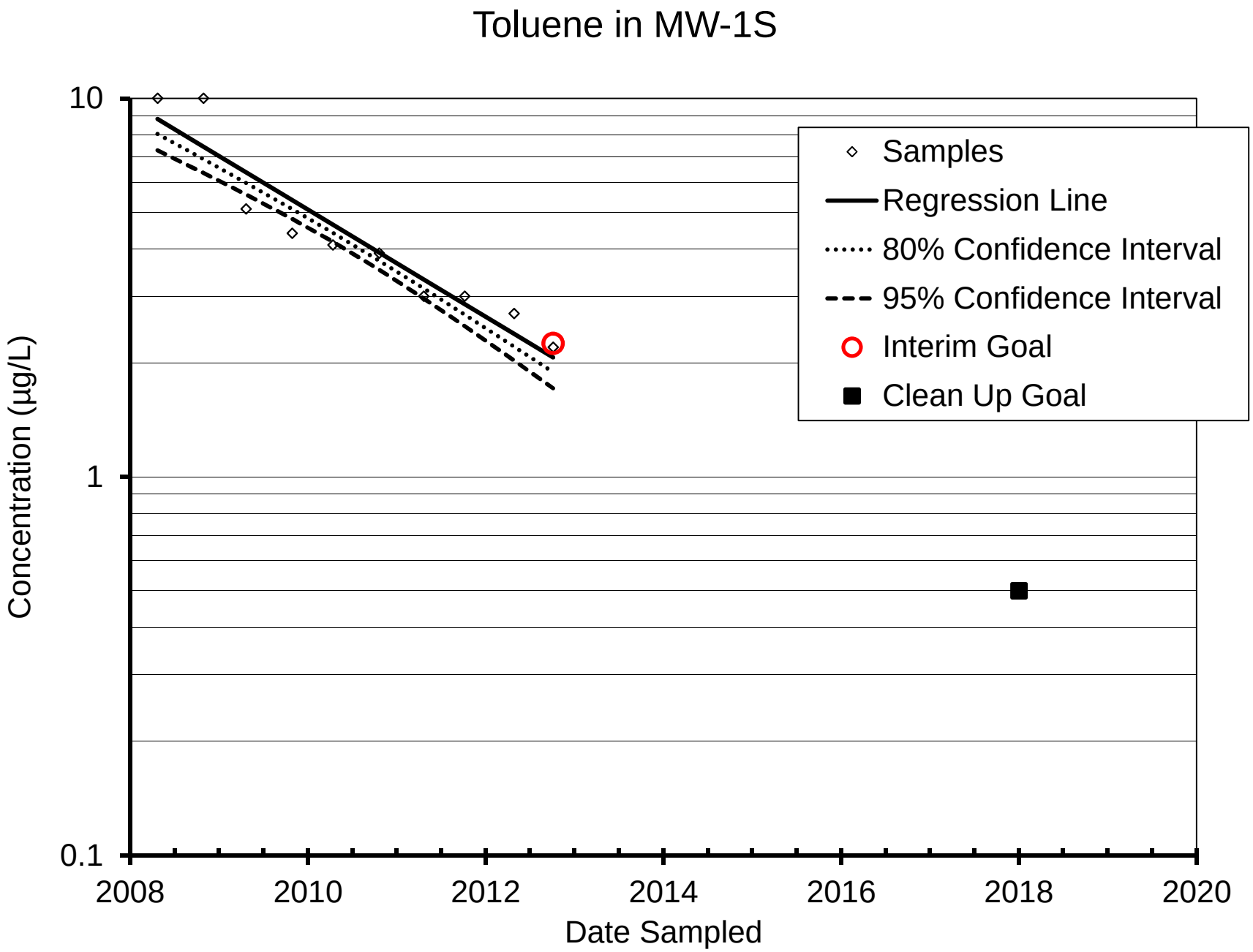

Benzene in MW-4R
10
1
0.1
Concentration (µg/L)
2008
2010
2012
2014
2016
2018
2020
Date Sampled
Samples
Regression Line
80% Confidence Interval
95% Confidence Interval
Interim Goal
Clean Up Goal

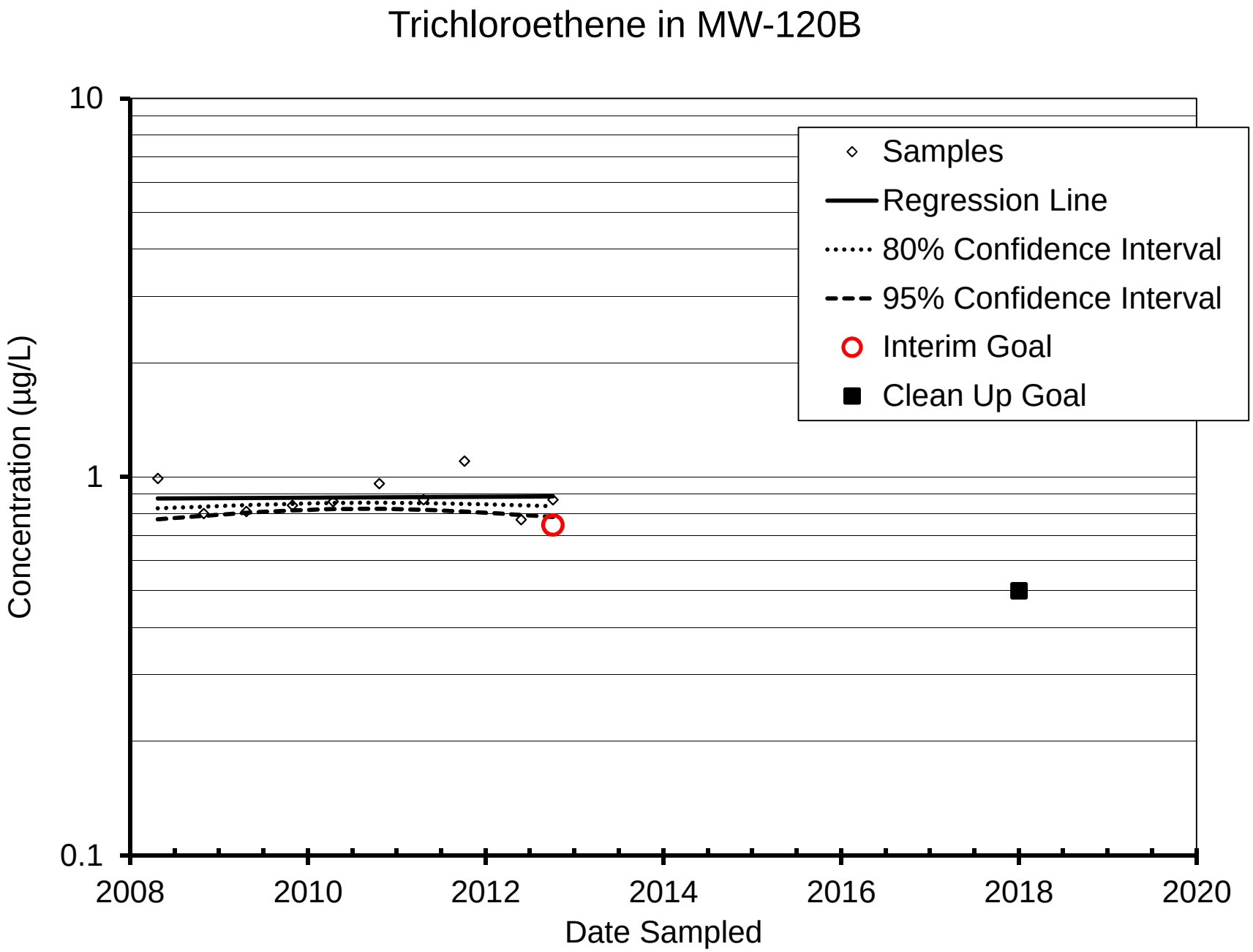

Benzene in MW-5S
10
1
0.1
Concentration (µg/L)
2008
2010
2012
2014
2016
2018
2020
Date Sampled
Samples
Regression Line
80% Confidence Interval
95% Confidence Interval
Interim Goal
Clean Up Goal

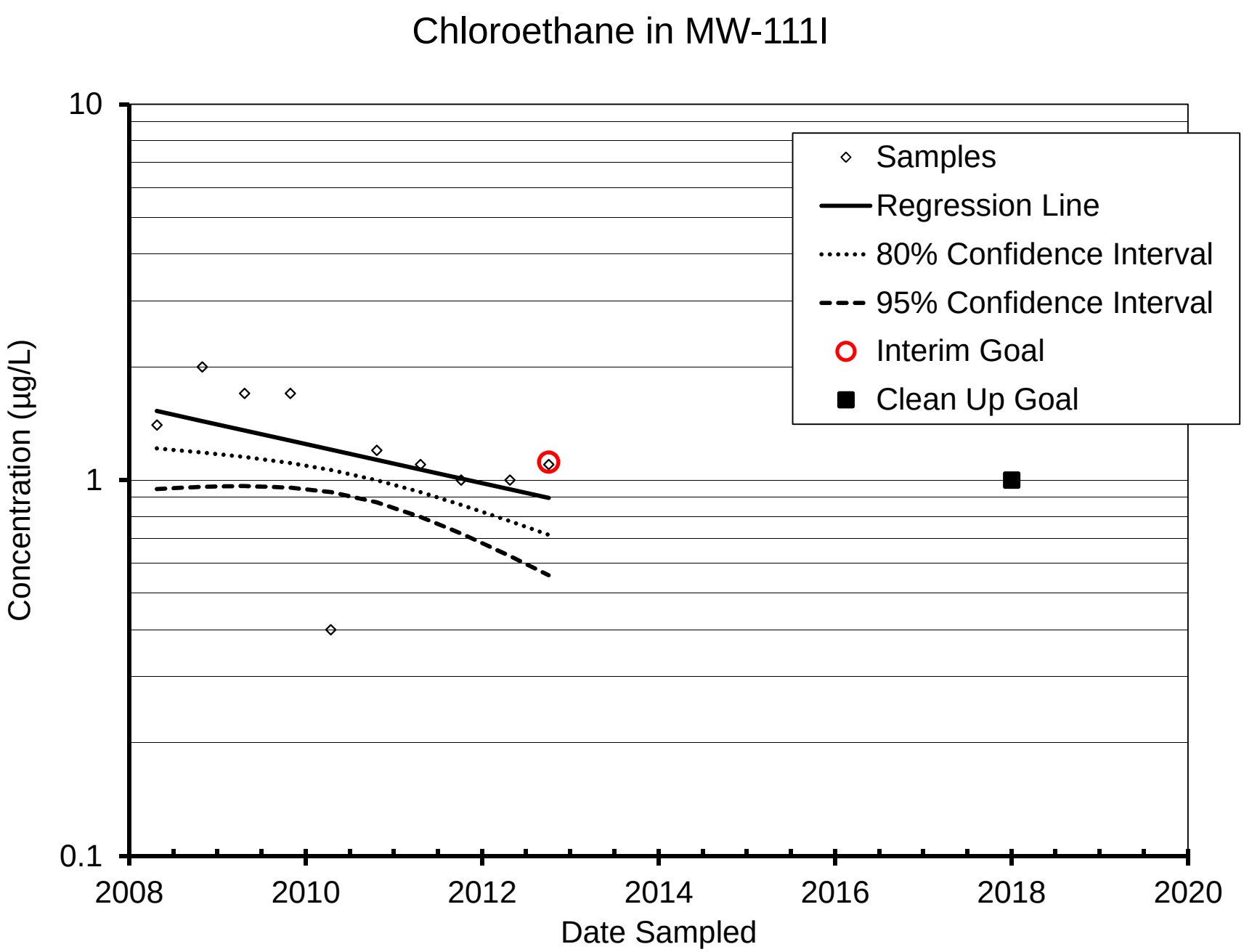

Benzene in MW-5B
10
1
0.1
Concentration (µg/L)
2008
2010
2012
2014
2016
2018
2020
Date Sampled
Samples
Regression Line
80% Confidence Interval
95% Confidence Interval
Interim Goal
Clean Up Goal

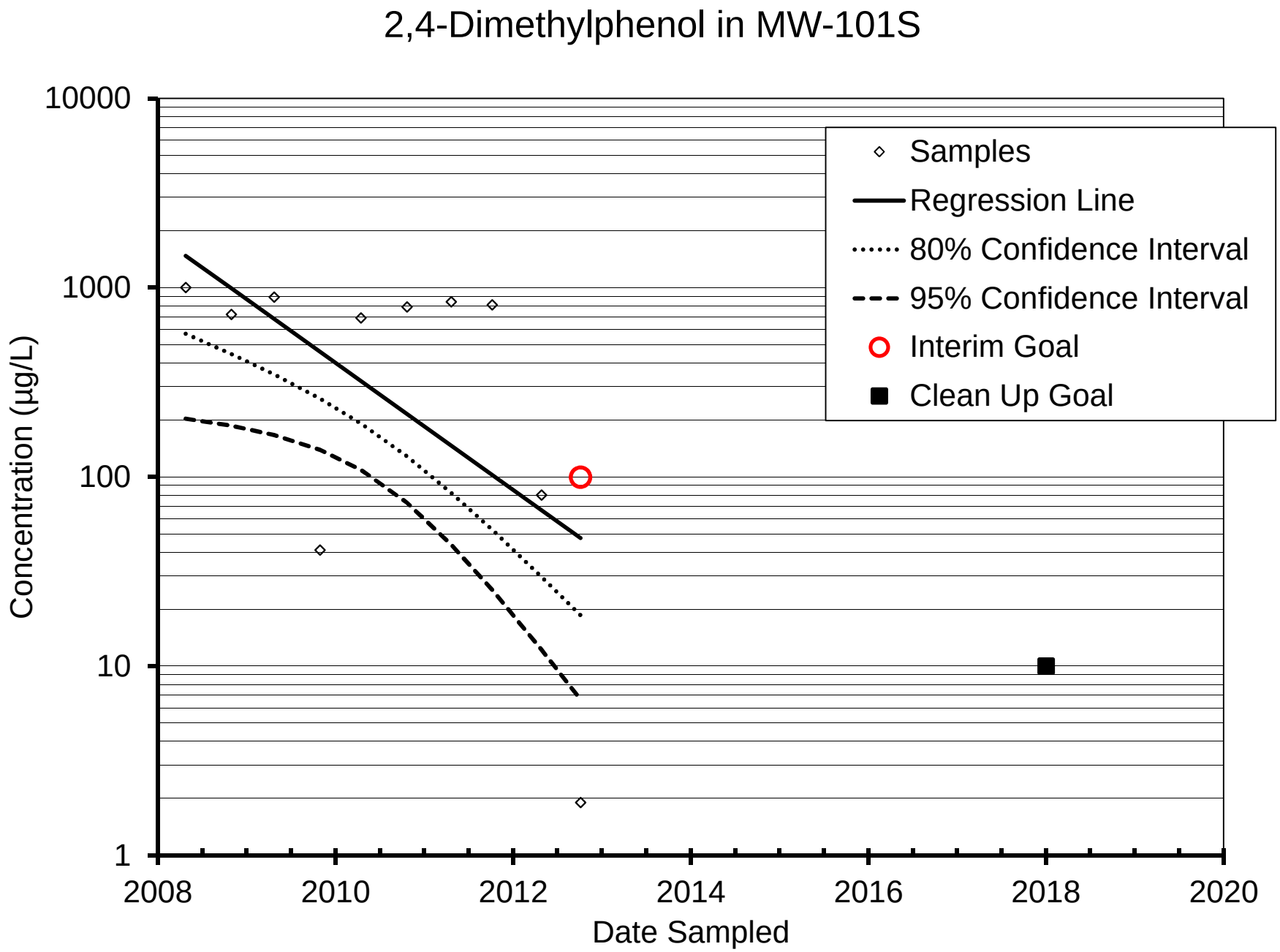

Benzene in S-3
10.0
1.0
0.1
Concentration (µg/L)
2008
2010
2012
2014
2016
2018
2020
Date Sampled
Samples
Regression Line
80% Confidence Interval
95% Confidence Interval
Interim Goal
Clean Up Goal

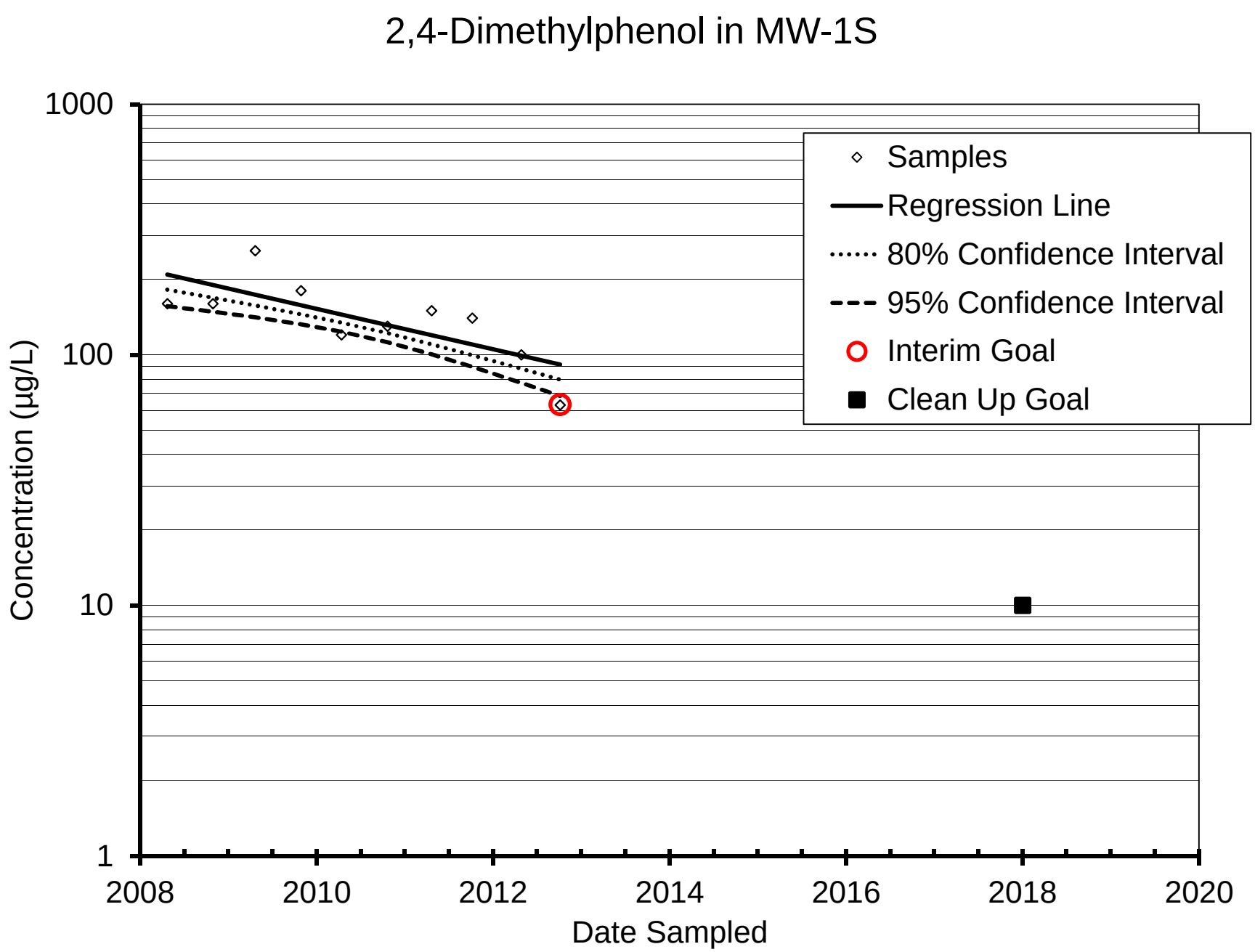

Toluene in MW-101S
100
10
1
0.1
Concentration (µg/L)
2008
2010
2012
2014
2016
2018
2020
Date Sampled
Samples
Regression Line
80% Confidence Interval
95% Confidence Interval
Interim Goal
Clean Up Goal

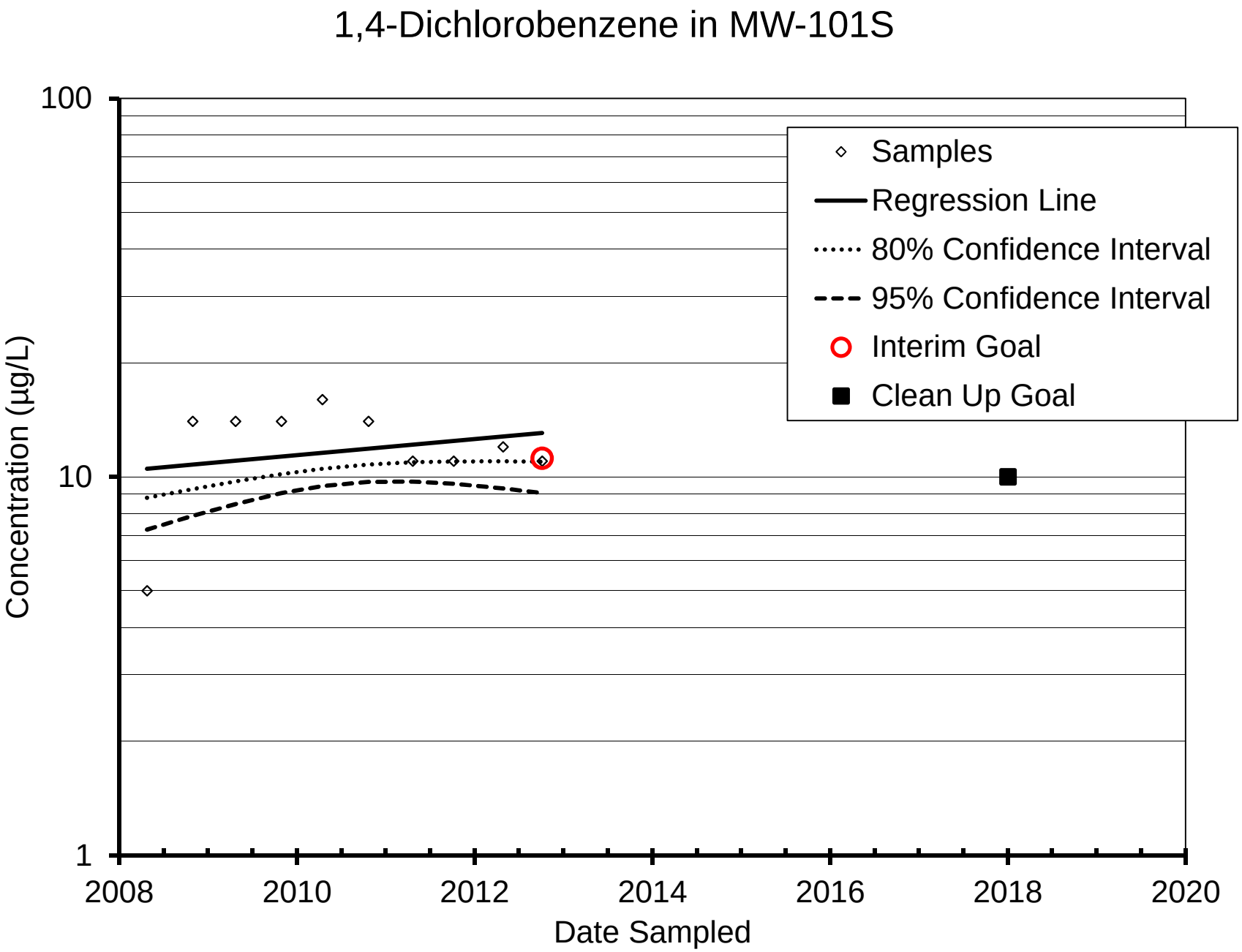

Toluene in MW-1S
10
1
0.1
Concentration (µg/L)
2008
2010
2012
2014
2016
2018
2020
Date Sampled
Samples
Regression Line
80% Confidence Interval
95% Confidence Interval
Interim Goal
Clean Up Goal

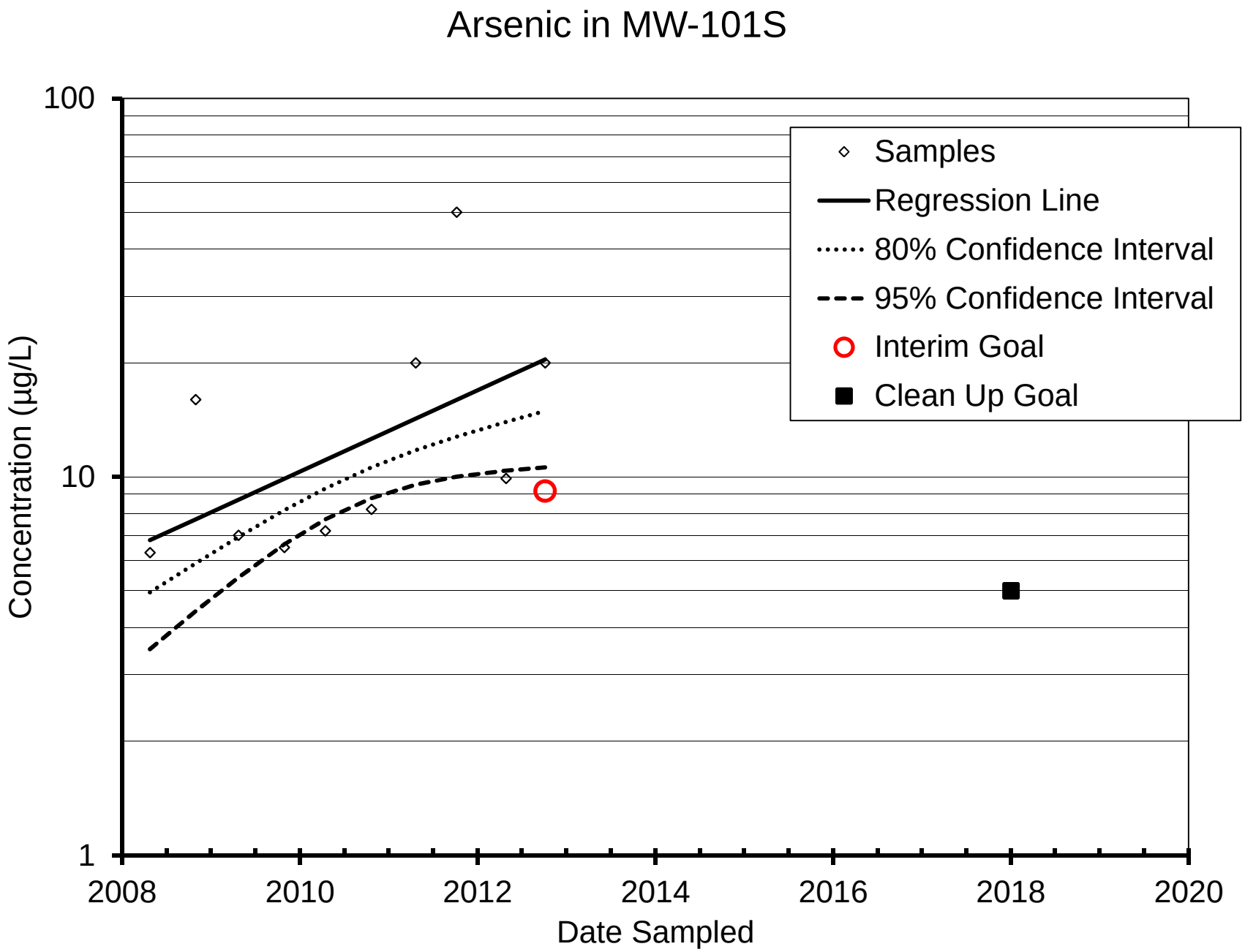

Trichloroethene in MW-120B
10
1
0.1
Concentration (µg/L)
2008
2010
2012
2014
2016
2018
2020
Date Sampled
Samples
Regression Line
80% Confidence Interval
95% Confidence Interval
Interim Goal
Clean Up Goal

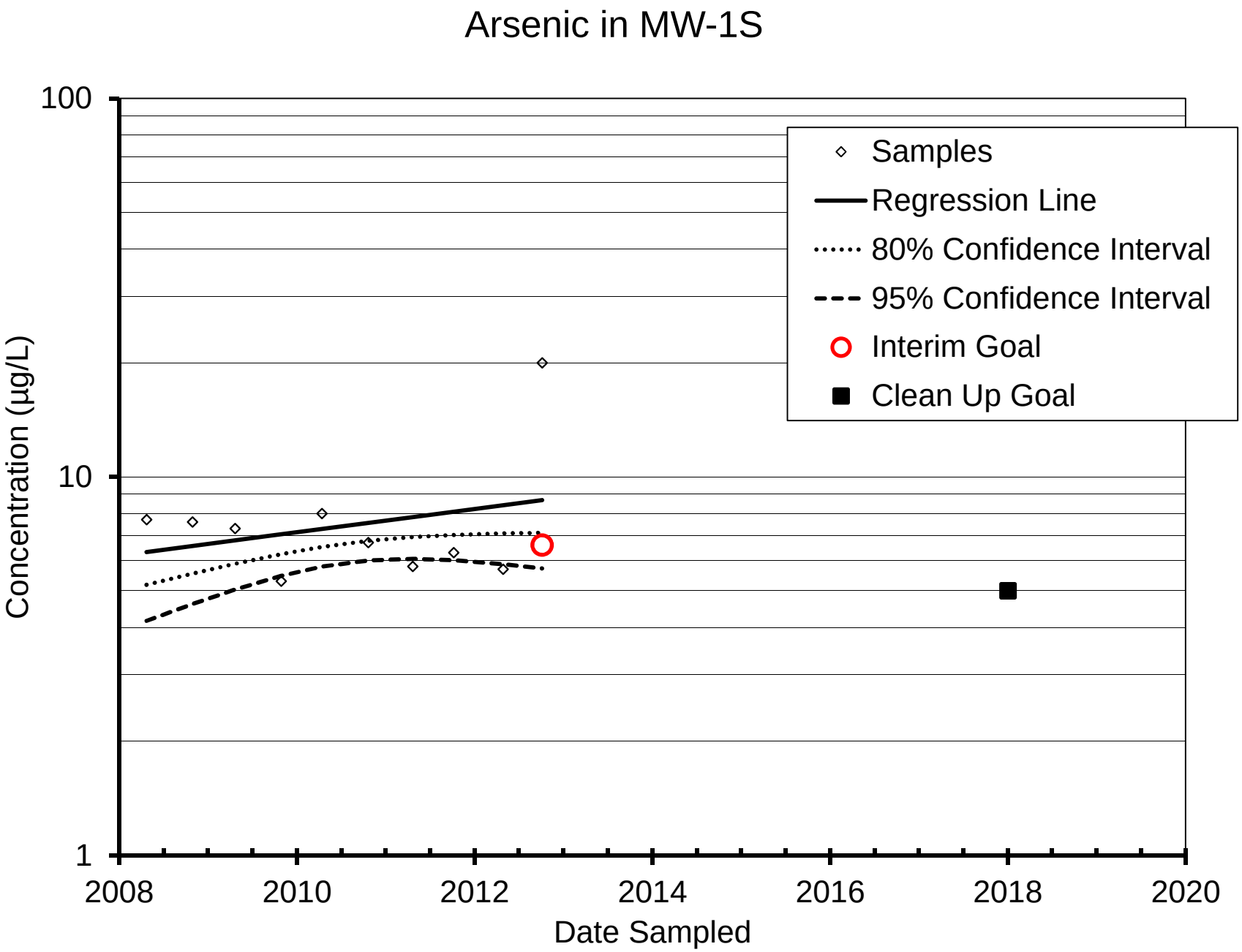

Chloroethane in MW-111I
10
1
0.1
Concentration (µg/L)
2008
2010
2012
2014
2016
2018
2020
Date Sampled
Samples
Regression Line
80% Confidence Interval
95% Confidence Interval
Interim Goal
Clean Up Goal

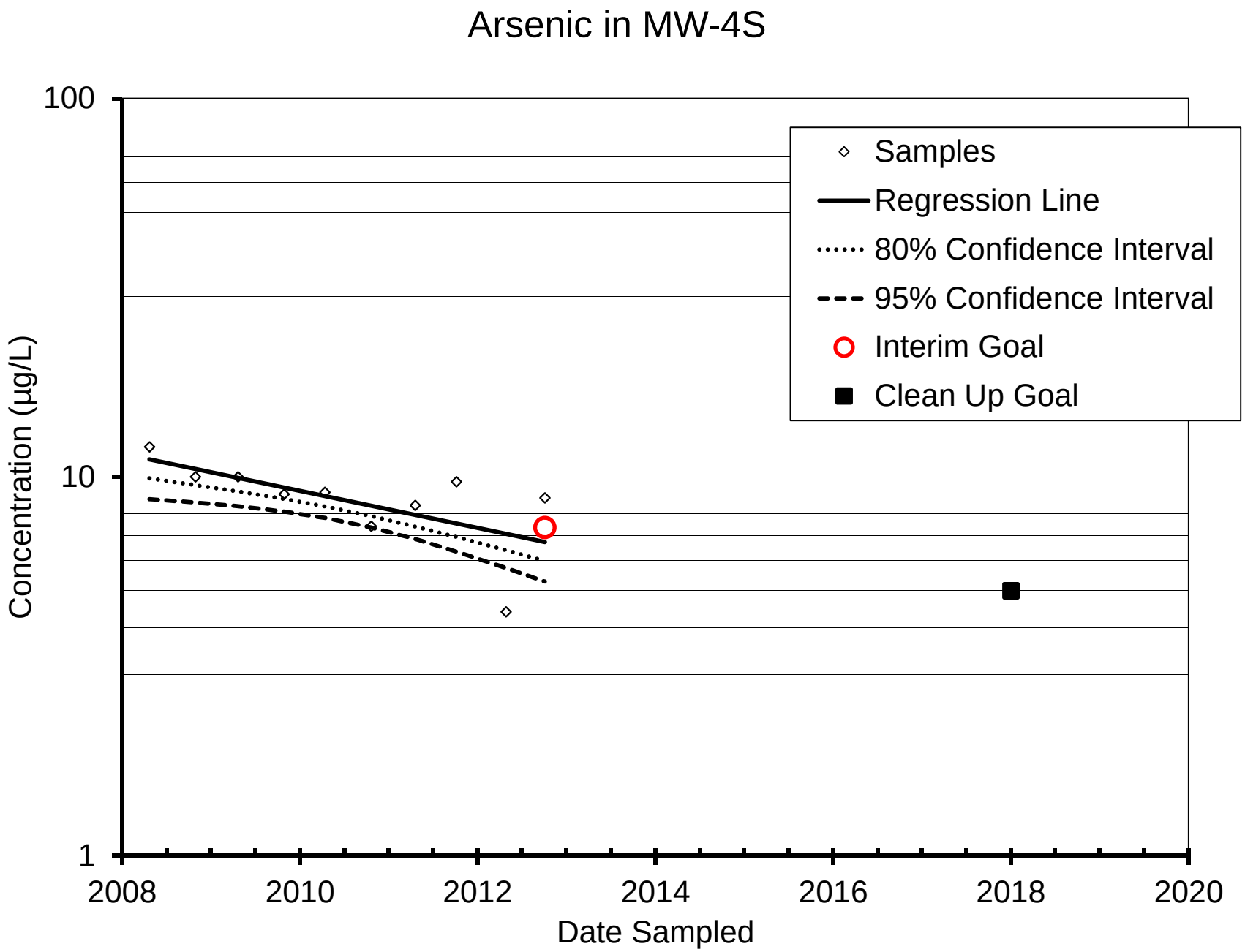

2,4-Dimethylphenol in MW-101S
10000
1000
100
10
1
Concentration (µg/L)
2008
2010
2012
2014
2016
2018
2020
Date Sampled
Samples
Regression Line
80% Confidence Interval
95% Confidence Interval
Interim Goal
Clean Up Goal

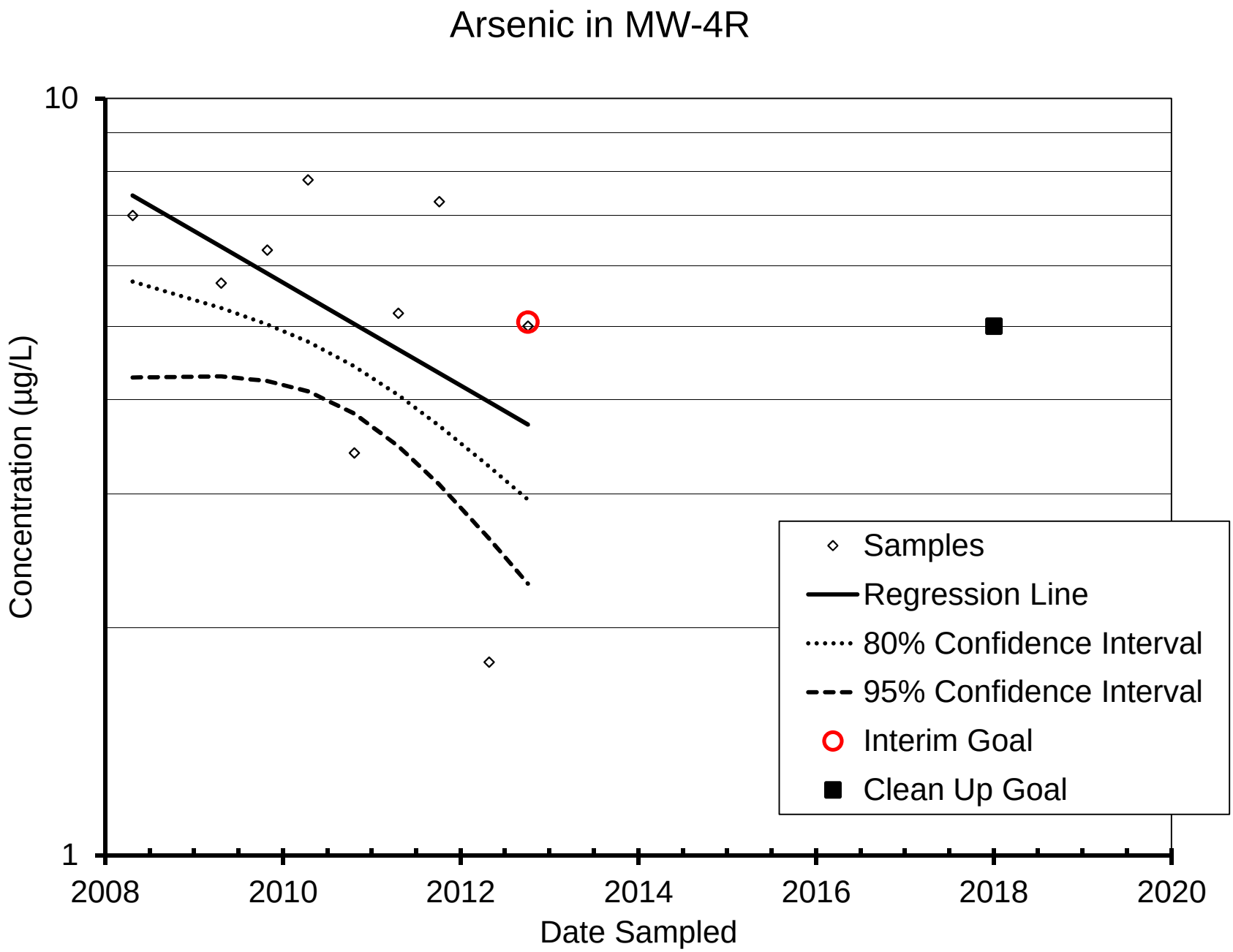

2,4-Dimethylphenol in MW-1S
1000
100
10
1
Concentration (µg/L)
2008
2010
2012
2014
2016
2018
2020
Date Sampled
Samples
Regression Line
80% Confidence Interval
95% Confidence Interval
Interim Goal
Clean Up Goal

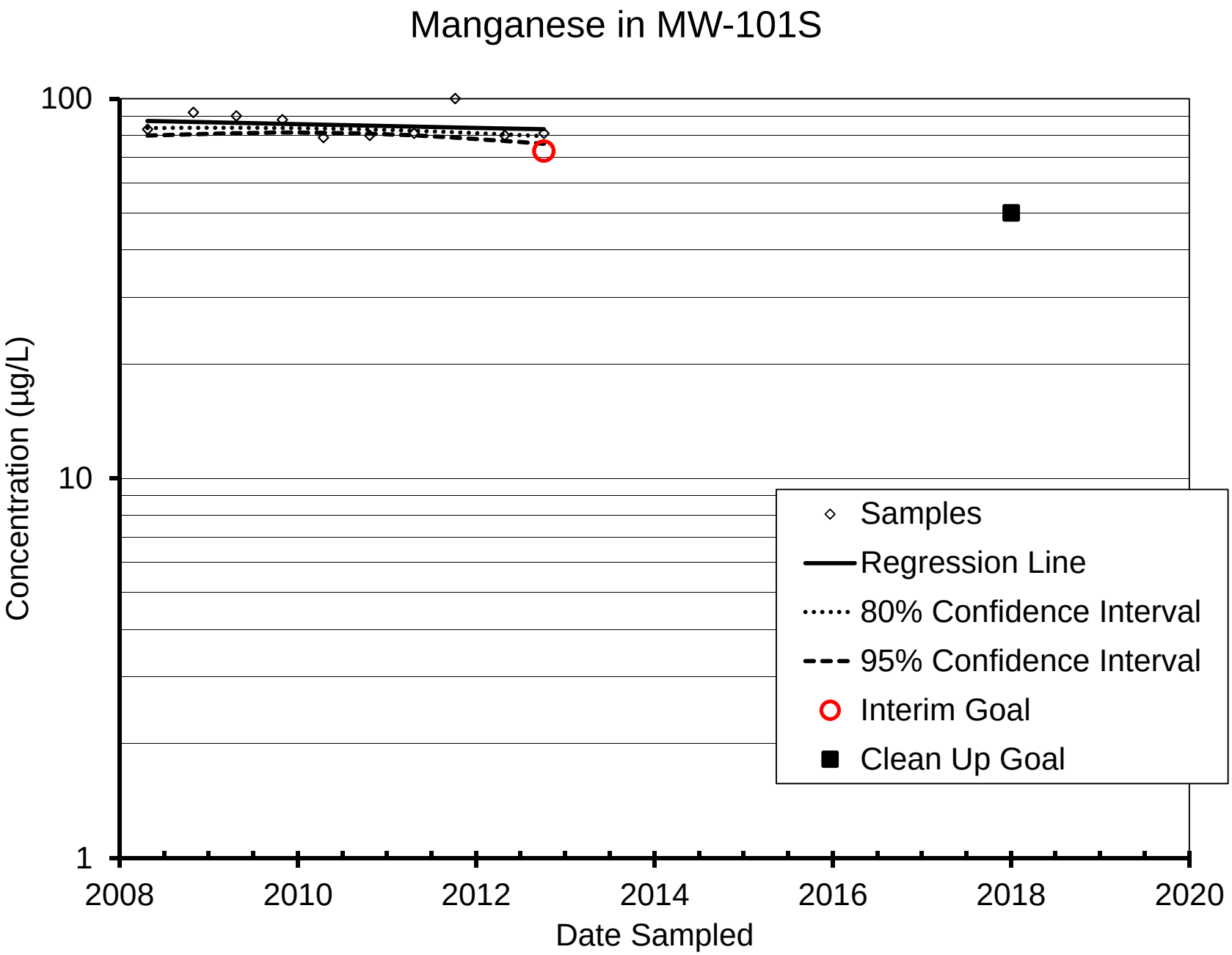

1,4-Dichlorobenzene in MW-101S
100
10
1
Concentration (µg/L)
2008
2010
2012
2014
2016
2018
2020
Date Sampled
Samples
Regression Line
80% Confidence Interval
95% Confidence Interval
Interim Goal
Clean Up Goal

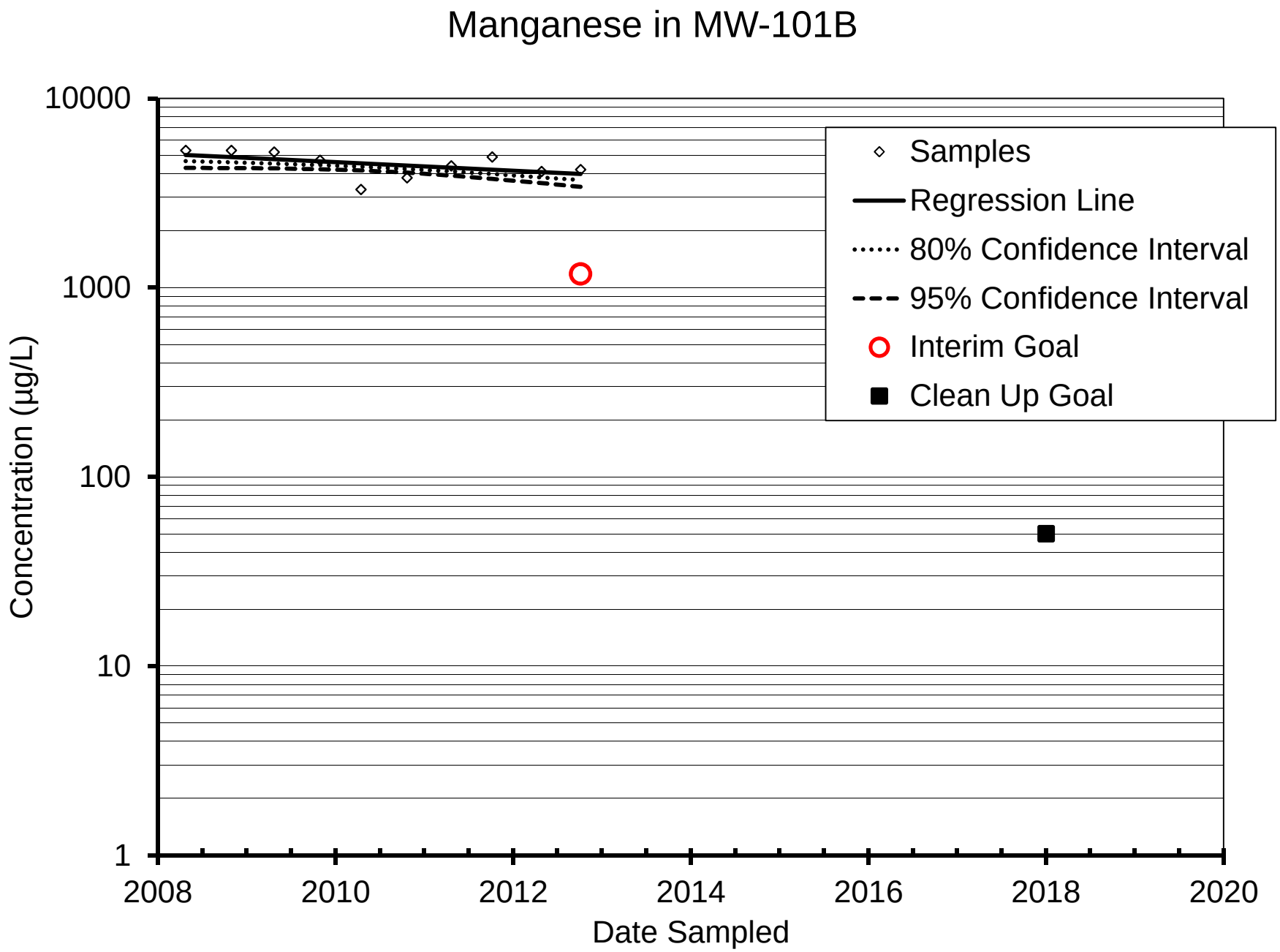

Arsenic in MW-101S
100
10
1
Concentration (µg/L)
2008
2010
2012
2014
2016
2018
2020
Date Sampled
Samples
Regression Line
80% Confidence Interval
95% Confidence Interval
Interim Goal
Clean Up Goal

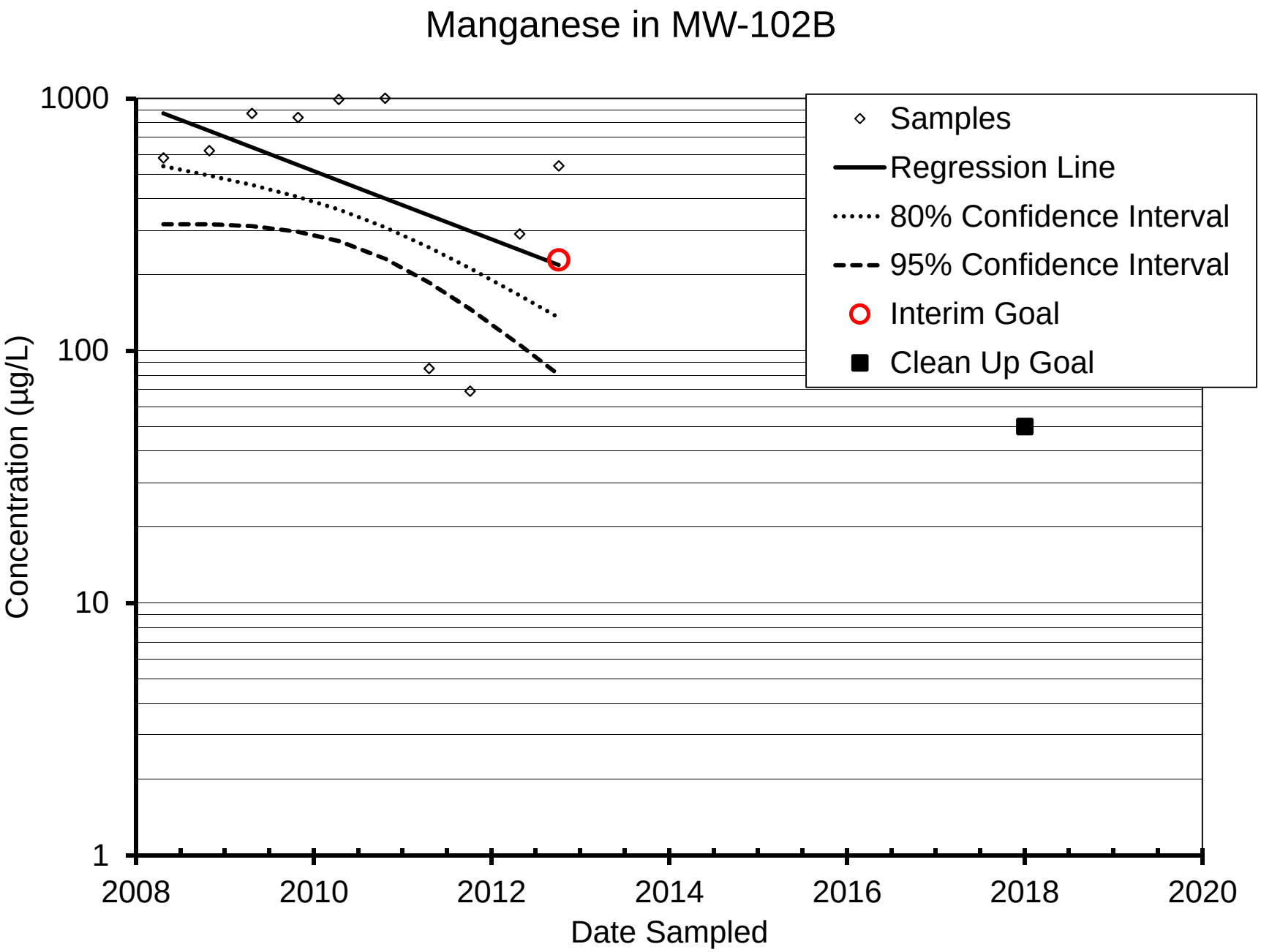

Arsenic in MW-1S
100
10
1
Concentration (µg/L)
2008
2010
2012
2014
2016
2018
2020
Date Sampled
Samples
Regression Line
80% Confidence Interval
95% Confidence Interval
Interim Goal
Clean Up Goal

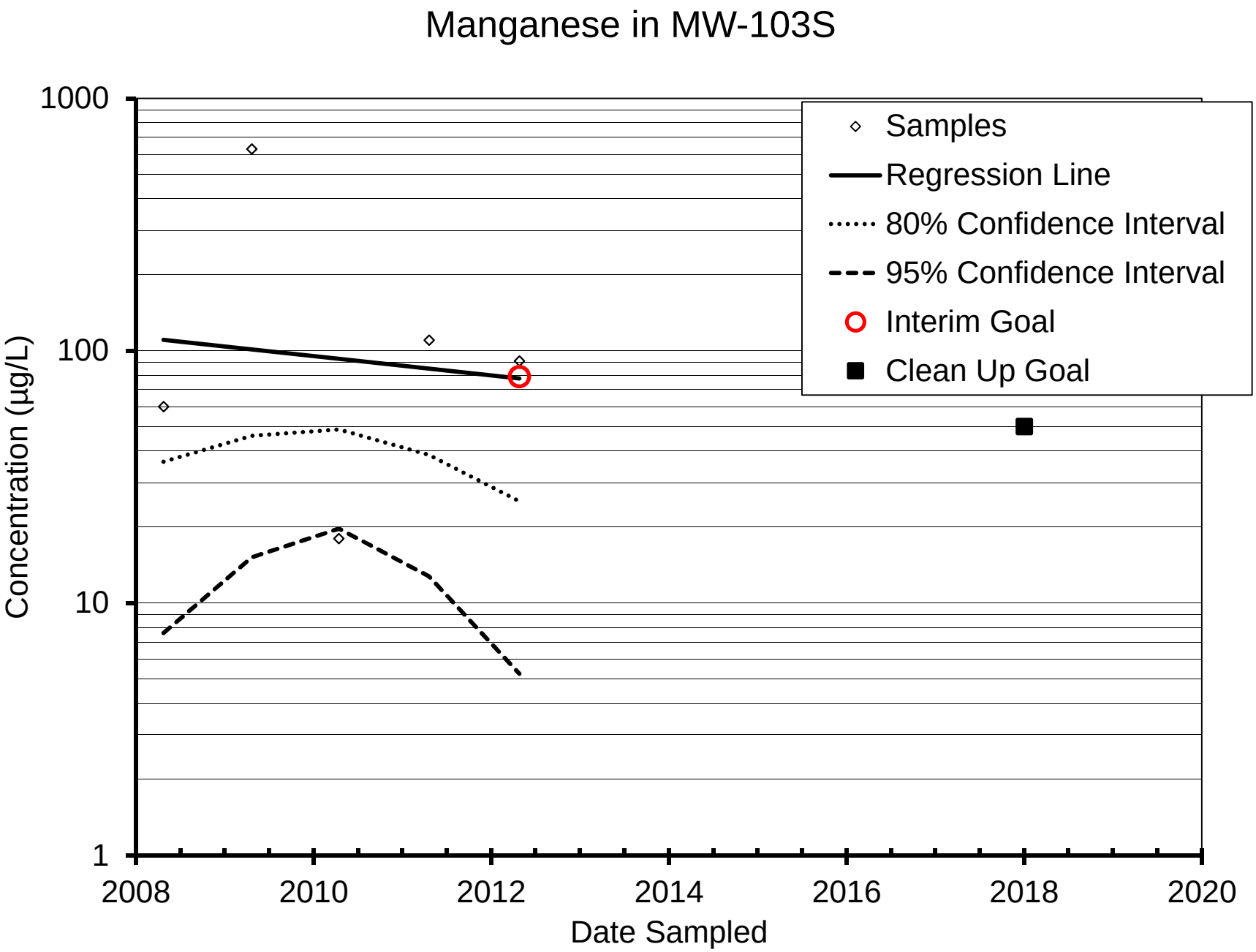

Arsenic in MW-4S
100
10
1
Concentration (µg/L)
2008
2010
2012
2014
2016
2018
2020
Date Sampled
Samples
Regression Line
80% Confidence Interval
95% Confidence Interval
Interim Goal
Clean Up Goal

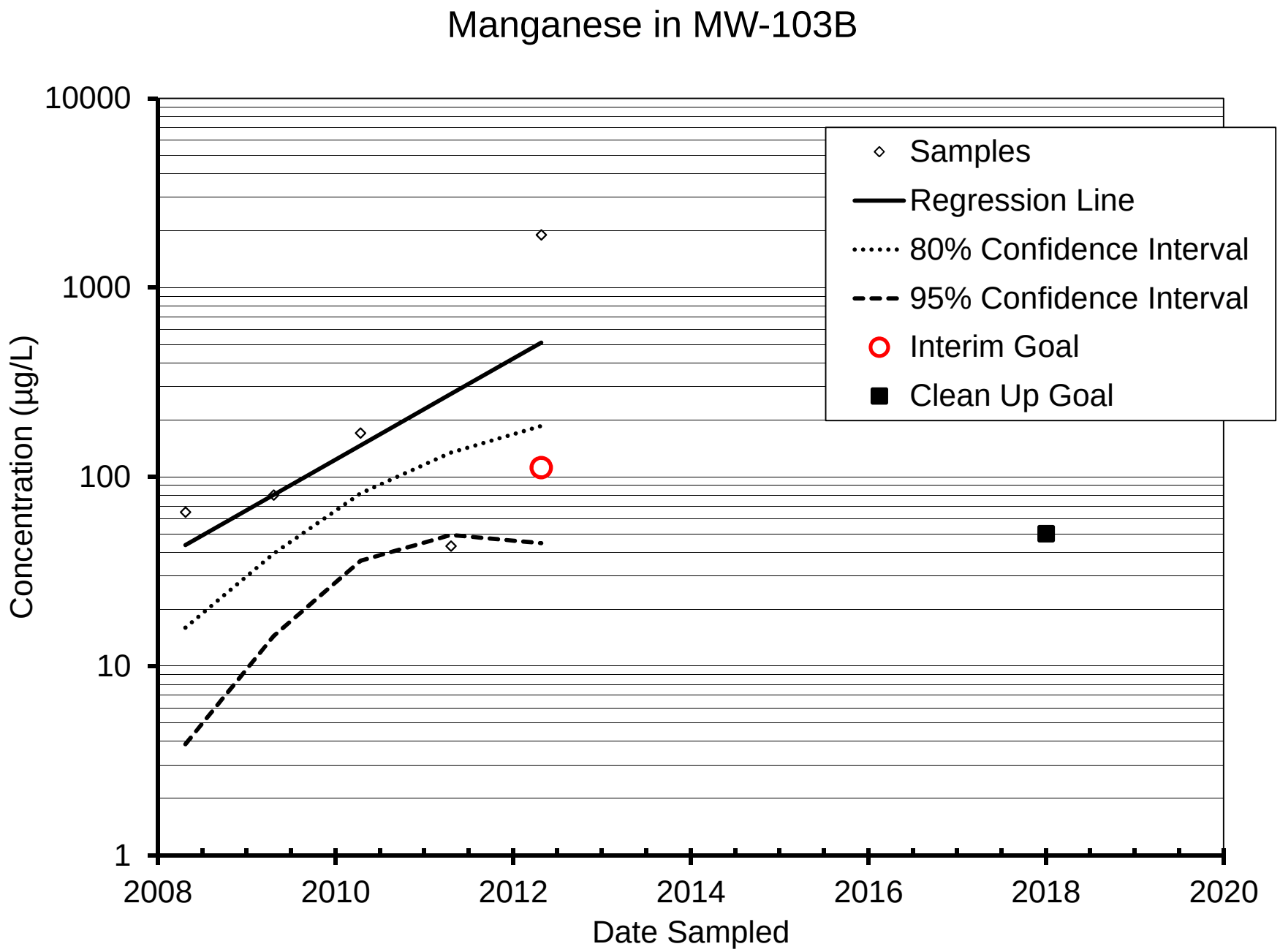

Arsenic in MW-4R
10
1
Concentration (µg/L)
2008
2010
2012
2014
2016
2018
2020
Date Sampled
Samples
Regression Line
80% Confidence Interval
95% Confidence Interval
Interim Goal
Clean Up Goal

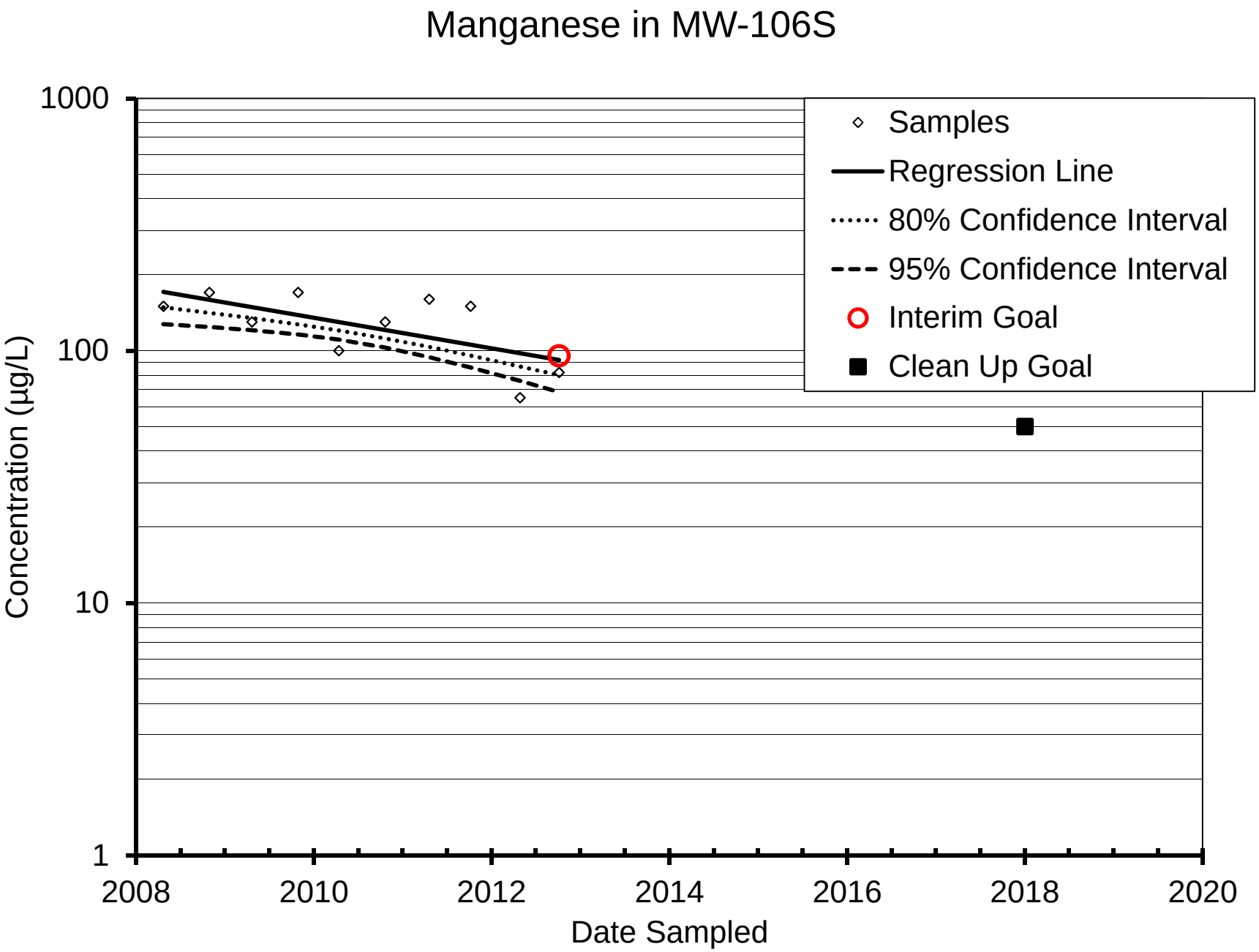

Manganese in MW-101S
100
10
1
Concentration (µg/L)
2008
2010
2012
2014
2016
2018
2020
Date Sampled
Samples
Regression Line
80% Confidence Interval
95% Confidence Interval
Interim Goal
Clean Up Goal

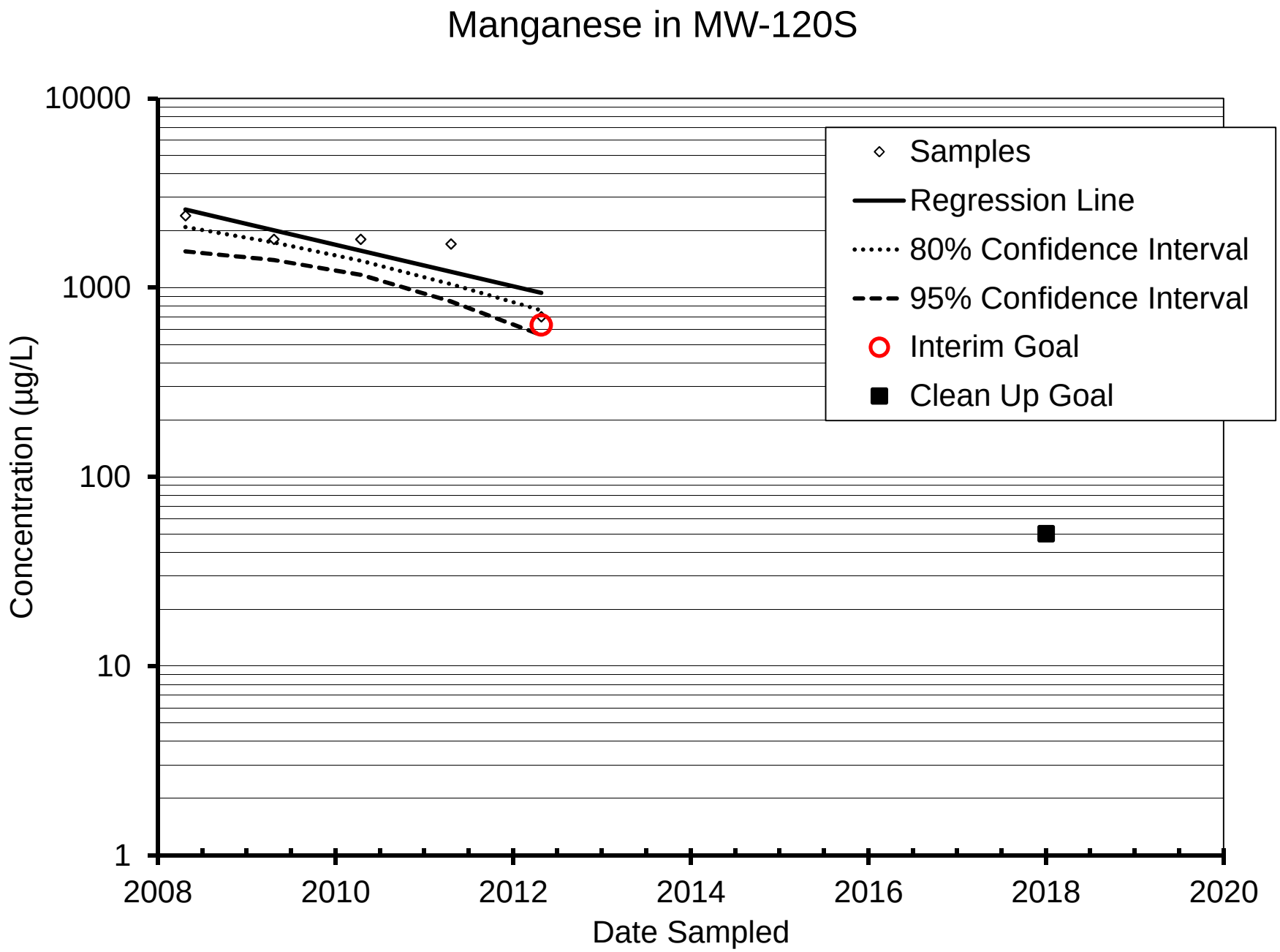

Manganese in MW-101B
10000
1000
100
10
1
Concentration (µg/L)
2008
2010
2012
2014
2016
2018
2020
Date Sampled
Samples
Regression Line
80% Confidence Interval
95% Confidence Interval
Interim Goal
Clean Up Goal

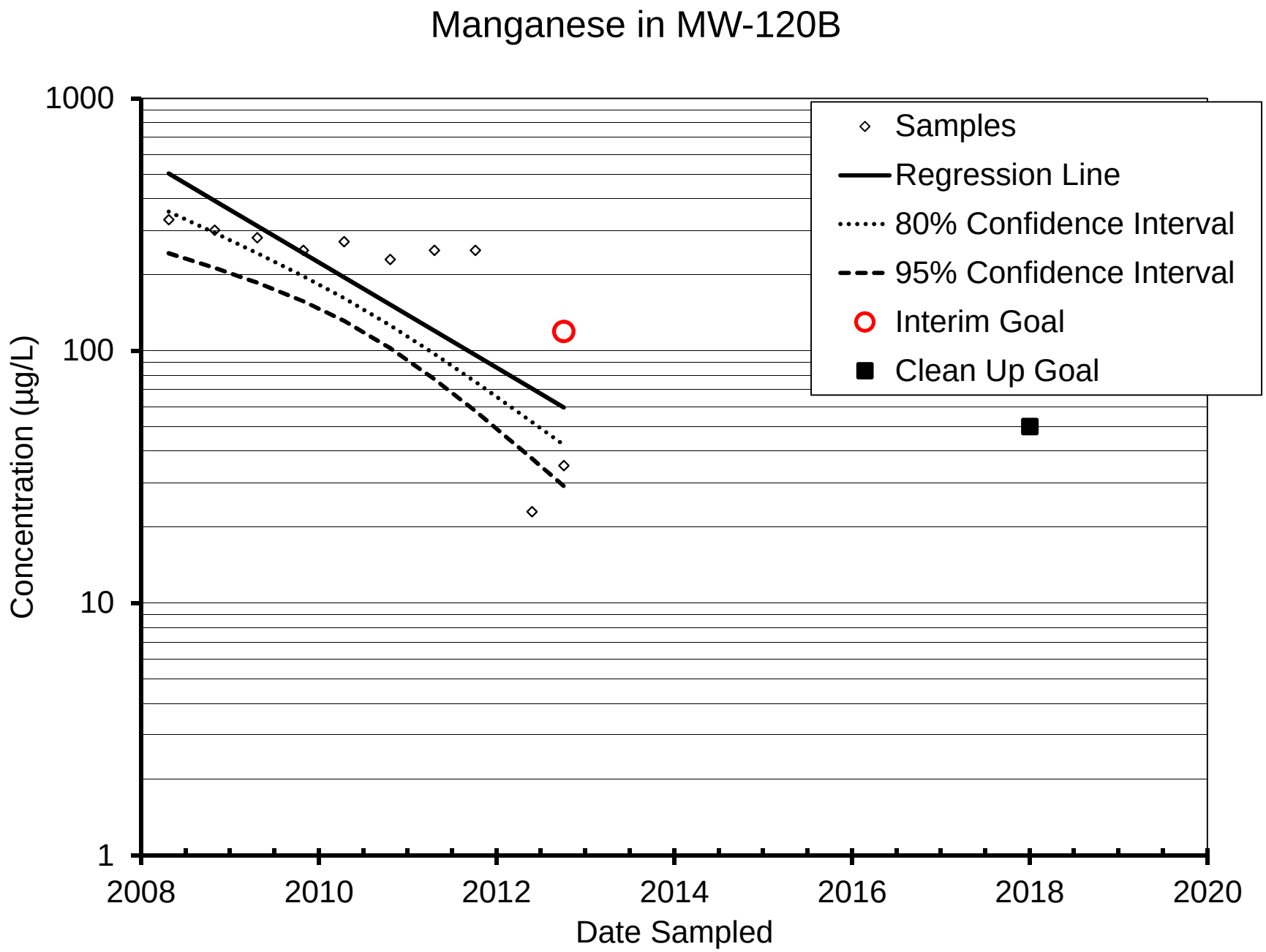

Manganese in MW-102B
1000
100
10
1
Concentration (µg/L)
2008
2010
2012
2014
2016
2018
2020
Date Sampled
Samples
Regression Line
80% Confidence Interval
95% Confidence Interval
Interim Goal
Clean Up Goal

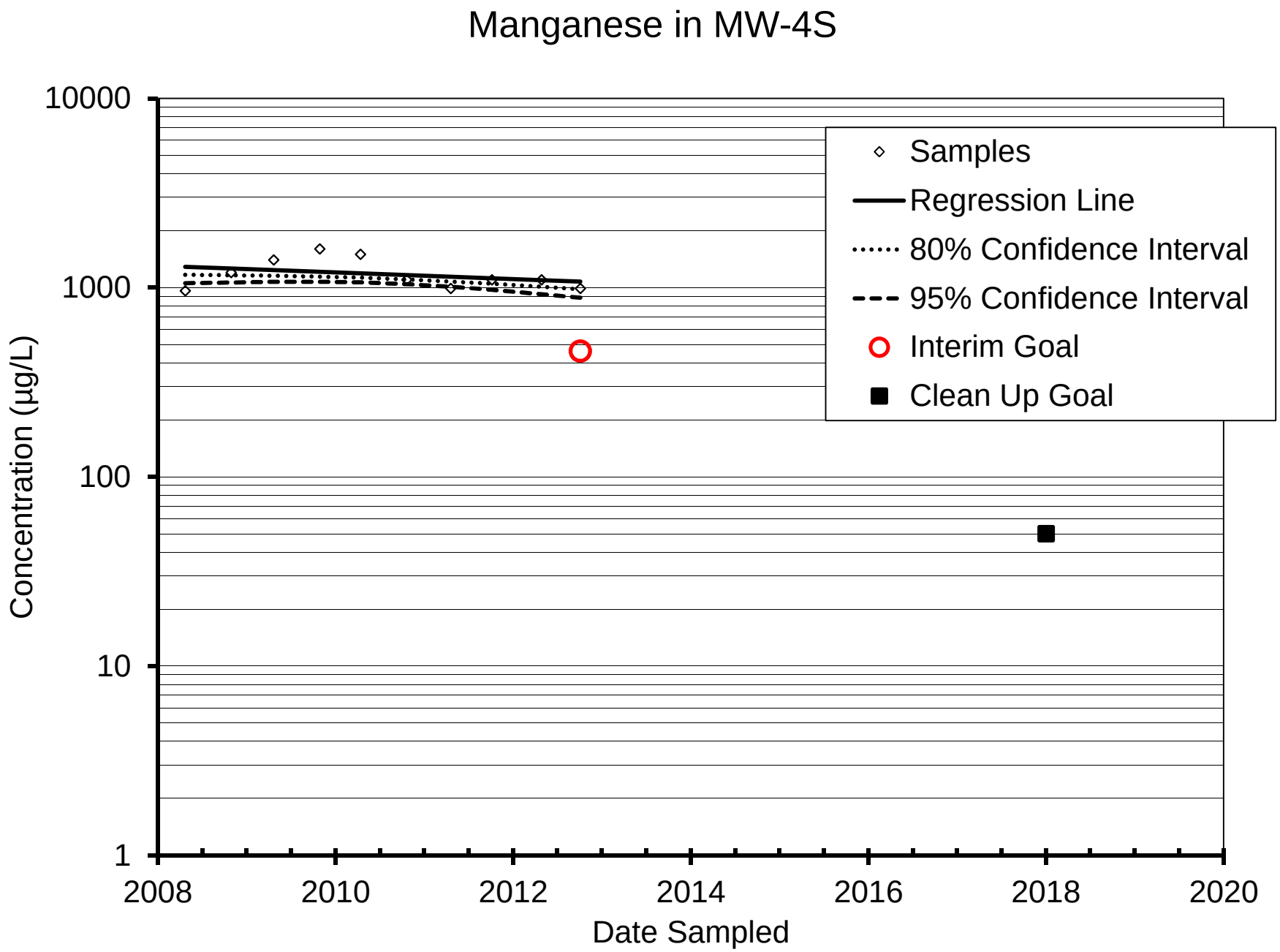

Manganese in MW-103S
1000
100
10
1
Concentration (µg/L)
2008
2010
2012
2014
2016
2018
2020
Date Sampled
Samples
Regression Line
80% Confidence Interval
95% Confidence Interval
Interim Goal
Clean Up Goal

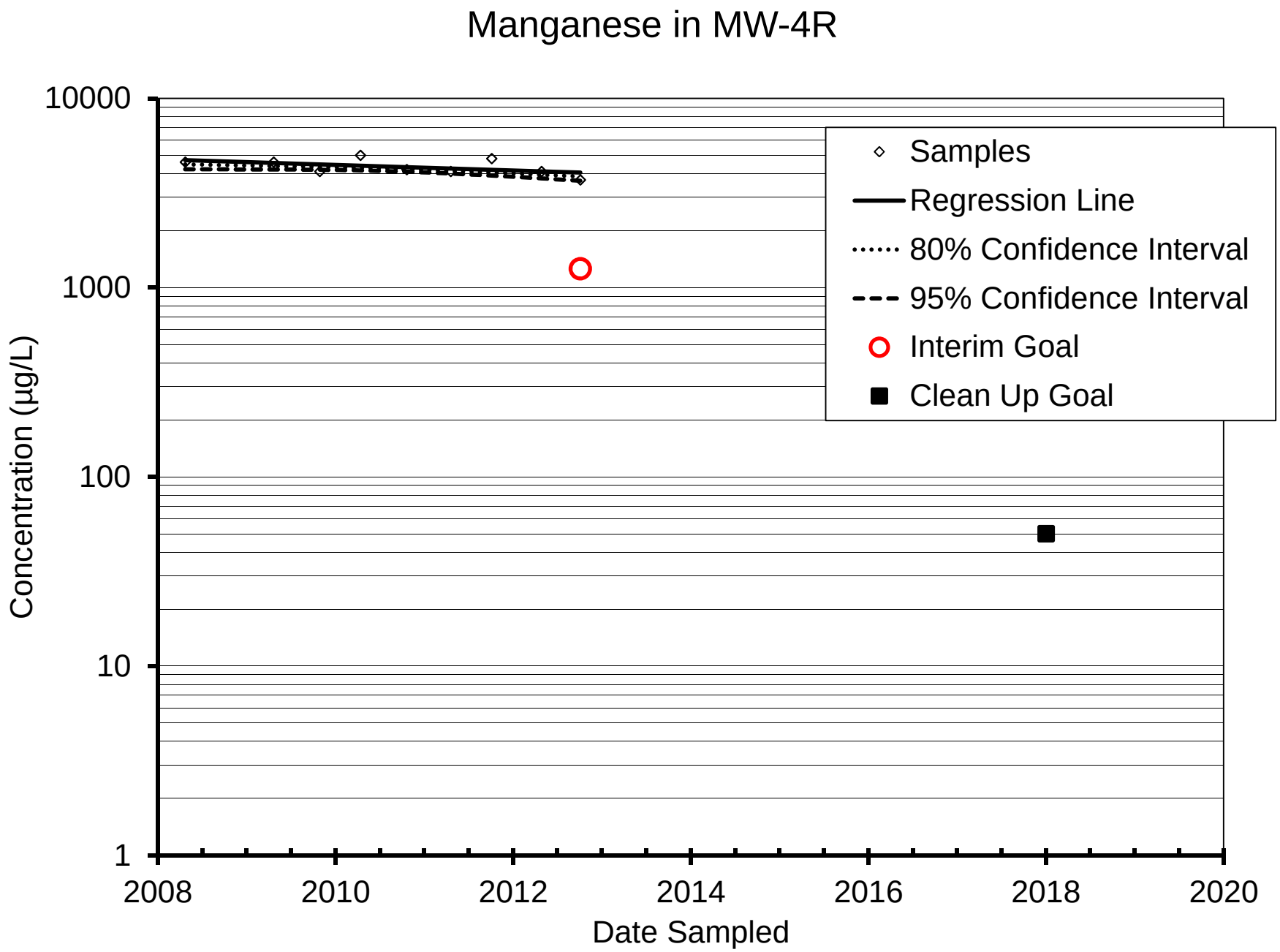

Manganese in MW-103B
10000
1000
100
10
1
Concentration (µg/L)
2008
2010
2012
2014
2016
2018
2020
Date Sampled
Samples
Regression Line
80% Confidence Interval
95% Confidence Interval
Interim Goal
Clean Up Goal

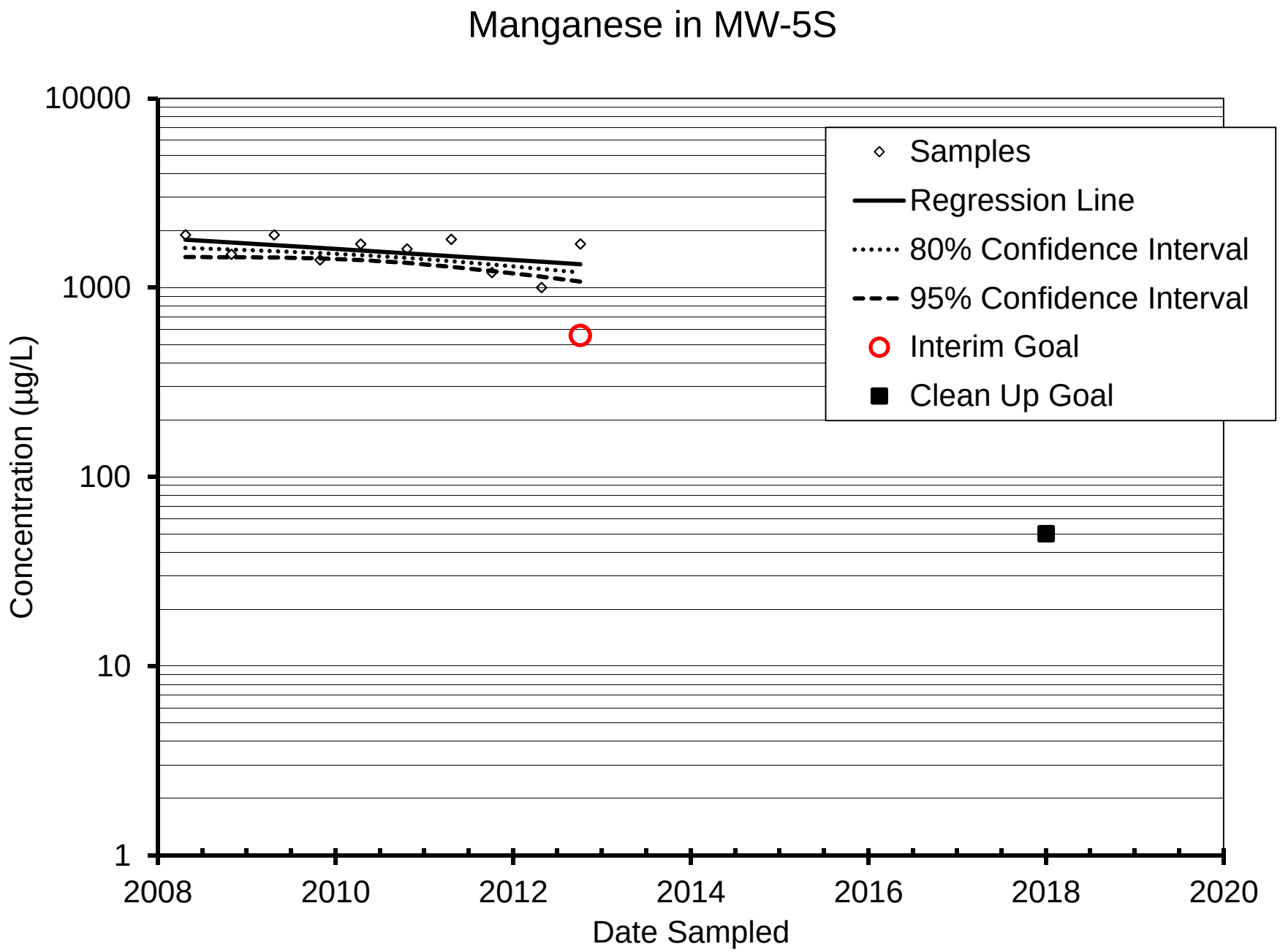

Manganese in MW-106S
1000
100
10
1
Concentration (µg/L)
2008
2010
2012
2014
2016
2018
2020
Date Sampled
Samples
Regression Line
80% Confidence Interval
95% Confidence Interval
Interim Goal
Clean Up Goal

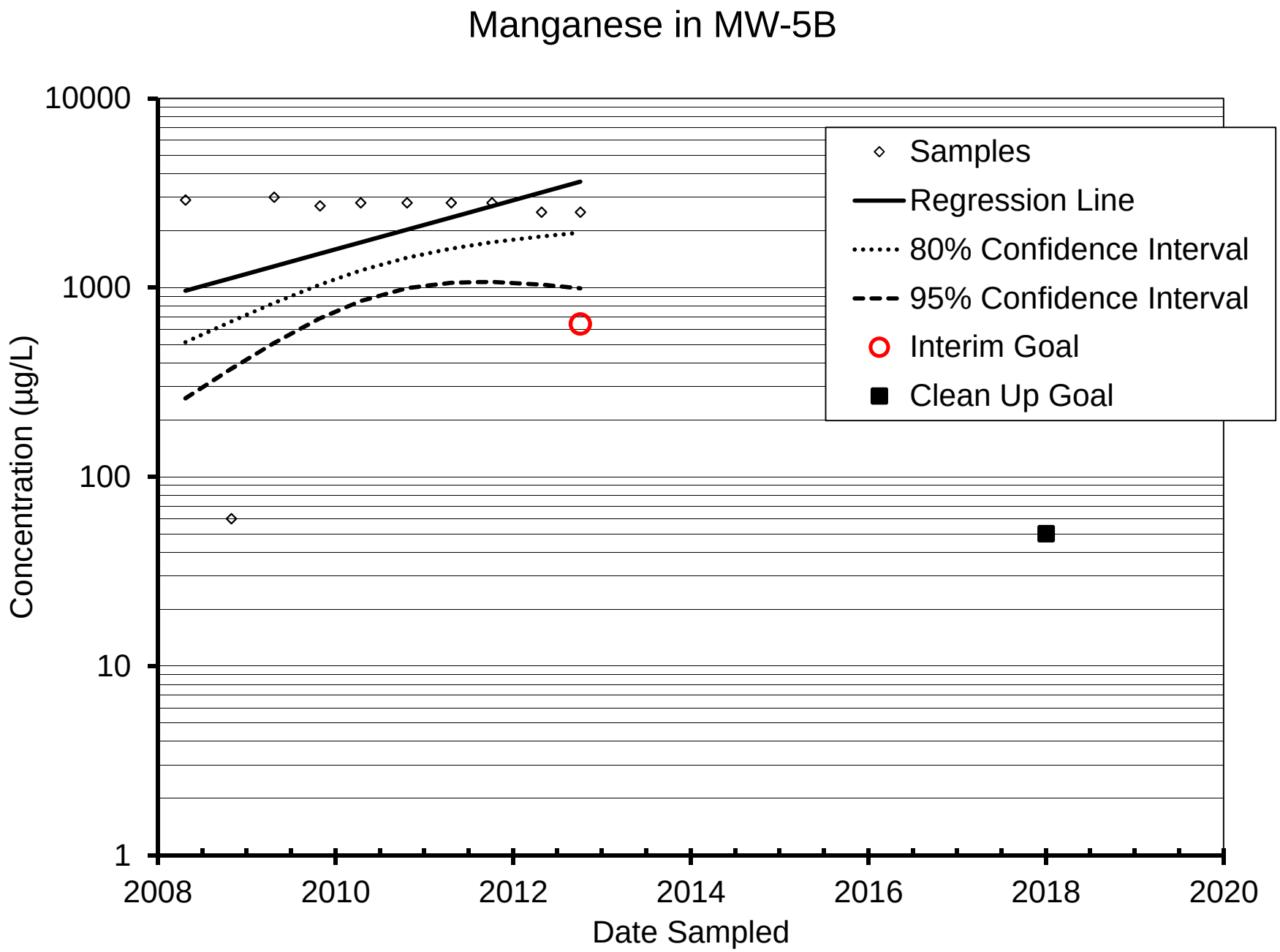

Manganese in MW-120S
10000
1000
100
10
1
Concentration (µg/L)
2008
2010
2012
2014
2016
2018
2020
Date Sampled
Samples
Regression Line
80% Confidence Interval
95% Confidence Interval
Interim Goal
Clean Up Goal

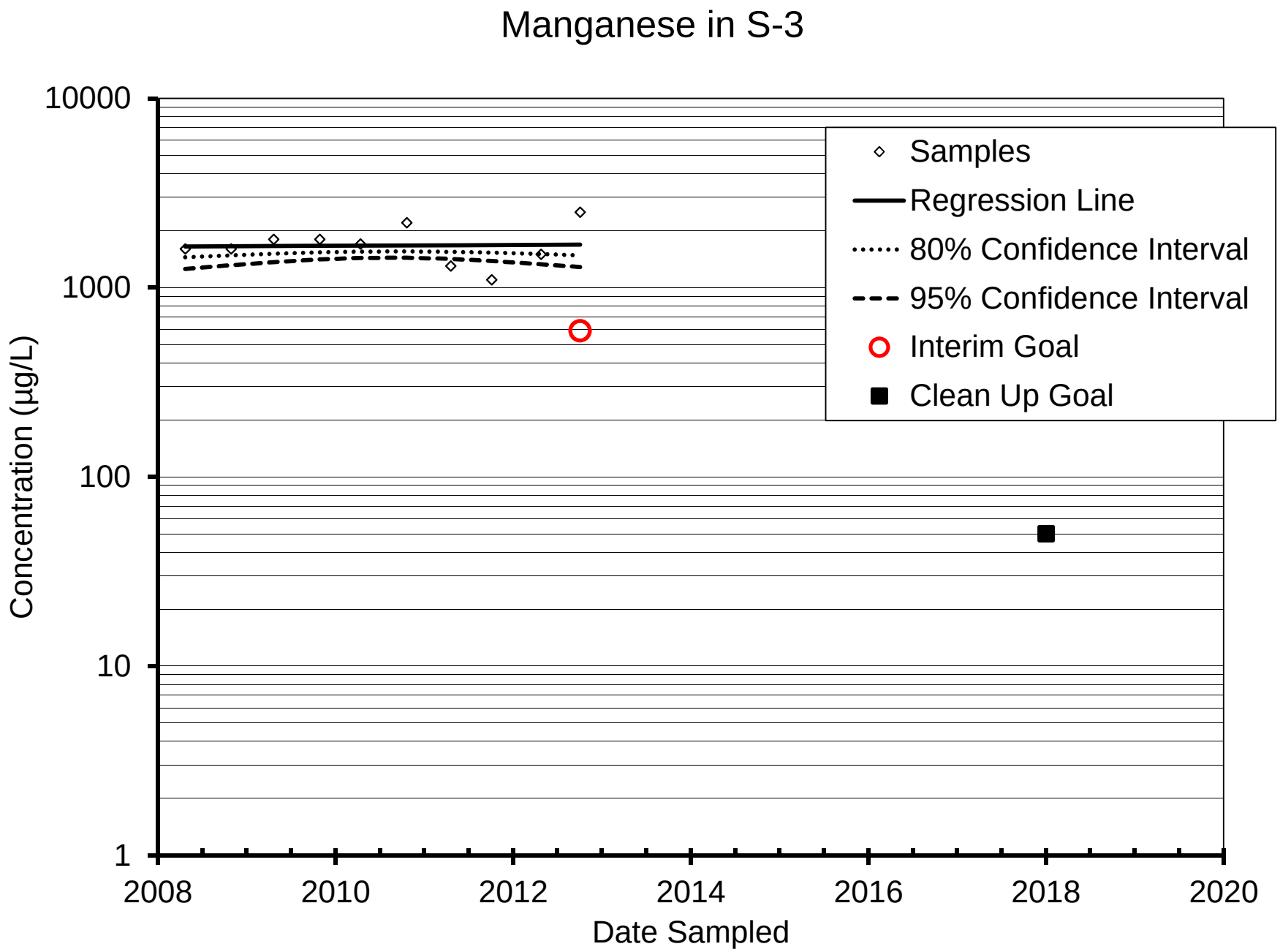

Manganese in MW-120B
1000
100
10
1
Concentration (µg/L)
2008
2010
2012
2014
2016
2018
2020
Date Sampled
Samples
Regression Line
80% Confidence Interval
95% Confidence Interval
Interim Goal
Clean Up Goal


Manganese in MW-4S
10000
1000
100
10
1
Concentration (µg/L)
2008
2010
2012
2014
2016
2018
2020
Date Sampled
Samples
Regression Line
80% Confidence Interval
95% Confidence Interval
Interim Goal
Clean Up Goal


Manganese in MW-4R
10000
1000
100
10
1
Concentration (µg/L)
2008
2010
2012
2014
2016
2018
2020
Date Sampled
Samples
Regression Line
80% Confidence Interval
95% Confidence Interval
Interim Goal
Clean Up Goal


Manganese in MW-5S
10000
1000
100
10
1
Concentration (µg/L)
2008
2010
2012
2014
2016
2018
2020
Date Sampled
Samples
Regression Line
80% Confidence Interval
95% Confidence Interval
Interim Goal
Clean Up Goal


Manganese in MW-5B
10000
1000
100
10
1
Concentration (µg/L)
2008
2010
2012
2014
2016
2018
2020
Date Sampled
Samples
Regression Line
80% Confidence Interval
95% Confidence Interval
Interim Goal
Clean Up Goal


Manganese in S-3
10000
1000
100
10
1
Concentration (µg/L)
2008
2010
2012
2014
2016
2018
2020
Date Sampled
Samples
Regression Line
80% Confidence Interval
95% Confidence Interval
Interim Goal
Clean Up Goal

APPENDIX D

EPA Starts Five-Year Review of the Barkhamsted-New Hartford Landfill Superfund Site

The U.S. Environmental Protection Agency (EPA) is beginning its third Five-Year Review of the Barkhamsted-New Hartford Landfill Superfund Site in Pleasant Valley, Barkhamsted, CT. Five-Year Reviews generally are required by law and occur every five years. The reviews determine if the cleanup is protective of human health and the environment. This Five-Year Review will be completed by September 2013 and the results will be publicly available.

The Superfund Site cleanup plan includes remediation of groundwater by natural attenuation, installation of groundwater monitoring wells in the down-gradient part of the plume, and institutional controls. Institutional controls include environmental land use restrictions on present and future uses, and groundwater use restrictions.

The last five year review completed in September 2008 concluded that the remedy is functioning as designed and was protective of public health and the environment.

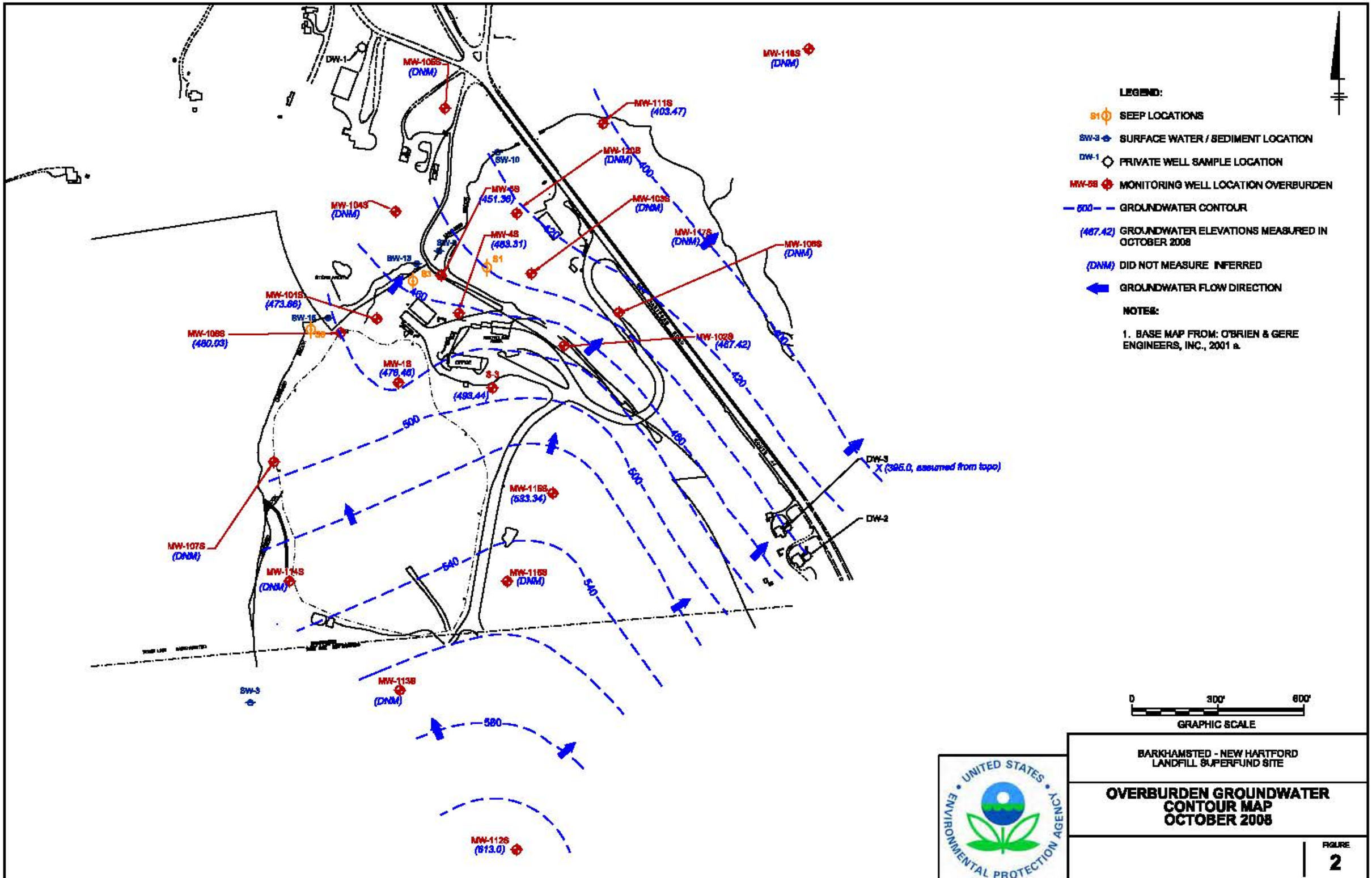
The soil and other waste material within the landfill, surface water and groundwater at the site are contaminated with metal grindings and volatile organic compounds (VOCs), primarily xylene, toluene, and vinyl chloride. An impermeable landfill cap was constructed in 2001 that prevents rain and runoff from infiltrating into the landfilled material and transmitting contaminants to surrounding areas.

More information about the cleanup can be found on line at www.epa.gov/ne/superfund/sites/barkhamsted or at the Beardsley & Memorial Library, 690 Main Street, Winsted, CT 06094.

For more information, contact: Almerinda Silva Toll Free 1-888-372-7341, ext.81246 or silva.almerinda@epa.gov; Rudy Brown 1-617-918-1031 or brown.rudy@epa.gov
www.epa.gov/ne/superfund/sites/barkhamsted

EPA United States Environmental Protection Agency New England

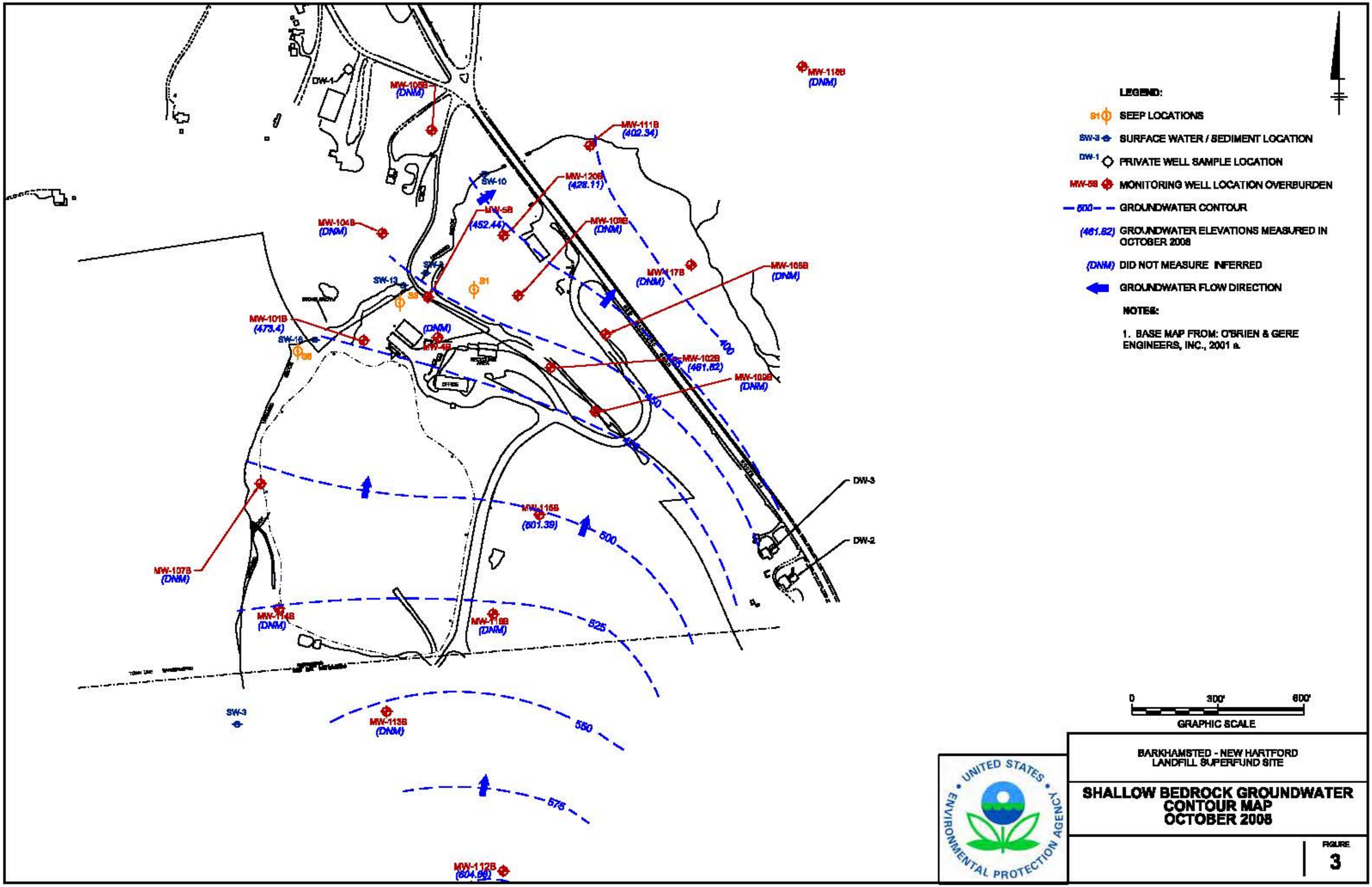
APPENDIX E

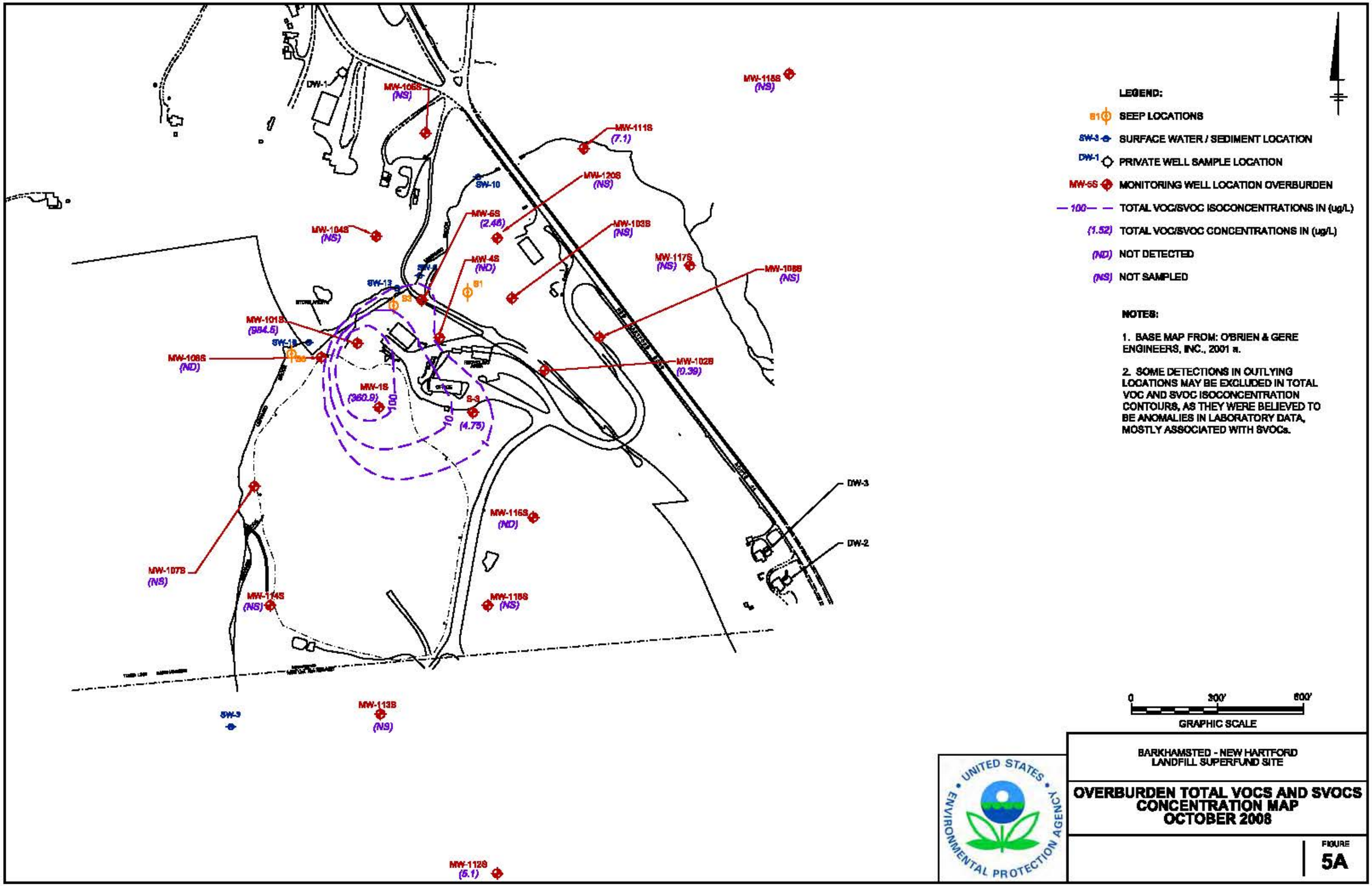


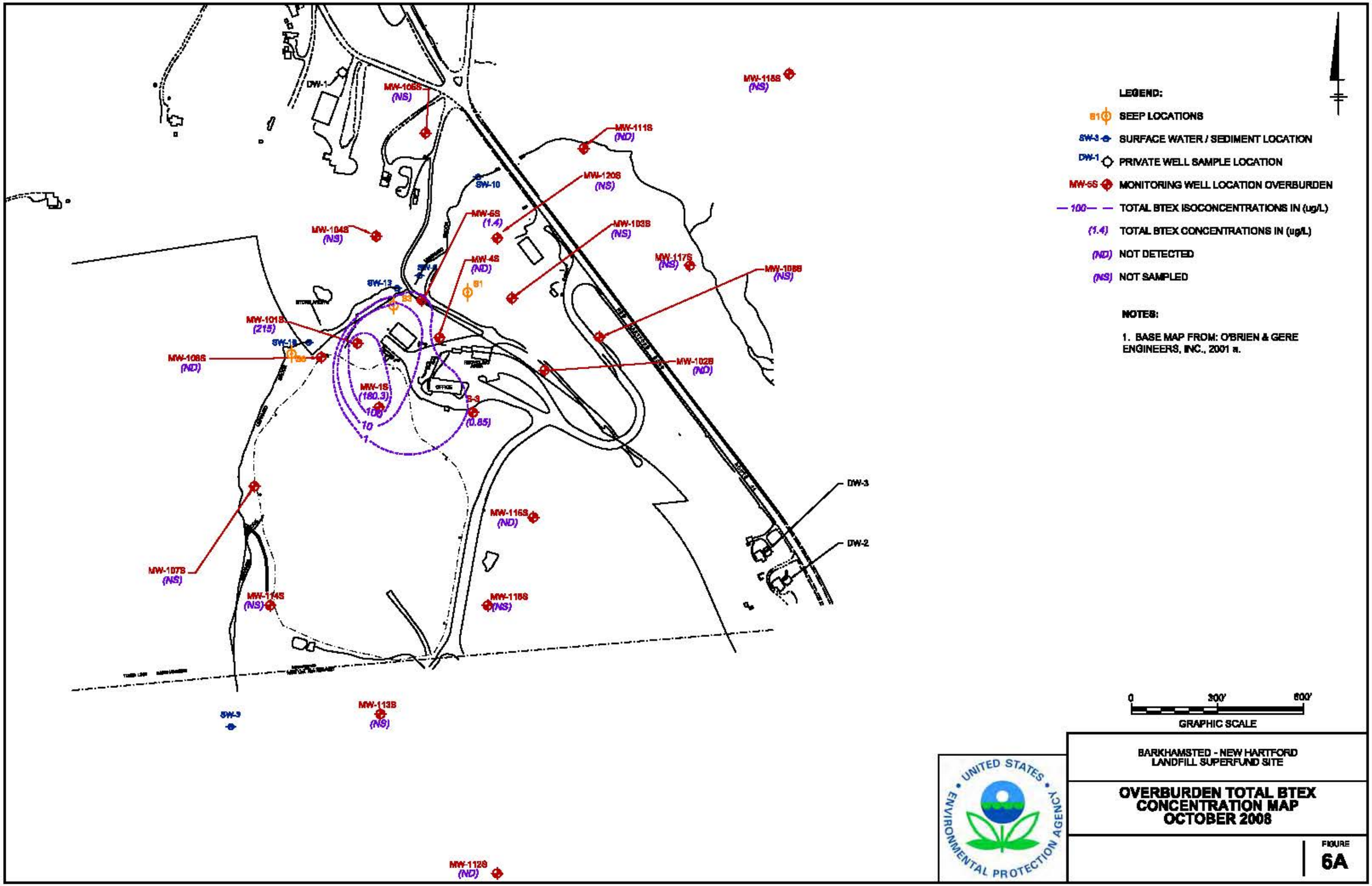
BARKHAMSTED - NEW HARTFORD LANDFILL SUPERFUND SITE

OVERBURDEN GROUNDWATER CONTOUR MAP OCTOBER 2008

FIGURE 2


LEGEND:
SEEP LOCATIONS
SURFACE WATER / SEDIMENT LOCATION
PRIVATE WELL SAMPLE LOCATION
MONITORING WELL LOCATION OVERBURDEN
GROUNDWATER CONTOUR
(461.82) GROUNDWATER ELEVATIONS MEASURED IN OCTOBER 2008
(DNM) DID NOT MEASURE INFERRED
GROUNDWATER FLOW DIRECTION
NOTES:
1. BASE MAP FROM: O'BRIEN & GERE ENGINEERS, INC., 2001 a.
0
300'
600'
GRAPHIC SCALE
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
BARKHAMSTED - NEW HARTFORD LANDFILL SUPERFUND SITE
SHALLOW BEDROCK GROUNDWATER CONTOUR MAP OCTOBER 2008
FIGURE
3
DW-1
MW-105B (DNM)
MW-116B (DNM)
MW-111B (402.34)
MW-120B (428.11)
SW-10
MW-5B (452.44)
MW-109B (DNM)
MW-104B (DNM)
SW-9
SW-13
S1
S3
MW-117B (DNM)
MW-108B (DNM)
MW-101B (473.4)
SW-16
S6
(DNM)
MW-4B
MW-102B (461.82)
MW-103B (DNM)
400
450
DW-3
DW-2
MW-115B (601.39)
500
MW-107B (DNM)
MW-114B (DNM)
MW-118B (DNM)
525
SW-3
MW-113B (DNM)
550
575
MW-112B (604.66)

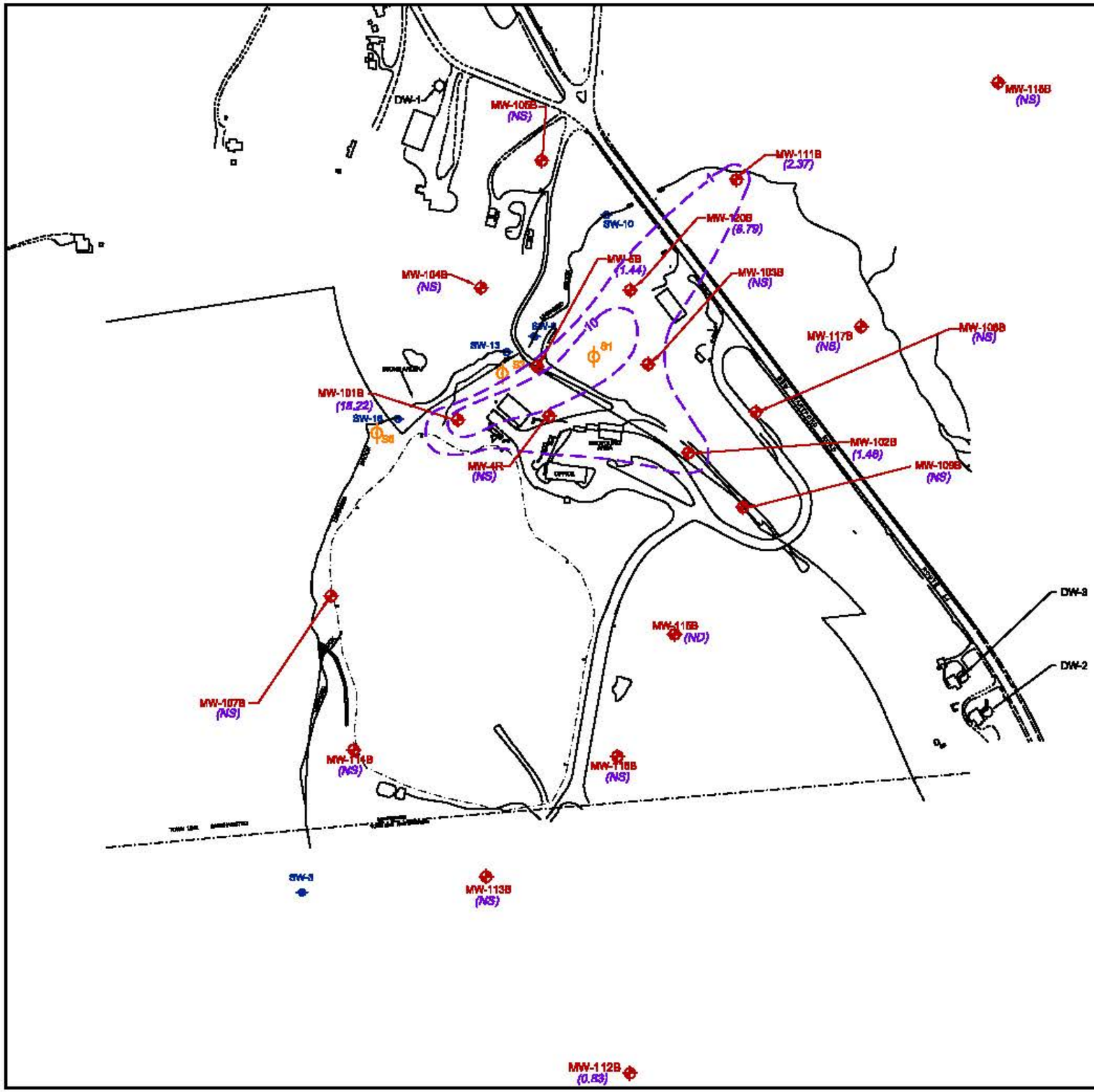

LEGEND:
S1 SEEP LOCATIONS
SW-3 SURFACE WATER / SEDIMENT LOCATION
DW-1 PRIVATE WELL SAMPLE LOCATION
MW-5S MONITORING WELL LOCATION OVERBURDEN
100 TOTAL VOC/SVOC ISOCONCENTRATIONS IN (ug/L)
(1.52) TOTAL VOC/SVOC CONCENTRATIONS IN (ug/L)
(ND) NOT DETECTED
(NS) NOT SAMPLED
NOTES:
1. BASE MAP FROM: O'BRIEN & GERE ENGINEERS, INC., 2001 a.
2. SOME DETECTIONS IN OUTLYING LOCATIONS MAY BE EXCLUDED IN TOTAL VOC AND SVOC ISOCONCENTRATION CONTOURS, AS THEY WERE BELIEVED TO BE ANOMALIES IN LABORATORY DATA, MOSTLY ASSOCIATED WITH SVOCs.
0 300' 600'
GRAPHIC SCALE
DW-1
MW-105S (NS)
MW-118S (NS)
MW-111S (7.1)
MW-120S (NS)
SW-10
MW-5S (2.46)
MW-103S (NS)
MW-104S (NS)
MW-4S (ND)
MW-117S (NS)
MW-108S (NS)
SW-12
S1
S2
MW-101S (984.5)
SW-13
MW-109S (ND)
S3
MW-102S (0.39)
MW-1S (360.9)
100
10
S-3 (4.75)
DW-3
DW-2
MW-116S (ND)
MW-107S (NS)
MW-114S (NS)
MW-115S (NS)
SW-9
MW-113S (NS)
MW-112S (5.1)
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
BARKHAMSTED - NEW HARTFORD LANDFILL SUPERFUND SITE
OVERBURDEN TOTAL VOCS AND SVOCS CONCENTRATION MAP OCTOBER 2008
FIGURE
5A



BARKHAMSTED - NEW HARTFORD LANDFILL SUPERFUND SITE

OVERBURDEN TOTAL BTEX CONCENTRATION MAP OCTOBER 2008

FIGURE **6A**



LEGEND:

- S1 SEEP LOCATIONS
- SW-3 SURFACE WATER / SEDIMENT LOCATION
- DW-1 PRIVATE WELL SAMPLE LOCATION
- MW-5S MONITORING WELL LOCATION OVERBURDEN
- --- 10 ------ TOTAL VOC/SVOC ISOCONCENTRATIONS IN (ug/L)
- (2.37) TOTAL VOC/SVOC CONCENTRATIONS IN (ug/L)
- (ND) NOT DETECTED
- (NS) NOT SAMPLED

NOTES:

1. BASE MAP FROM: O'BRIEN & GERE ENGINEERS, INC., 2001 a.
2. SOME DETECTIONS IN OUTLYING LOCATIONS MAY BE EXCLUDED IN TOTAL VOC AND SVOC ISOCONCENTRATION CONTOURS, AS THEY WERE BELIEVED TO BE ANOMALIES IN LABORATORY DATA, MOSTLY ASSOCIATED WITH SVOCs.

0 300' 600'

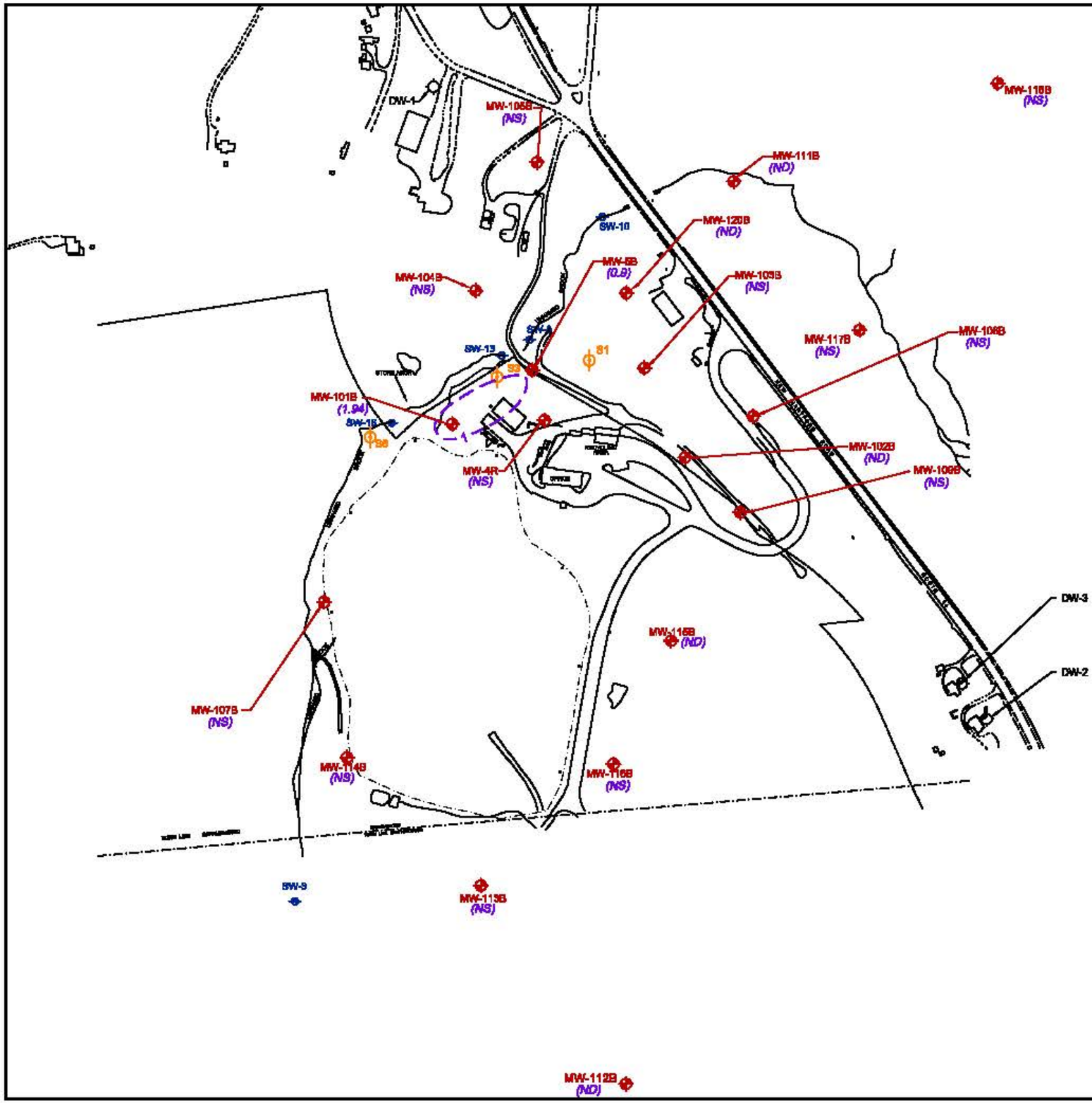
GRAPHIC SCALE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

BARKHAMSTED - NEW HARTFORD LANDFILL SUPERFUND SITE

SHALLOW BEDROCK TOTAL VOCS AND SVOCS CONCENTRATION MAP OCTOBER 2008

FIGURE **7A**



LEGEND:

- S1 SEEP LOCATIONS
- SW-3 SURFACE WATER / SEDIMENT LOCATION
- DW-1 PRIVATE WELL SAMPLE LOCATION
- MW-5S MONITORING WELL LOCATION OVERBURDEN
- ---1------ TOTAL BTEX ISOCONCENTRATIONS IN (ug/L)
- (0.8) TOTAL BTEX CONCENTRATIONS IN (ug/L)
- (ND) NOT DETECTED
- (NS) NOT SAMPLED

NOTES:

1. BASE MAP FROM: O'BRIEN & GERE ENGINEERS, INC., 2001 a.

0 300' 600'

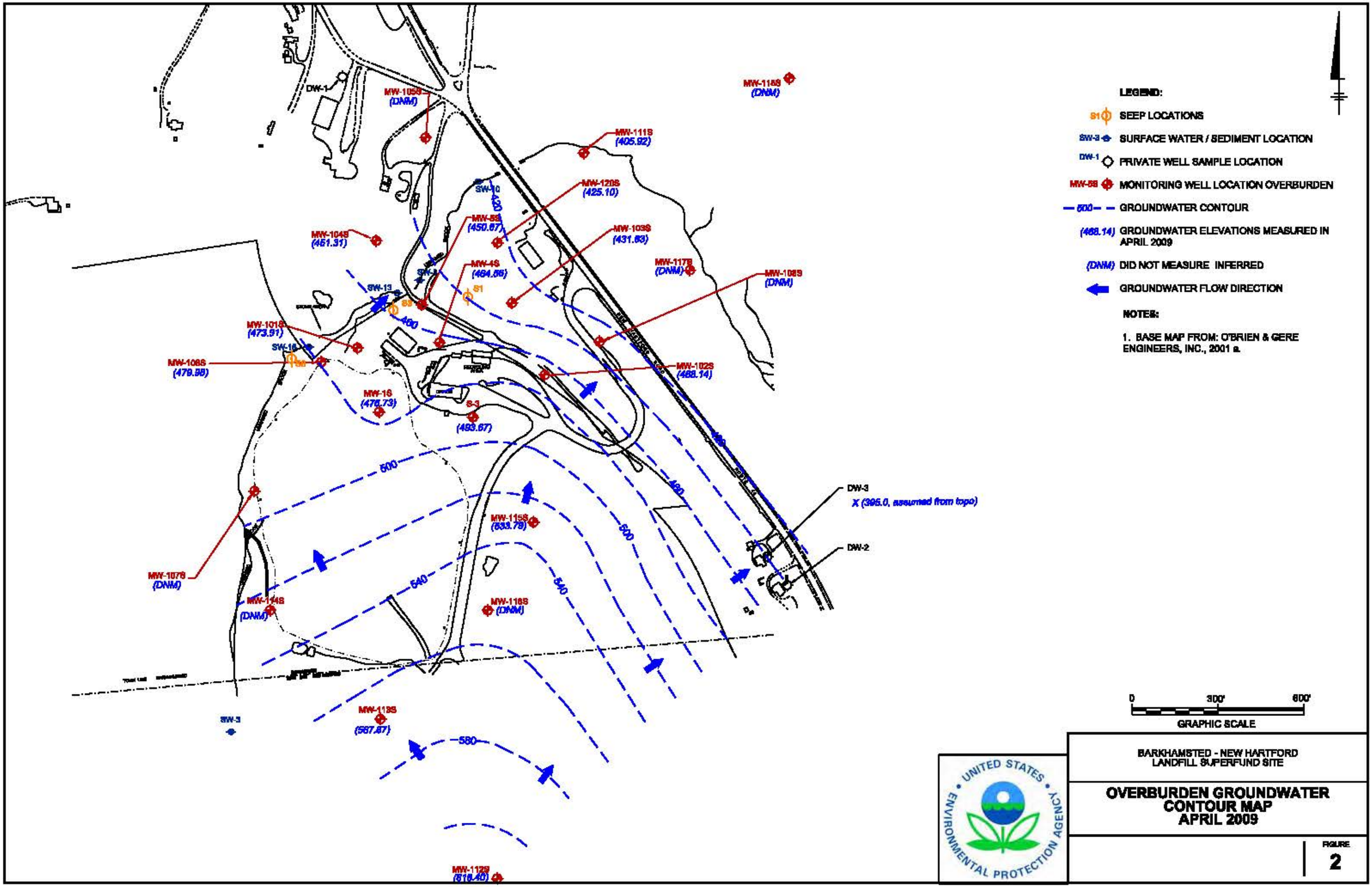
GRAPHIC SCALE

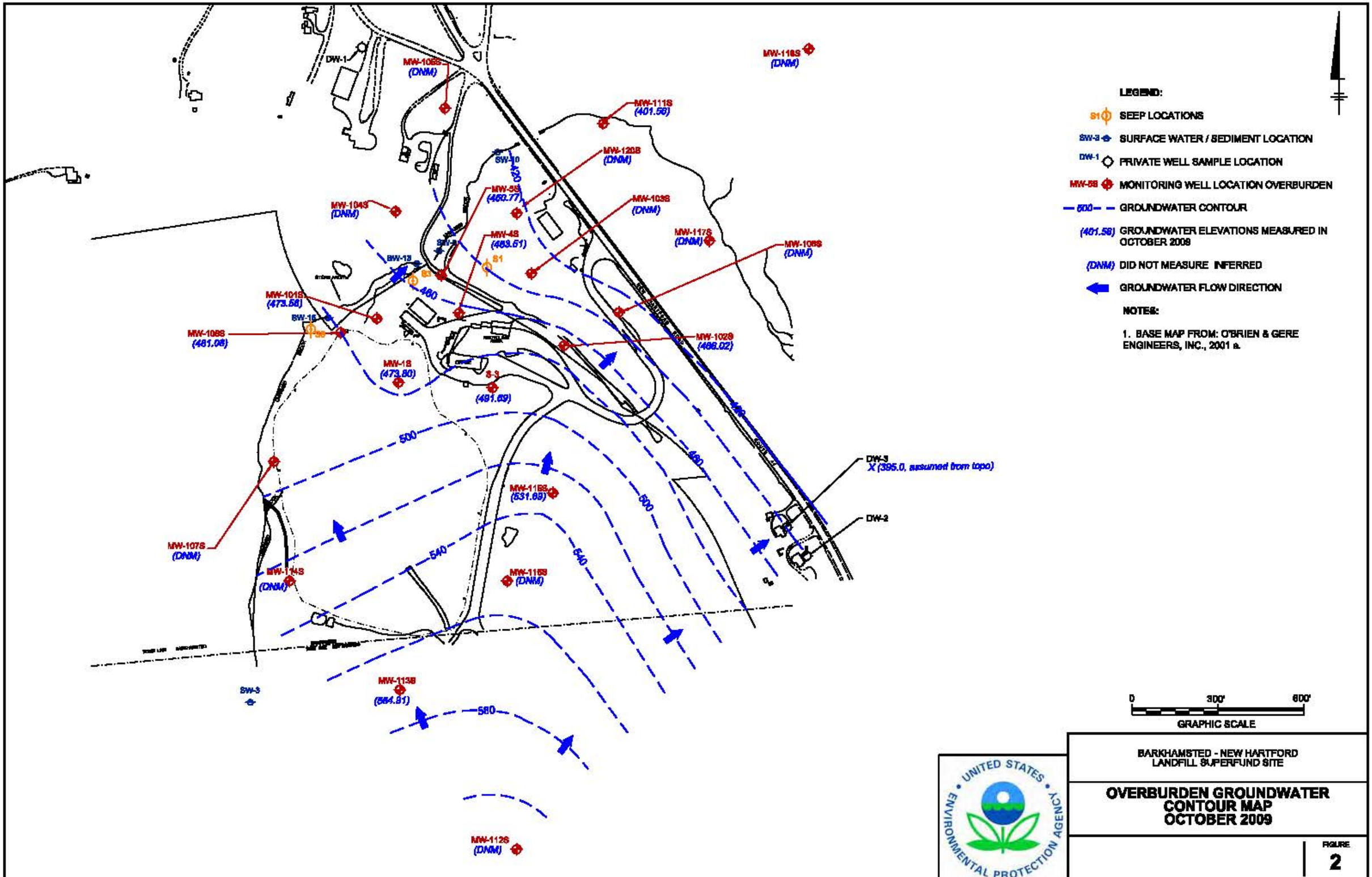
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

BARKHAMSTED - NEW HARTFORD LANDFILL SUPERFUND SITE

SHALLOW BEDROCK TOTAL BTEX CONCENTRATION MAP OCTOBER 2008

FIGURE **8A**

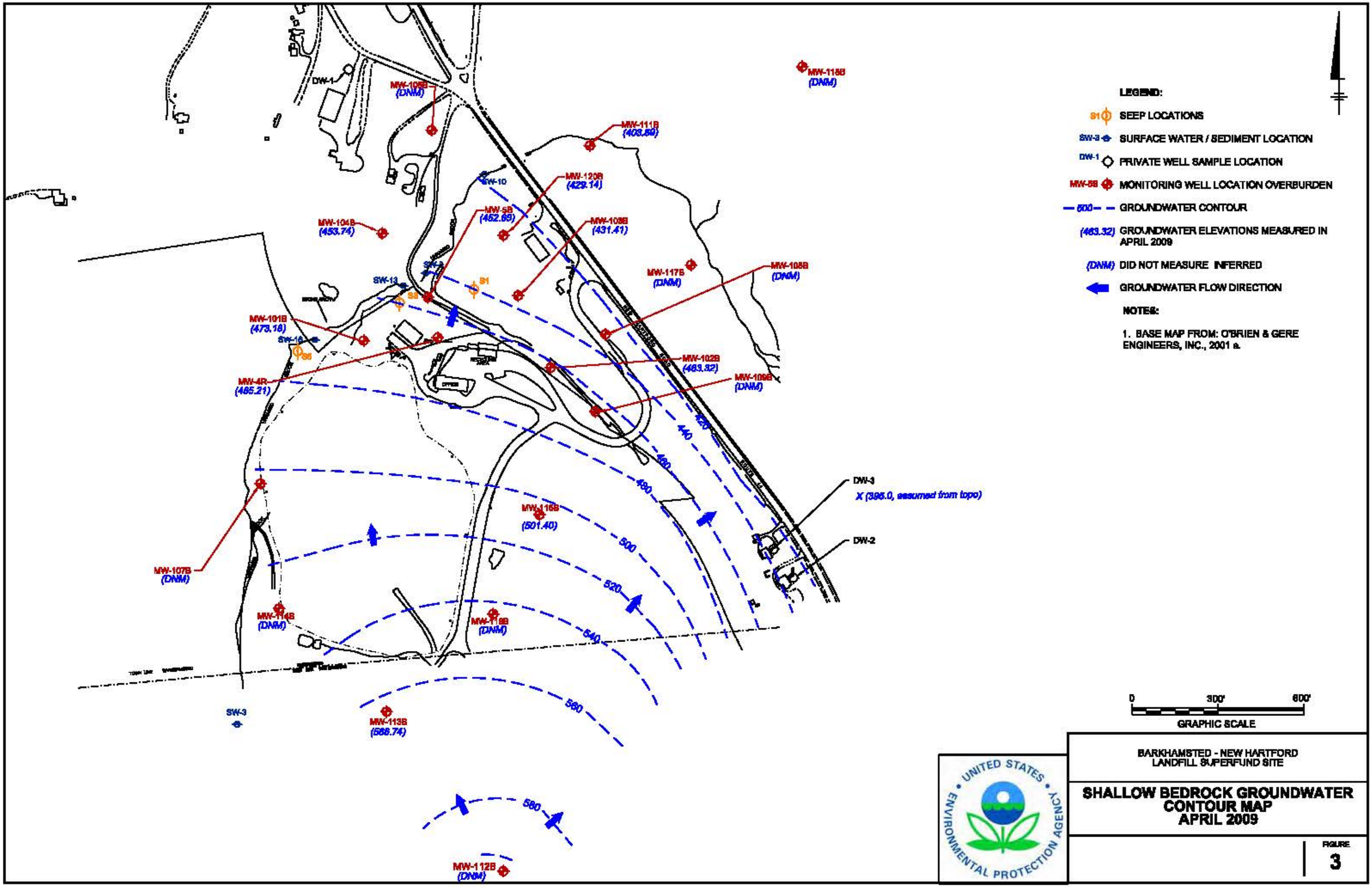

LEGEND:
S1 SEEP LOCATIONS
SW-3 SURFACE WATER / SEDIMENT LOCATION
DW-1 PRIVATE WELL SAMPLE LOCATION
MW-5S MONITORING WELL LOCATION OVERBURDEN
500 GROUNDWATER CONTOUR
(468.14) GROUNDWATER ELEVATIONS MEASURED IN APRIL 2009
(DNM) DID NOT MEASURE INFERRED
GROUNDWATER FLOW DIRECTION
NOTES:
1. BASE MAP FROM: O'BRIEN & GERE ENGINEERS, INC., 2001 a.
0 300' 600'
GRAPHIC SCALE
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
BARKHAMSTED - NEW HARTFORD LANDFILL SUPERFUND SITE
OVERBURDEN GROUNDWATER CONTOUR MAP APRIL 2009
FIGURE 2
DW-1
MW-105S (DNM)
MW-118S (DNM)
MW-111S (405.92)
MW-120S (425.10)
SW-10
MW-5S (450.67)
MW-104S (451.31)
MW-103S (431.63)
MW-4S (464.56)
MW-117S (DNM)
MW-108S (DNM)
SW-13
S2
S1
MW-101S (473.91)
SW-16
MW-106S (479.58)
MW-102S (468.14)
MW-1S (476.73)
S-3
(483.67)
DW-3
X (395.0, assumed from topo)
DW-2
MW-115S (633.79)
MW-107S (DNM)
MW-114S (DNM)
MW-116S (DNM)
SW-3
MW-113S (567.87)
MW-112S (616.40)
400
420
440
460
480
500
520
540
560
580



BARKHAMSTED - NEW HARTFORD LANDFILL SUPERFUND SITE

OVERBURDEN GROUNDWATER CONTOUR MAP OCTOBER 2009

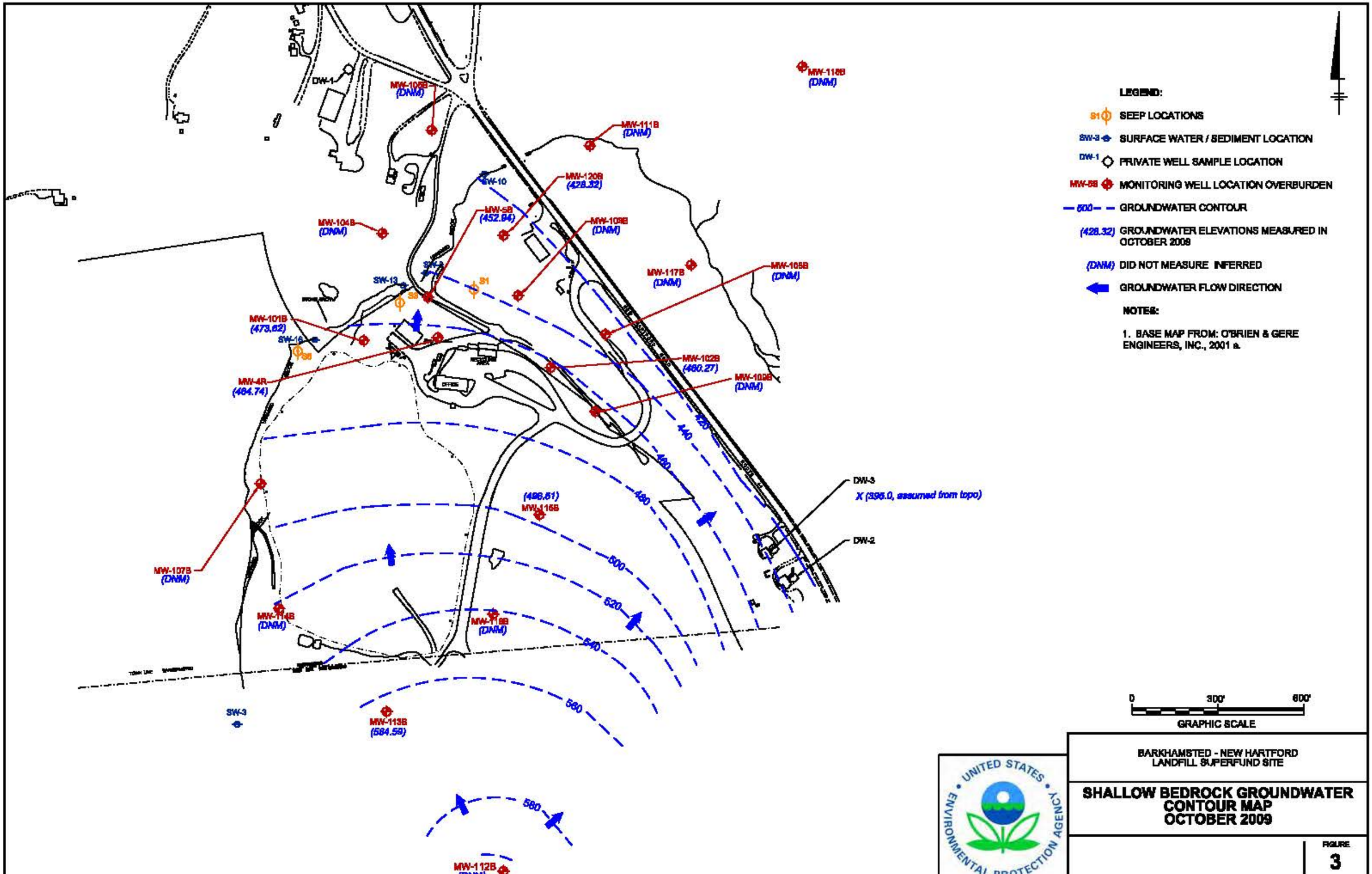
FIGURE 2

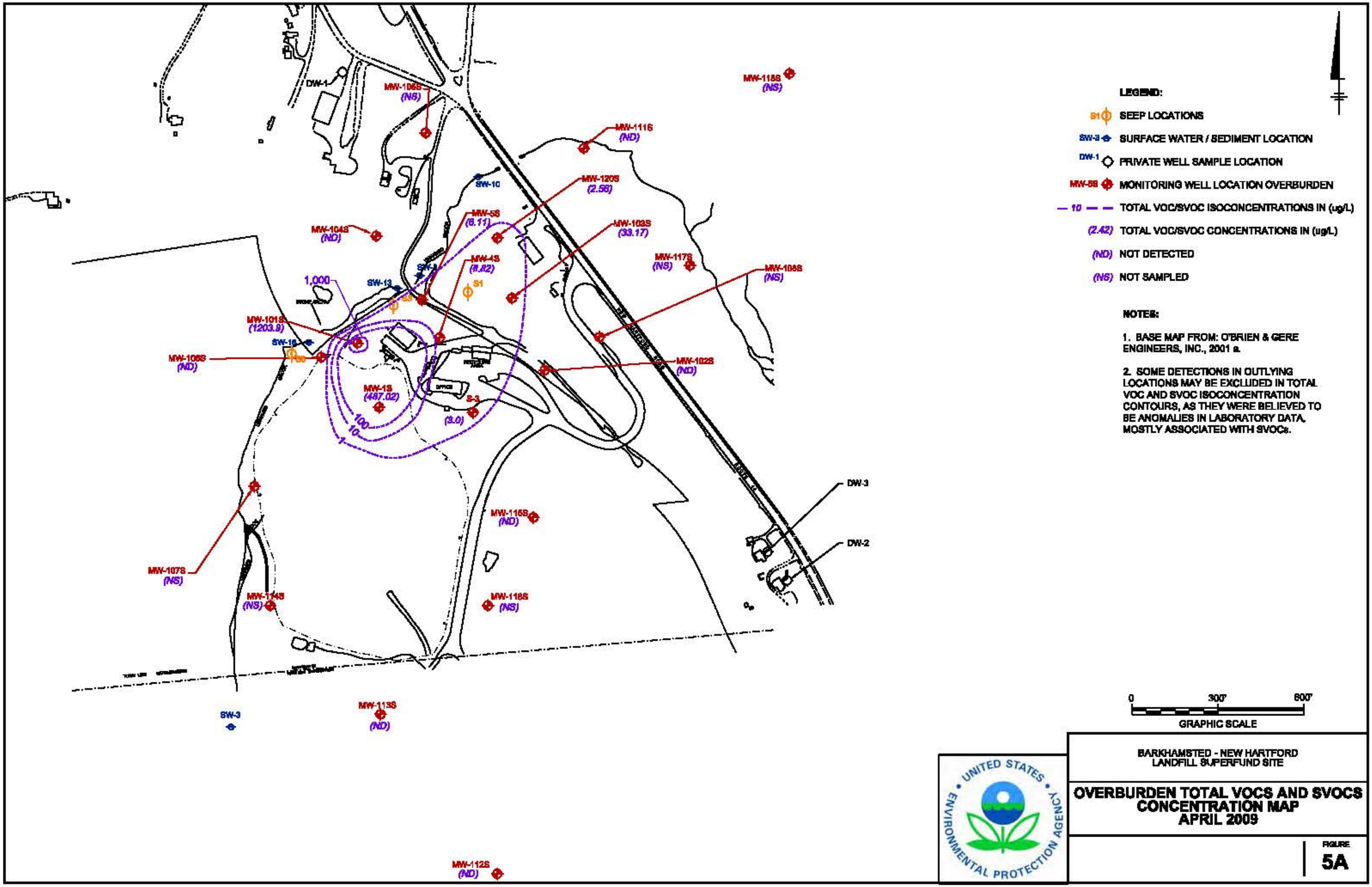


BARKHAMSTED - NEW HARTFORD LANDFILL SUPERFUND SITE

SHALLOW BEDROCK GROUNDWATER CONTOUR MAP APRIL 2009

FIGURE 3

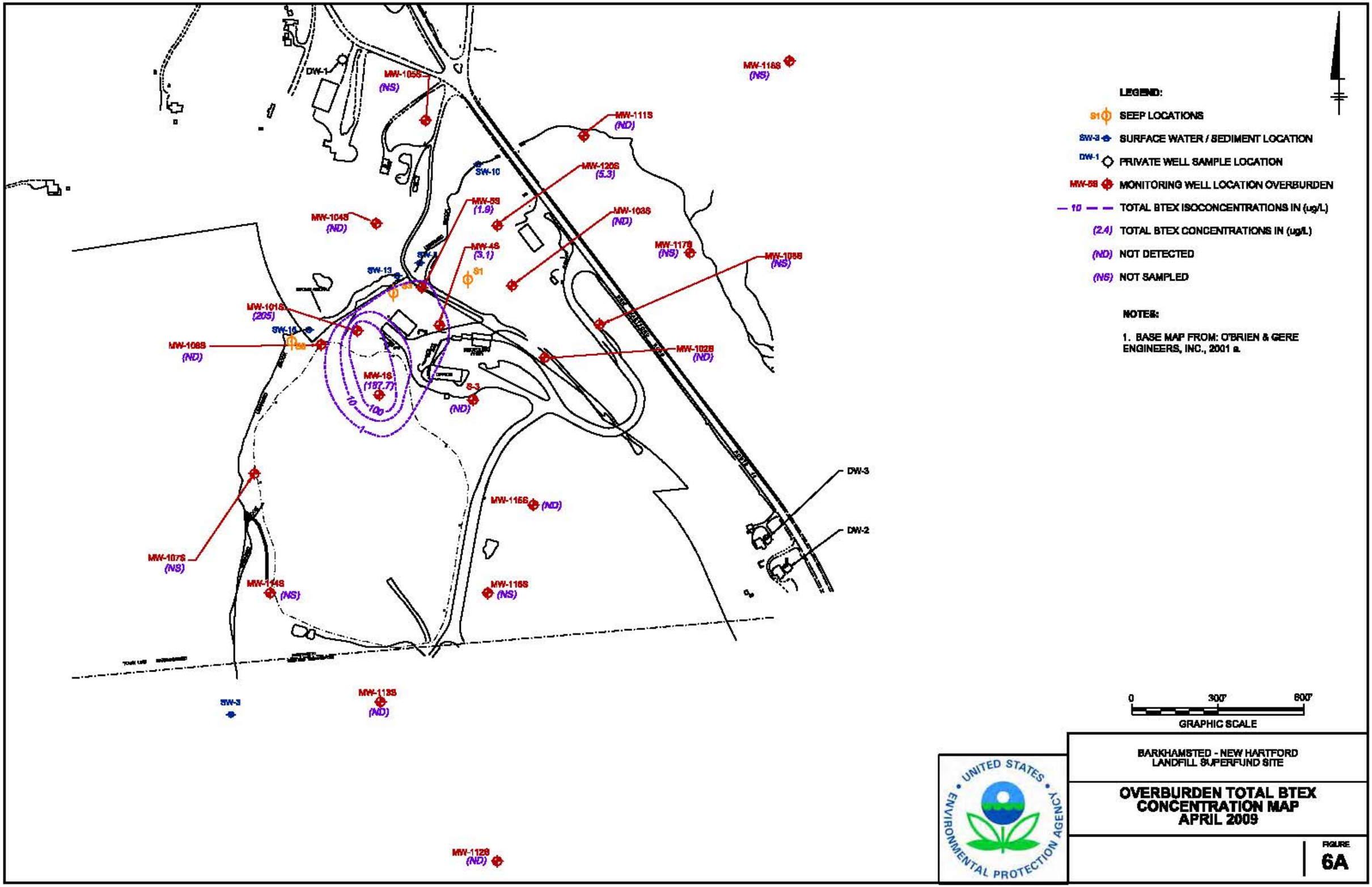

LEGEND:
S1 SEEP LOCATIONS
SW-3 SURFACE WATER / SEDIMENT LOCATION
DW-1 PRIVATE WELL SAMPLE LOCATION
MW-5B MONITORING WELL LOCATION OVERBURDEN
500 GROUNDWATER CONTOUR
(428.32) GROUNDWATER ELEVATIONS MEASURED IN OCTOBER 2009
(DNM) DID NOT MEASURE INFERRED
GROUNDWATER FLOW DIRECTION
NOTES:
1. BASE MAP FROM: O'BRIEN & GERE ENGINEERS, INC., 2001 a.
0 300' 600'
GRAPHIC SCALE
BARKHAMSTED - NEW HARTFORD LANDFILL SUPERFUND SITE
SHALLOW BEDROCK GROUNDWATER CONTOUR MAP OCTOBER 2009
FIGURE 3
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
MW-118B (DNM)
MW-111B (DNM)
MW-105B (DNM)
DW-1
SW-10
MW-120B (428.32)
MW-5B (452.84)
MW-109B (DNM)
MW-104B (DNM)
MW-117B (DNM)
MW-106B (DNM)
SW-13
SW-9
S1
S3
MW-101B (473.62)
SW-16
S6
MW-4R (484.74)
MW-102B (460.27)
MW-108B (DNM)
DW-3
X (395.0, assumed from topo)
DW-2
(496.61)
MW-116B
MW-107B (DNM)
MW-114B (DNM)
MW-119B (DNM)
SW-3
MW-113B (584.59)
MW-112B (DNM)
420
440
460
480
500
520
540
560
580



BARKHAMSTED - NEW HARTFORD LANDFILL SUPERFUND SITE

OVERBURDEN TOTAL VOCS AND SVOCS CONCENTRATION MAP APRIL 2009

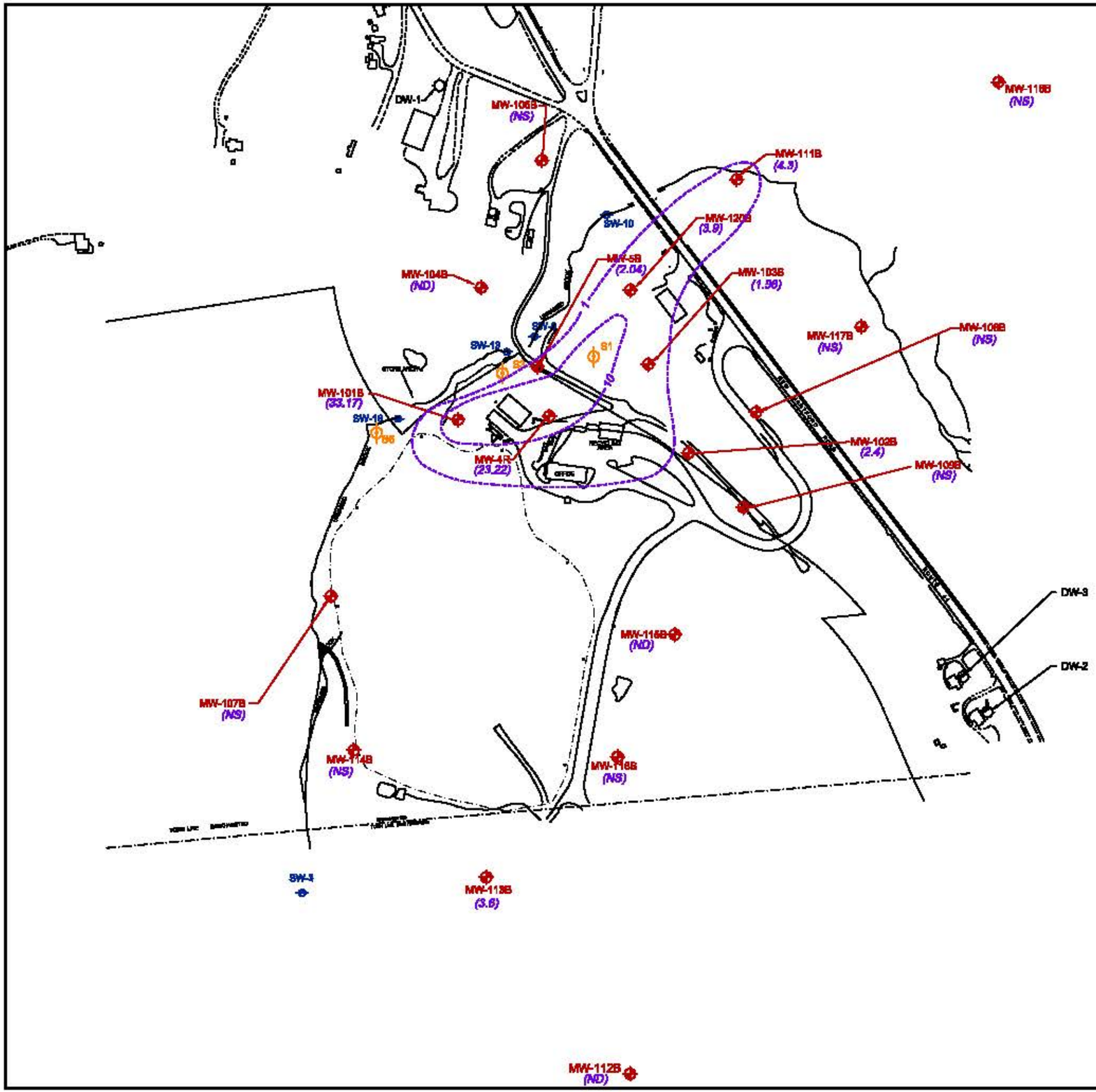
FIGURE **5A**



BARKHAMSTED - NEW HARTFORD LANDFILL SUPERFUND SITE

OVERBURDEN TOTAL BTEX CONCENTRATION MAP APRIL 2009

FIGURE **6A**



LEGEND:

- S1 SEEP LOCATIONS
- SW-3 SURFACE WATER / SEDIMENT LOCATION
- DW-1 PRIVATE WELL SAMPLE LOCATION
- MW-5B MONITORING WELL LOCATION OVERBURDEN
- --- 10 ------ TOTAL VOC/SVOC ISOCONCENTRATIONS IN (ug/L)
- (2.44) TOTAL VOC/SVOC CONCENTRATIONS IN (ug/L)
- (ND) NOT DETECTED
- (NS) NOT SAMPLED

NOTES:

1. BASE MAP FROM: O'BRIEN & GERE ENGINEERS, INC., 2001 a.

2. SOME DETECTIONS IN OUTLYING LOCATIONS MAY BE EXCLUDED IN TOTAL VOC AND SVOC ISOCONCENTRATION CONTOURS, AS THEY WERE BELIEVED TO BE ANOMALIES IN LABORATORY DATA, MOSTLY ASSOCIATED WITH SVOCs.

0 300' 600'

GRAPHIC SCALE

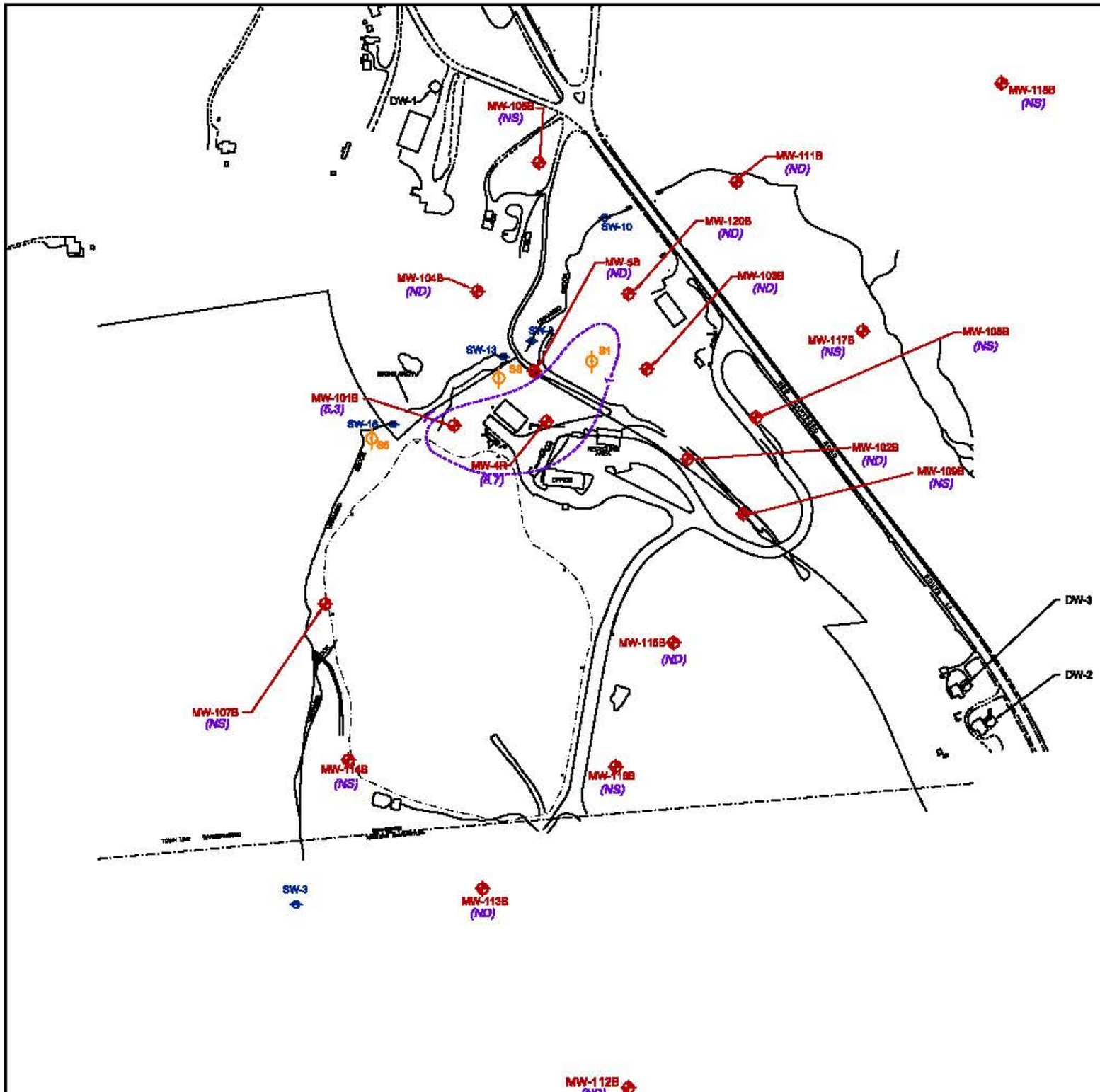
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

BARKHAMSTED - NEW HARTFORD LANDFILL SUPERFUND SITE

SHALLOW BEDROCK TOTAL VOCS AND SVOCS CONCENTRATION MAP APRIL 2009

FIGURE

7A



LEGEND:

- S1 SEEP LOCATIONS
- SW-3 SURFACE WATER / SEDIMENT LOCATION
- DW-1 PRIVATE WELL SAMPLE LOCATION
- MW-5B MONITORING WELL LOCATION OVERBURDEN
- 1 TOTAL BTEX ISOCONCENTRATIONS IN (ug/L)
- (0.68) TOTAL BTEX CONCENTRATIONS IN (ug/L)
- (ND) NOT DETECTED
- (NS) NOT SAMPLED

NOTES:

1. BASE MAP FROM: O'BRIEN & GERE ENGINEERS, INC., 2001 a.

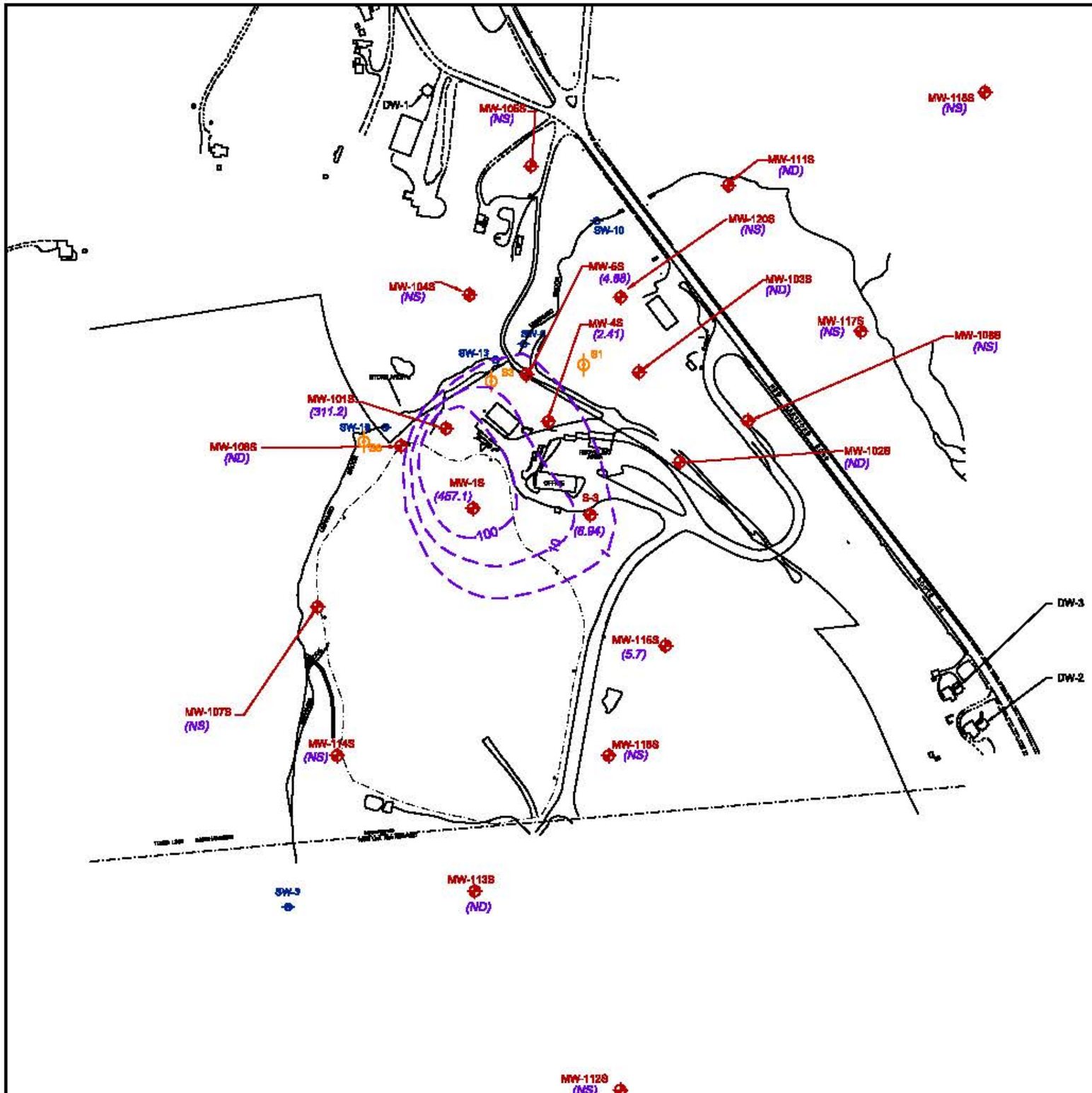
0 300' 600'
GRAPHIC SCALE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

BARKHAMSTED - NEW HARTFORD LANDFILL SUPERFUND SITE

SHALLOW BEDROCK TOTAL BTEX CONCENTRATION MAP APRIL 2009

FIGURE **8A**



LEGEND:

- S1 SEEP LOCATIONS
- SW-3 SURFACE WATER / SEDIMENT LOCATION
- DW-1 PRIVATE WELL SAMPLE LOCATION
- MW-5S MONITORING WELL LOCATION OVERBURDEN
- — 100 — — TOTAL VOC/SVOC ISOCONCENTRATIONS IN (ug/L)
- (2.41) TOTAL VOC/SVOC CONCENTRATIONS IN (ug/L)
- (ND) NOT DETECTED
- (NS) NOT SAMPLED

NOTES:

1. BASE MAP FROM: O'BRIEN & GERE ENGINEERS, INC., 2001 a.

2. SOME DETECTIONS IN OUTLYING LOCATIONS MAY BE EXCLUDED IN TOTAL VOC AND SVOC ISOCONCENTRATION CONTOURS, AS THEY WERE BELIEVED TO BE ANOMALIES IN LABORATORY DATA, MOSTLY ASSOCIATED WITH SVOCs.

0 300' 600'

GRAPHIC SCALE

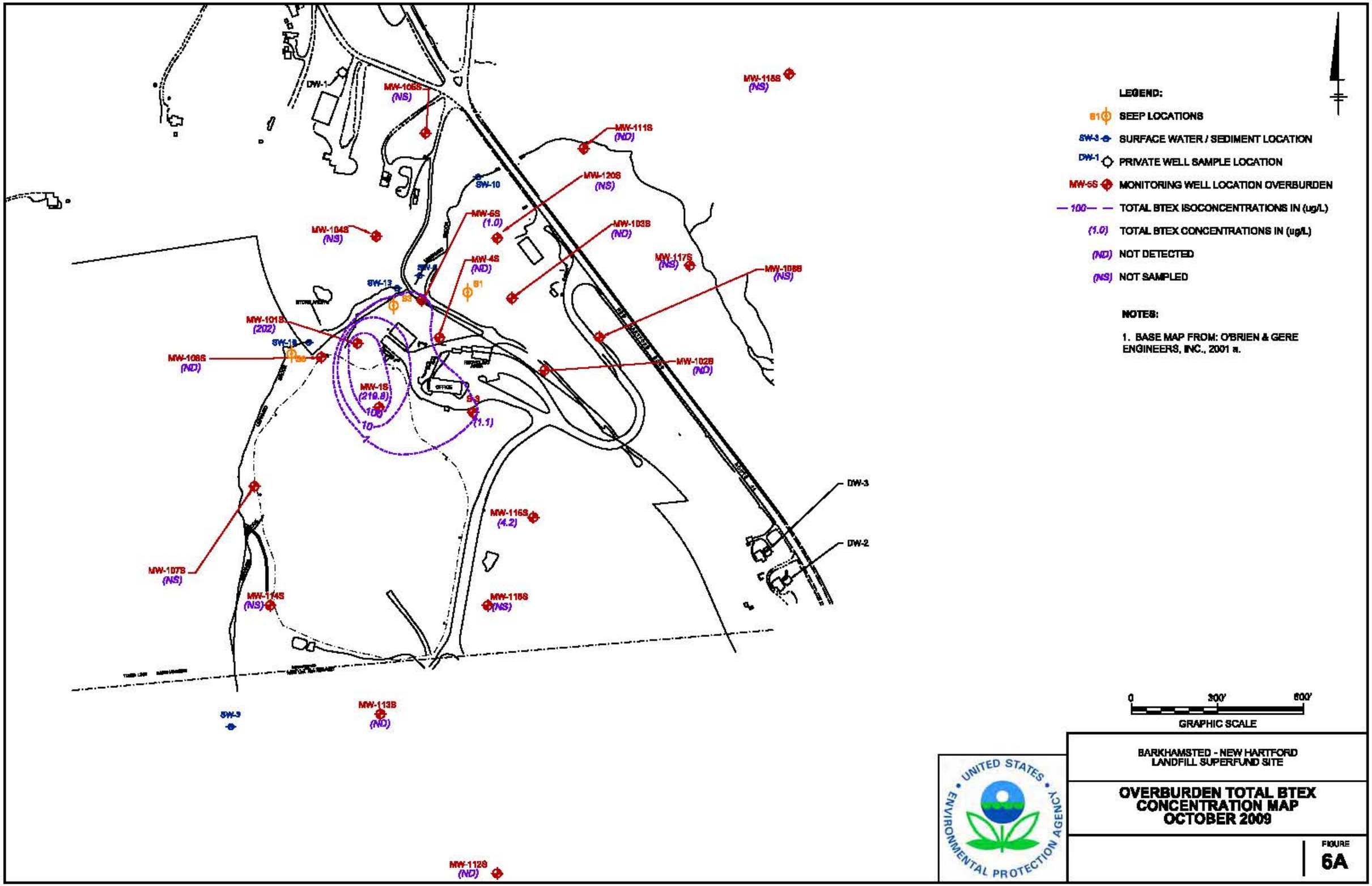
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

BARKHAMSTED - NEW HARTFORD LANDFILL SUPERFUND SITE

OVERBURDEN TOTAL VOCS AND SVOCS CONCENTRATION MAP OCTOBER 2009

FIGURE

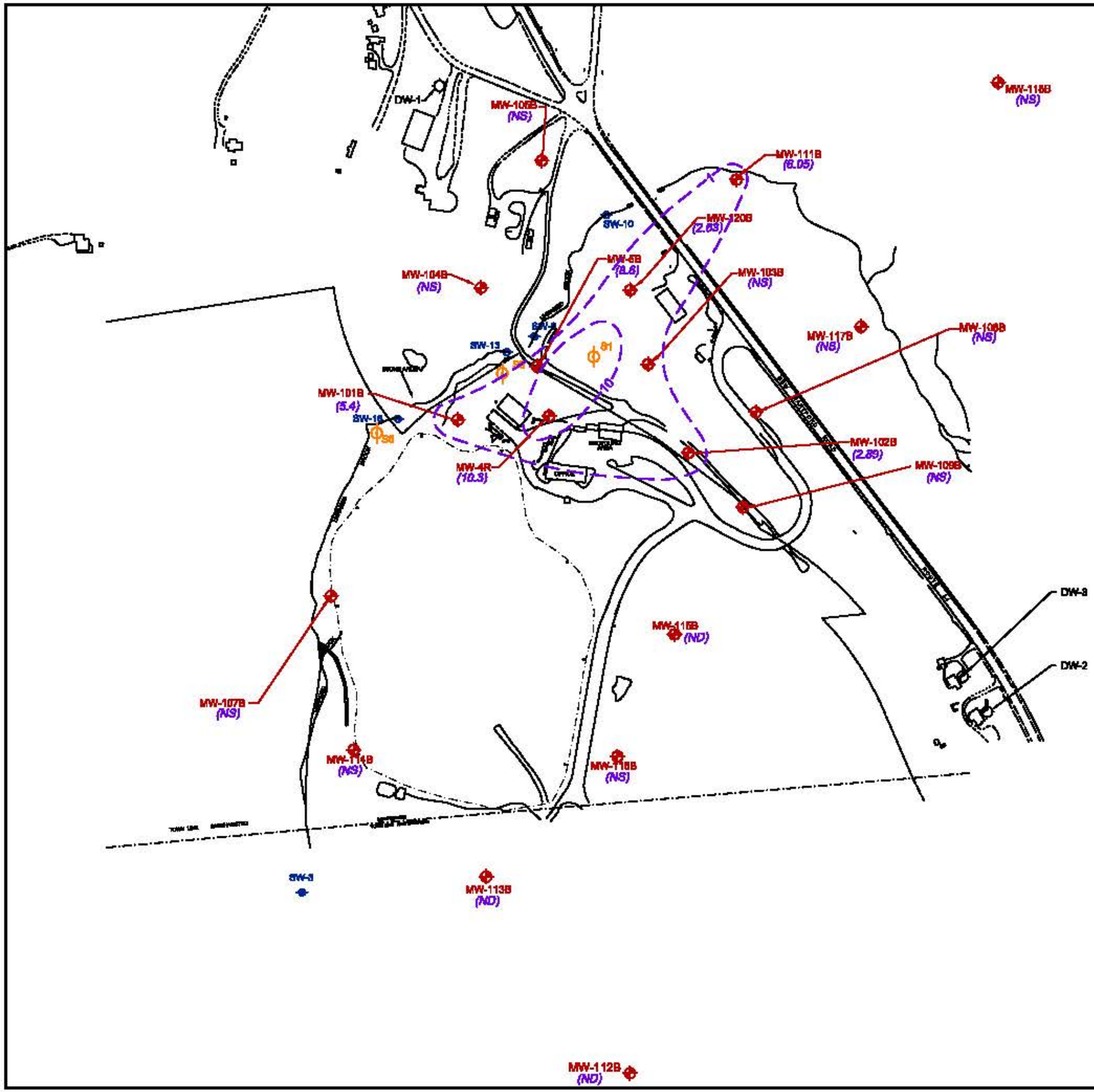
5A



BARKHAMSTED - NEW HARTFORD LANDFILL SUPERFUND SITE

OVERBURDEN TOTAL BTEX CONCENTRATION MAP OCTOBER 2009

FIGURE **6A**



LEGEND:

- S1 SEEP LOCATIONS
- SW-3 SURFACE WATER / SEDIMENT LOCATION
- DW-1 PRIVATE WELL SAMPLE LOCATION
- MW-5S MONITORING WELL LOCATION OVERBURDEN
- --- 10 ------ TOTAL VOC/SVOC ISOCONCENTRATIONS IN (ug/L)
- (2.63) TOTAL VOC/SVOC CONCENTRATIONS IN (ug/L)
- (ND) NOT DETECTED
- (NS) NOT SAMPLED

NOTES:

1. BASE MAP FROM: O'BRIEN & GERE ENGINEERS, INC., 2001 a.
2. SOME DETECTIONS IN OUTLYING LOCATIONS MAY BE EXCLUDED IN TOTAL VOC AND SVOC ISOCONCENTRATION CONTOURS, AS THEY WERE BELIEVED TO BE ANOMALIES IN LABORATORY DATA, MOSTLY ASSOCIATED WITH SVOCs.

0 300' 600'

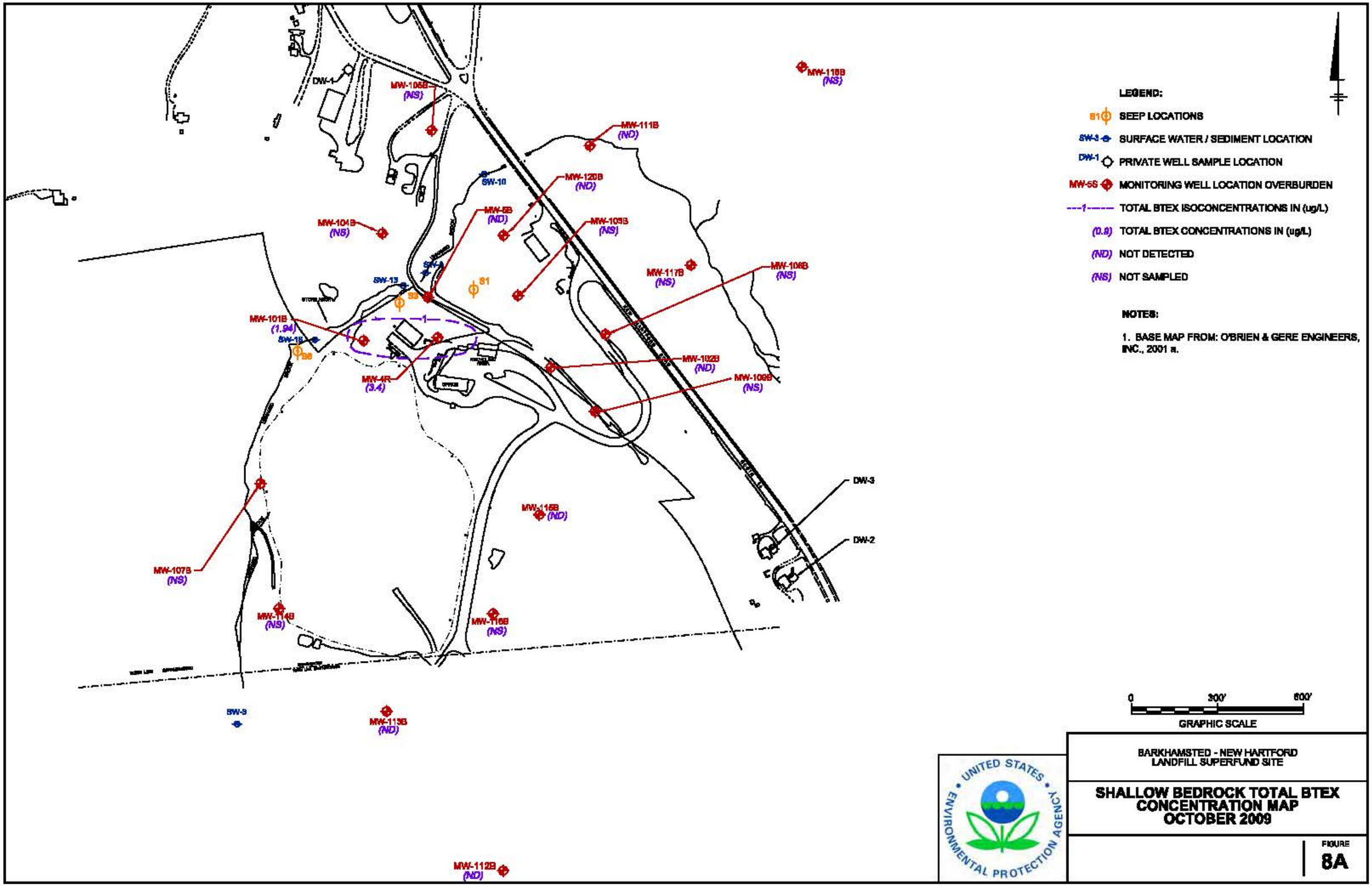
GRAPHIC SCALE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

BARKHAMSTED - NEW HARTFORD LANDFILL SUPERFUND SITE

SHALLOW BEDROCK TOTAL SVOCS AND VOCS CONCENTRATION MAP OCTOBER 2009

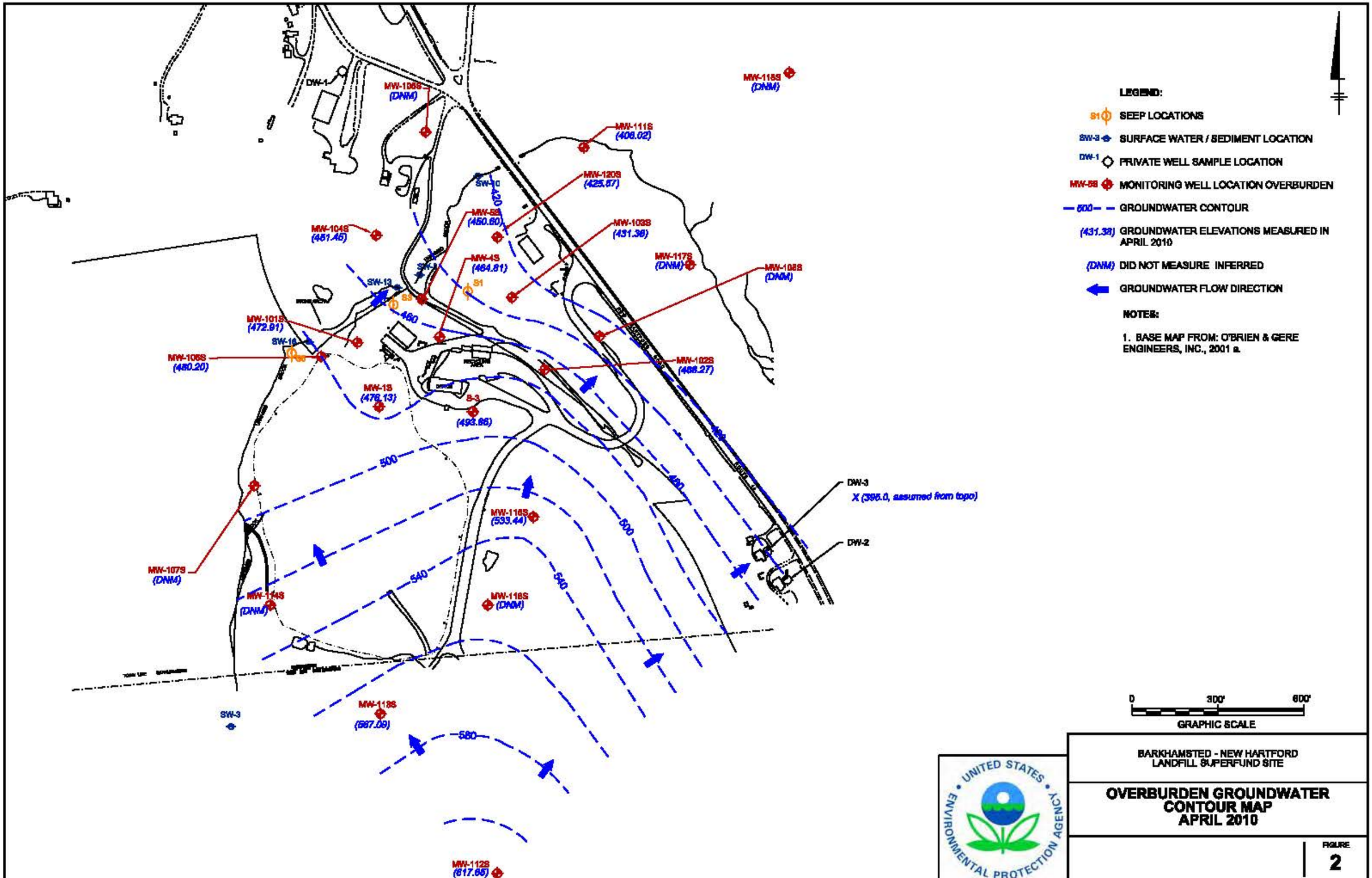
FIGURE **7A**



BARKHAMSTED - NEW HARTFORD LANDFILL SUPERFUND SITE

SHALLOW BEDROCK TOTAL BTEX CONCENTRATION MAP OCTOBER 2009

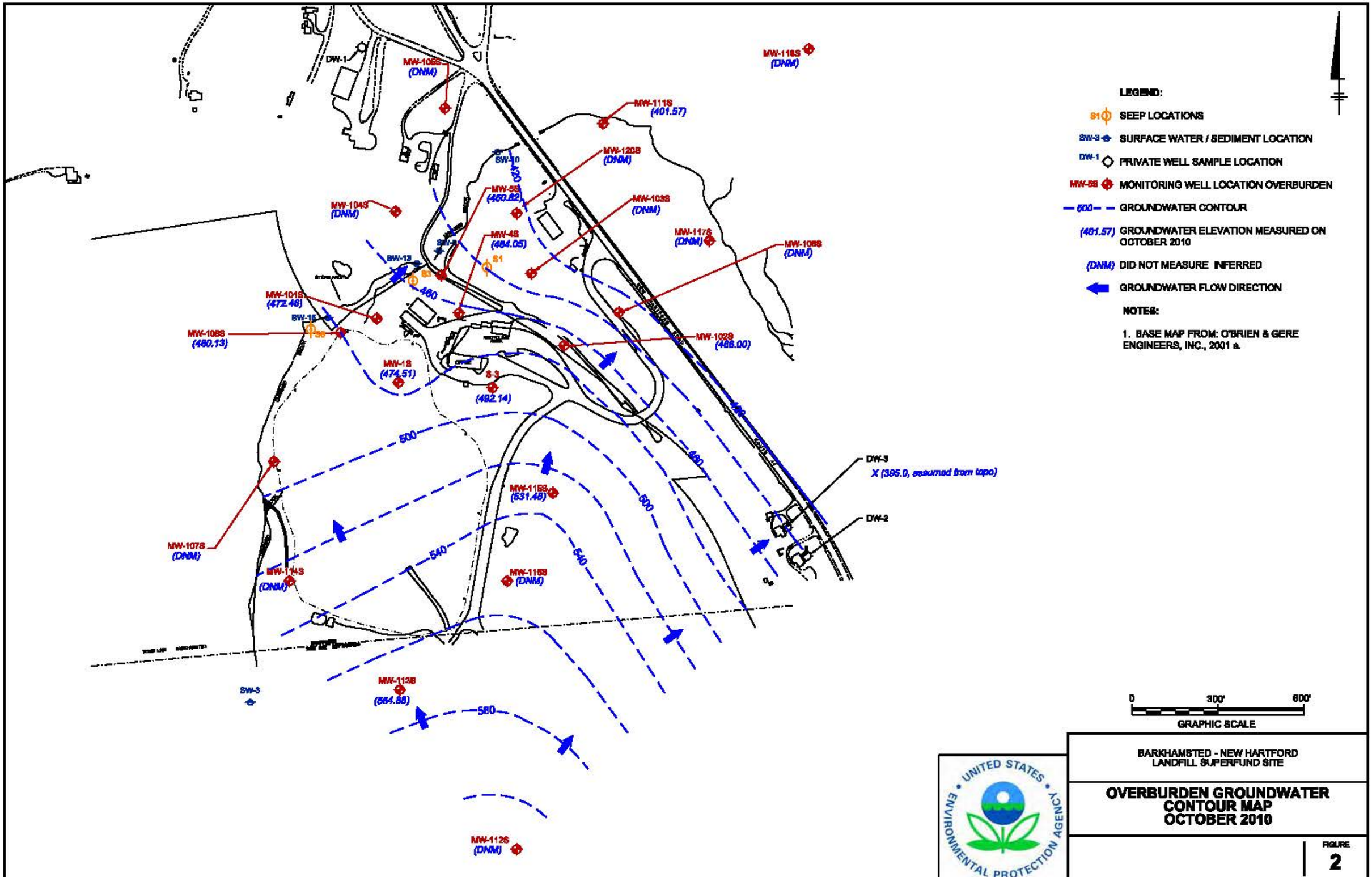
FIGURE **8A**



BARKHAMSTED - NEW HARTFORD LANDFILL SUPERFUND SITE

OVERBURDEN GROUNDWATER CONTOUR MAP APRIL 2010

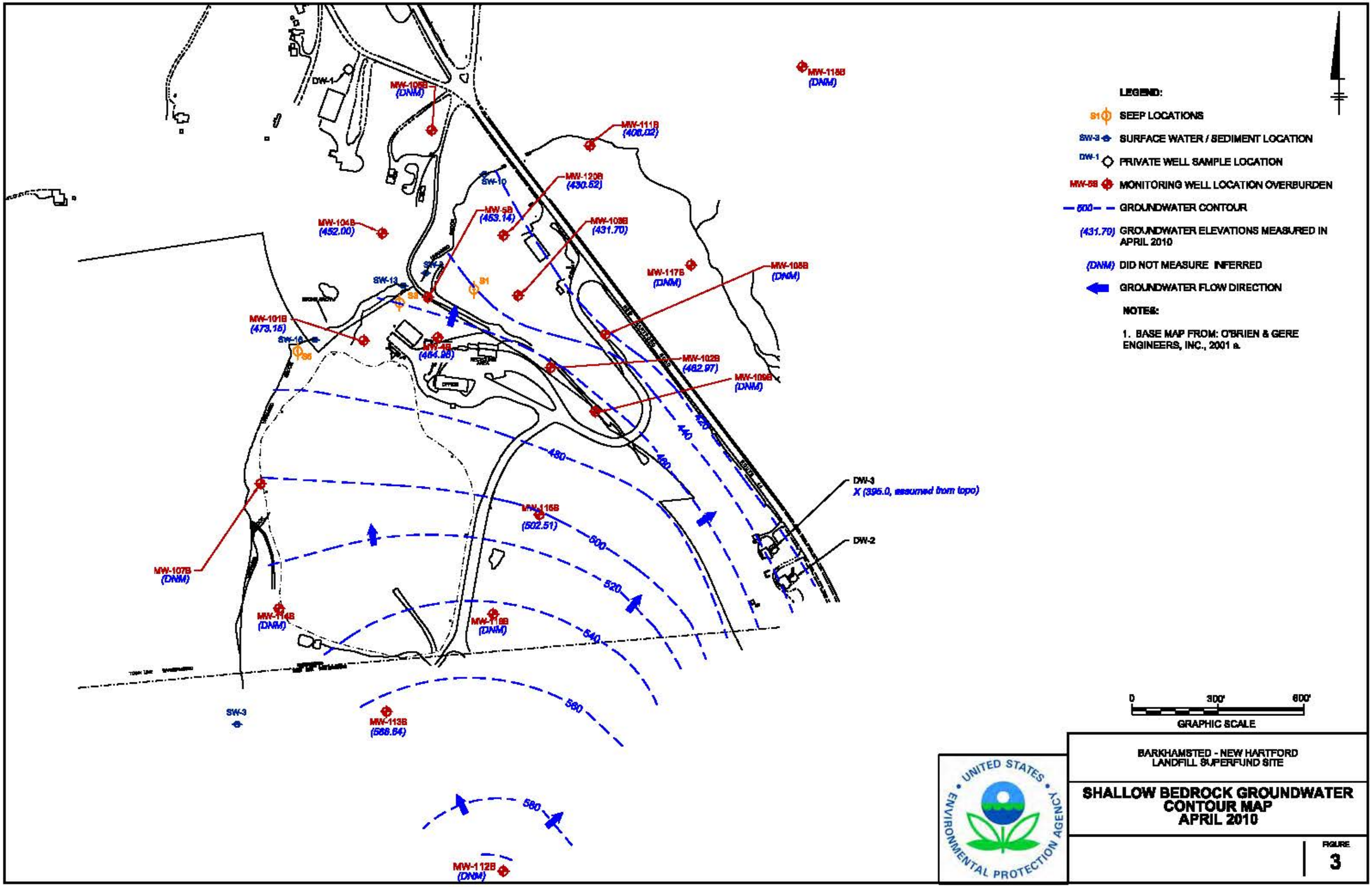
FIGURE 2



BARKHAMSTED - NEW HARTFORD LANDFILL SUPERFUND SITE

OVERBURDEN GROUNDWATER CONTOUR MAP OCTOBER 2010

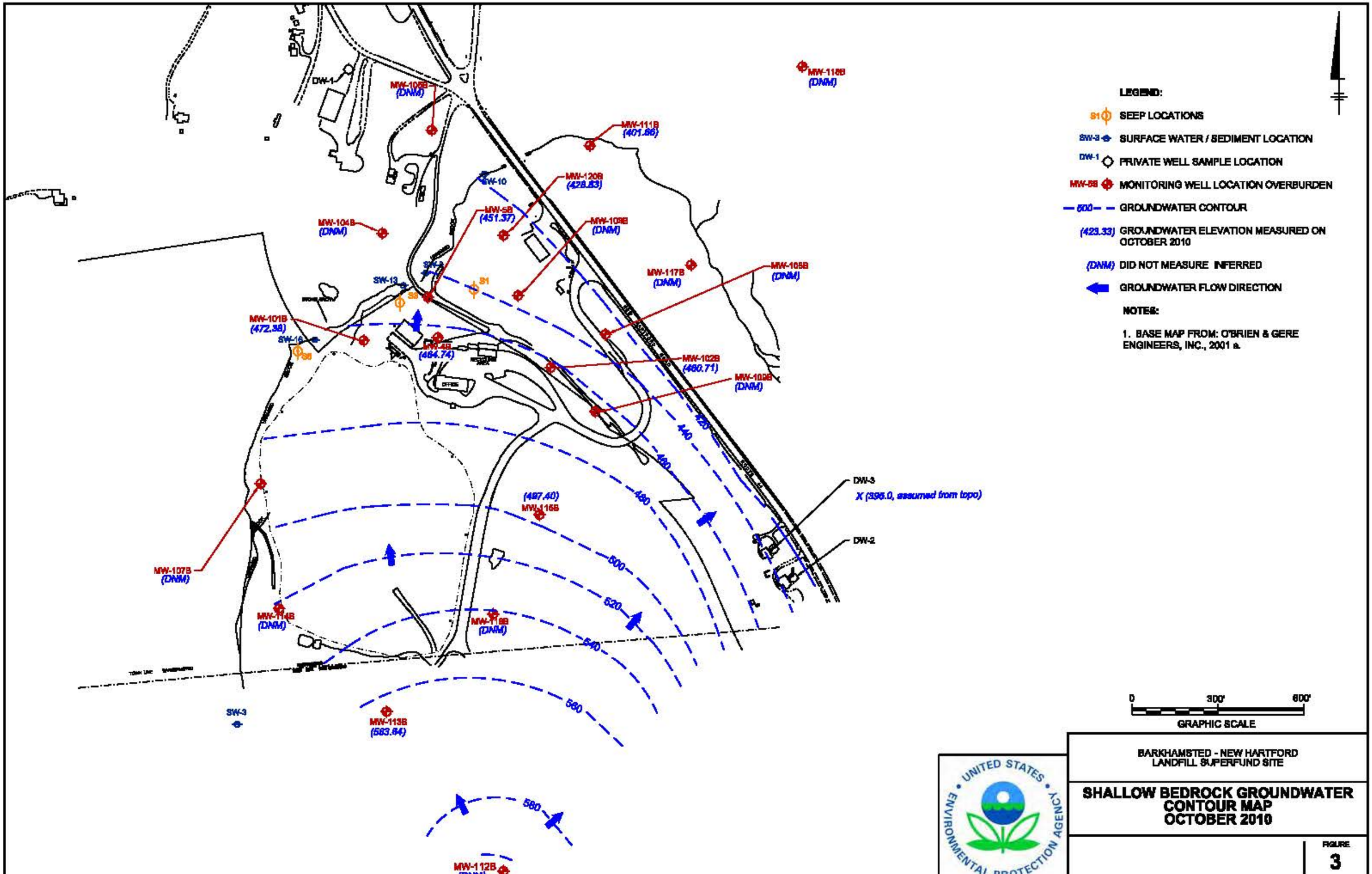
FIGURE 2

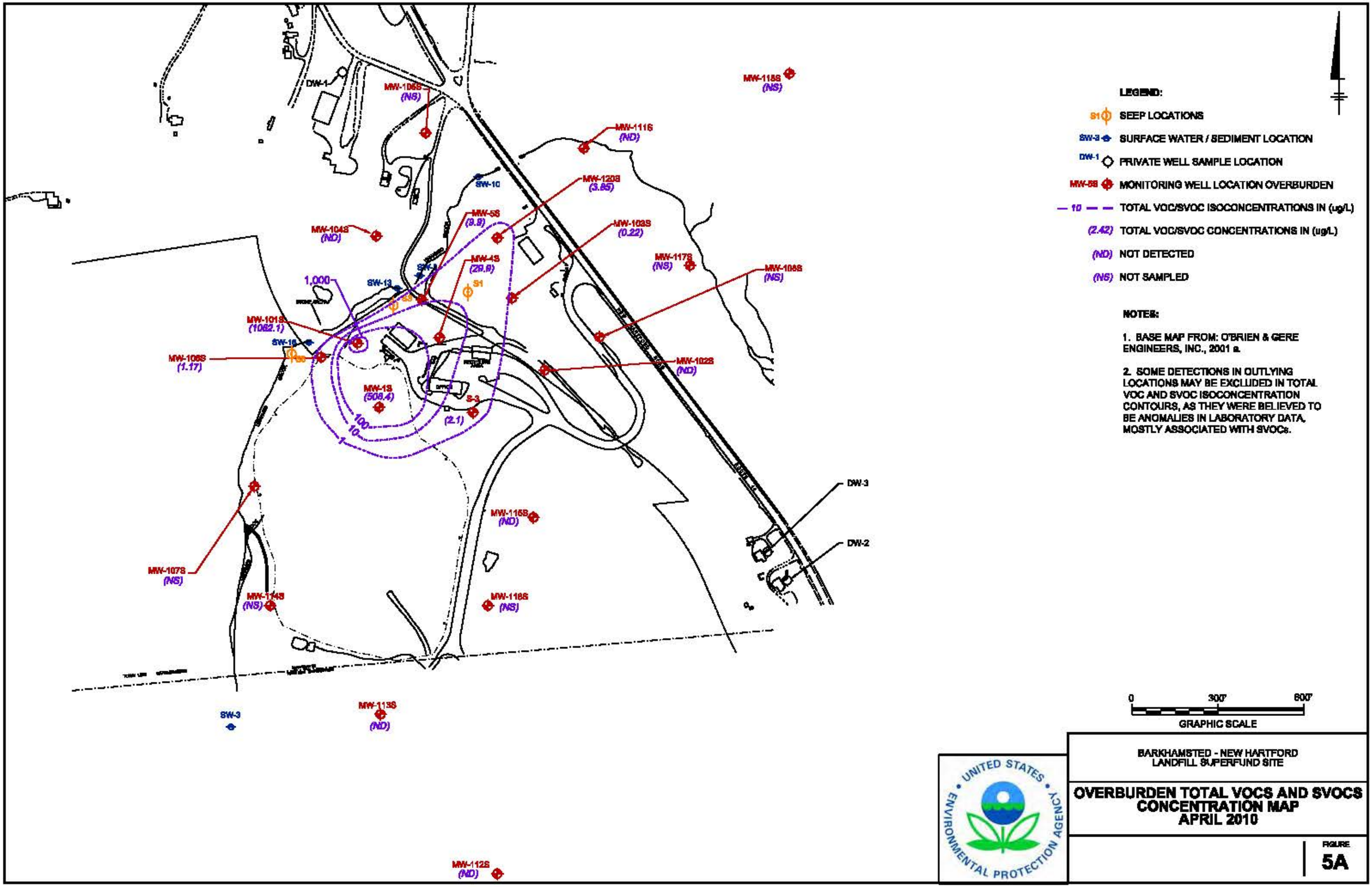


BARKHAMSTED - NEW HARTFORD LANDFILL SUPERFUND SITE

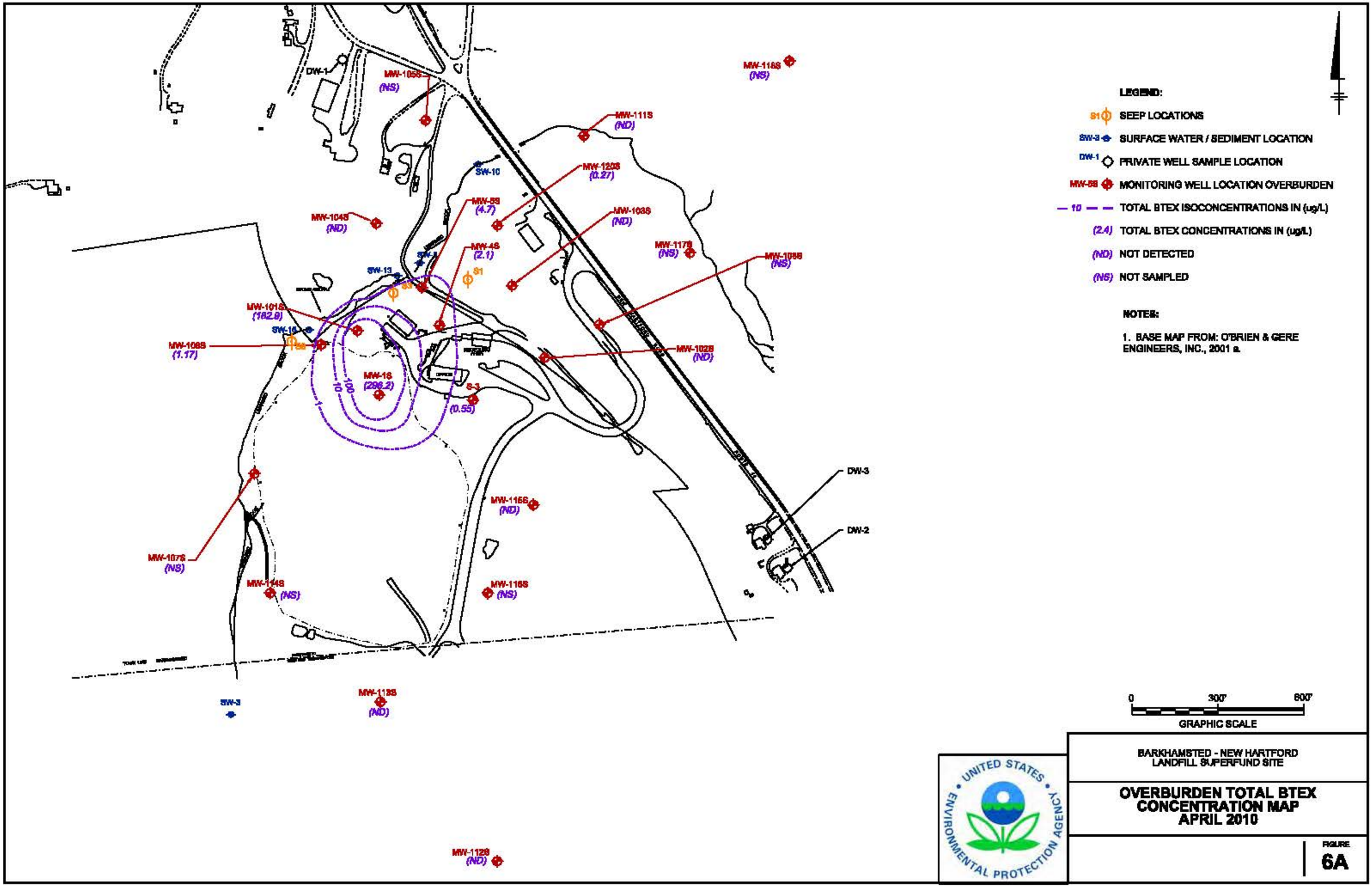
SHALLOW BEDROCK GROUNDWATER CONTOUR MAP APRIL 2010

FIGURE 3


LEGEND:
SEEP LOCATIONS
SURFACE WATER / SEDIMENT LOCATION
PRIVATE WELL SAMPLE LOCATION
MONITORING WELL LOCATION OVERBURDEN
GROUNDWATER CONTOUR
(423.33) GROUNDWATER ELEVATION MEASURED ON OCTOBER 2010
(DNM) DID NOT MEASURE INFERRED
GROUNDWATER FLOW DIRECTION
NOTES:
1. BASE MAP FROM: O'BRIEN & GERE ENGINEERS, INC., 2001 a.
GRAPHIC SCALE
0
300'
600'
DW-1
DW-2
DW-3
X (395.0, assumed from topo)
MW-116B (DNM)
MW-105B (DNM)
MW-111B (401.86)
MW-120B (428.83)
MW-5B (451.37)
MW-109B (DNM)
MW-104B (DNM)
MW-117B (DNM)
MW-108B (DNM)
MW-101B (472.38)
MW-4B (464.74)
MW-102B (460.71)
MW-103B (DNM)
(497.40) MW-115B
MW-107B (DNM)
MW-114B (DNM)
MW-118B (DNM)
MW-113B (583.64)
MW-112B (DNM)
SW-10
SW-9
SW-13
SW-16
SW-3
S1
S2
S3
420
440
460
480
500
520
540
560
580
BARKHAMSTED - NEW HARTFORD LANDFILL SUPERFUND SITE
SHALLOW BEDROCK GROUNDWATER CONTOUR MAP OCTOBER 2010
FIGURE
3
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY



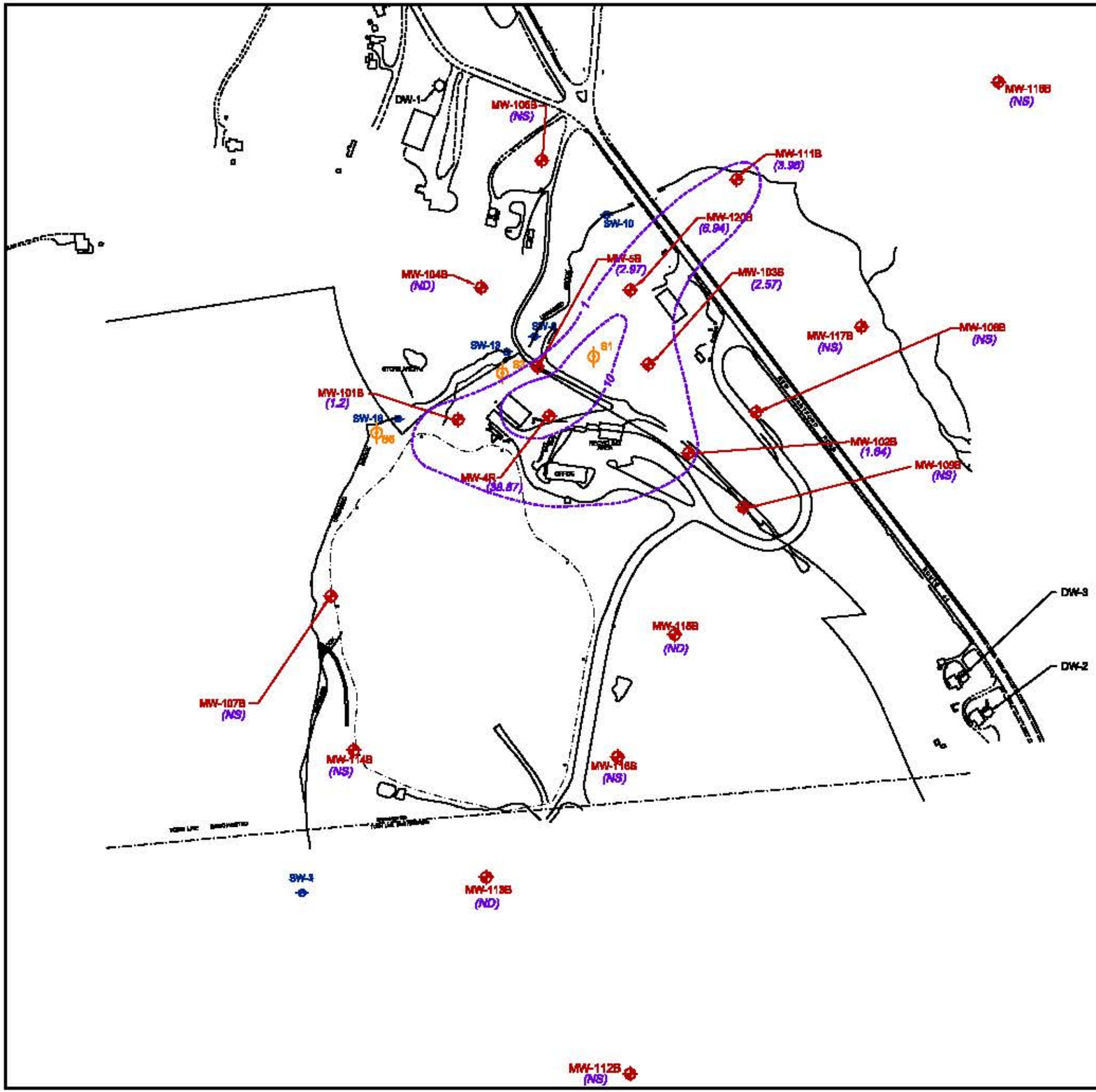
DW-1
MW-106S (NS)
MW-118S (NS)
MW-111S (ND)
SW-10
MW-120S (3.85)
MW-5S (9.9)
MW-104S (ND)
MW-103S (0.22)
MW-4S (29.9)
MW-117S (NS)
MW-108S (NS)
1,000
SW-13
S1
MW-101S (1062.1)
SW-16
MW-106S (1.17)
MW-102S (ND)
MW-1S (508.4)
S-3
(2.1)
100
10
1
DW-3
DW-2
MW-115S (ND)
MW-107S (NS)
MW-114S (NS)
MW-116S (NS)
SW-3
MW-113S (ND)
MW-112S (ND)
LEGEND:
S1 SEEP LOCATIONS
SW-3 SURFACE WATER / SEDIMENT LOCATION
DW-1 PRIVATE WELL SAMPLE LOCATION
MW-5S MONITORING WELL LOCATION OVERBURDEN
10 TOTAL VOC/SVOC ISOCONCENTRATIONS IN (ug/L)
(2.42) TOTAL VOC/SVOC CONCENTRATIONS IN (ug/L)
(ND) NOT DETECTED
(NS) NOT SAMPLED
NOTES:
1. BASE MAP FROM: O'BRIEN & GERE ENGINEERS, INC., 2001 a.
2. SOME DETECTIONS IN OUTLYING LOCATIONS MAY BE EXCLUDED IN TOTAL VOC AND SVOC ISOCONCENTRATION CONTOURS, AS THEY WERE BELIEVED TO BE ANOMALIES IN LABORATORY DATA, MOSTLY ASSOCIATED WITH SVOCs.
0
300'
600'
GRAPHIC SCALE
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
BARKHAMSTED - NEW HARTFORD LANDFILL SUPERFUND SITE
OVERBURDEN TOTAL VOCS AND SVOCS CONCENTRATION MAP APRIL 2010
FIGURE
5A



BARKHAMSTED - NEW HARTFORD LANDFILL SUPERFUND SITE

OVERBURDEN TOTAL BTEX CONCENTRATION MAP APRIL 2010

FIGURE **6A**



LEGEND:

- S1 SEEP LOCATIONS
- SW-3 SURFACE WATER / SEDIMENT LOCATION
- DW-1 PRIVATE WELL SAMPLE LOCATION
- MW-5B MONITORING WELL LOCATION OVERBURDEN
- --- 10 ------ TOTAL VOC/SVOC ISOCONCENTRATIONS IN (ug/L)
- (2.44) TOTAL VOC/SVOC CONCENTRATIONS IN (ug/L)
- (ND) NOT DETECTED
- (NS) NOT SAMPLED

NOTES:

1. BASE MAP FROM: O'BRIEN & GERE ENGINEERS, INC., 2001 a.

2. SOME DETECTIONS IN OUTLYING LOCATIONS MAY BE EXCLUDED IN TOTAL VOC AND SVOC ISOCONCENTRATION CONTOURS, AS THEY WERE BELIEVED TO BE ANOMALIES IN LABORATORY DATA, MOSTLY ASSOCIATED WITH SVOCs.

0 300' 600'

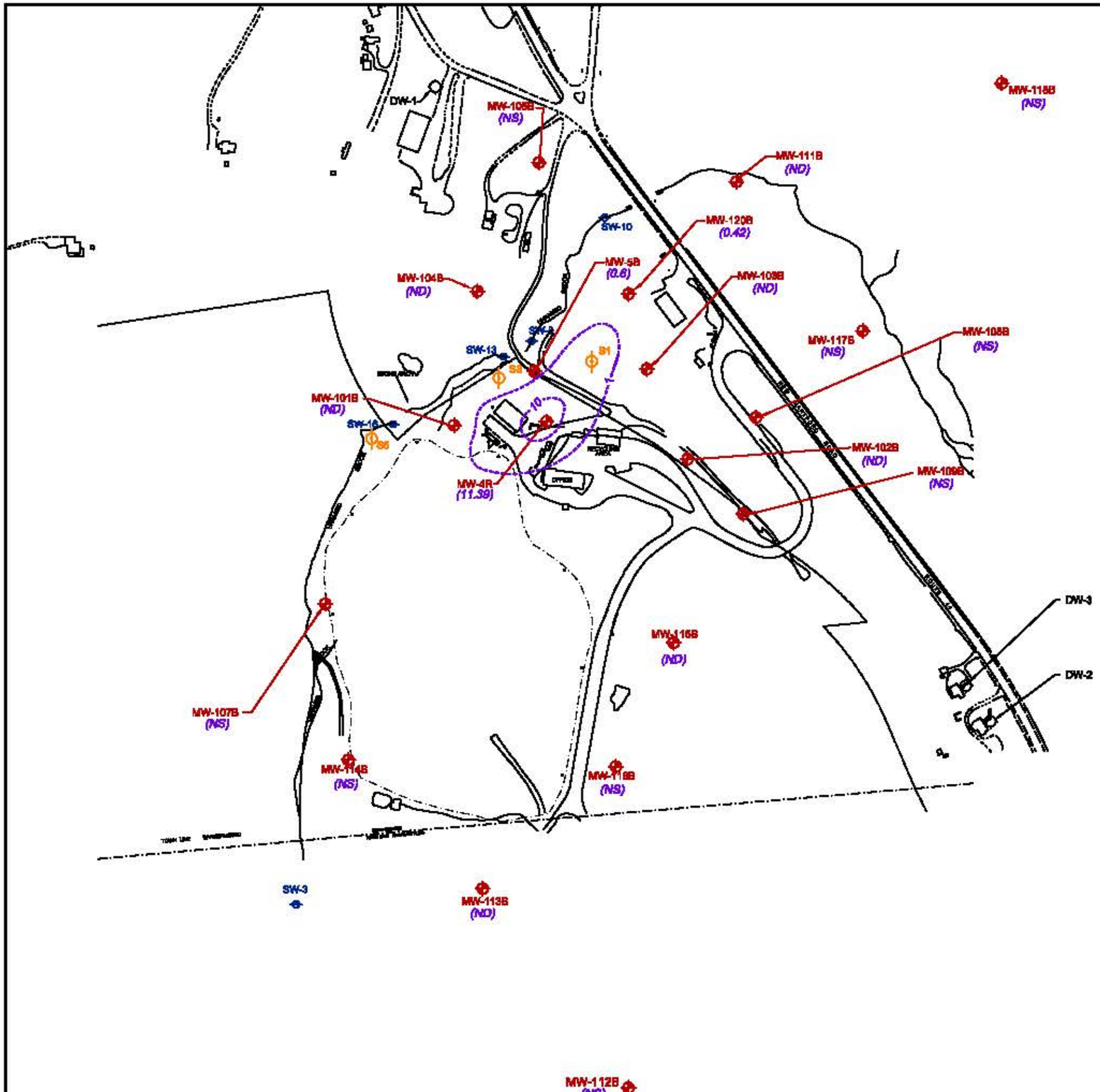
GRAPHIC SCALE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

BARKHAMSTED - NEW HARTFORD LANDFILL SUPERFUND SITE

SHALLOW BEDROCK TOTAL VOCS AND SVOCS CONCENTRATION MAP APRIL 2010

FIGURE **7A**



LEGEND:

- S1 SEEP LOCATIONS
- SW-3 SURFACE WATER / SEDIMENT LOCATION
- DW-1 PRIVATE WELL SAMPLE LOCATION
- MW-5B MONITORING WELL LOCATION OVERBURDEN
- 1 TOTAL BTEX ISOCONCENTRATIONS IN (ug/L)
- (0.68) TOTAL BTEX CONCENTRATIONS IN (ug/L)
- (ND) NOT DETECTED
- (NS) NOT SAMPLED

NOTES:

1. BASE MAP FROM: O'BRIEN & GERE ENGINEERS, INC., 2001 a.

0 300' 600'

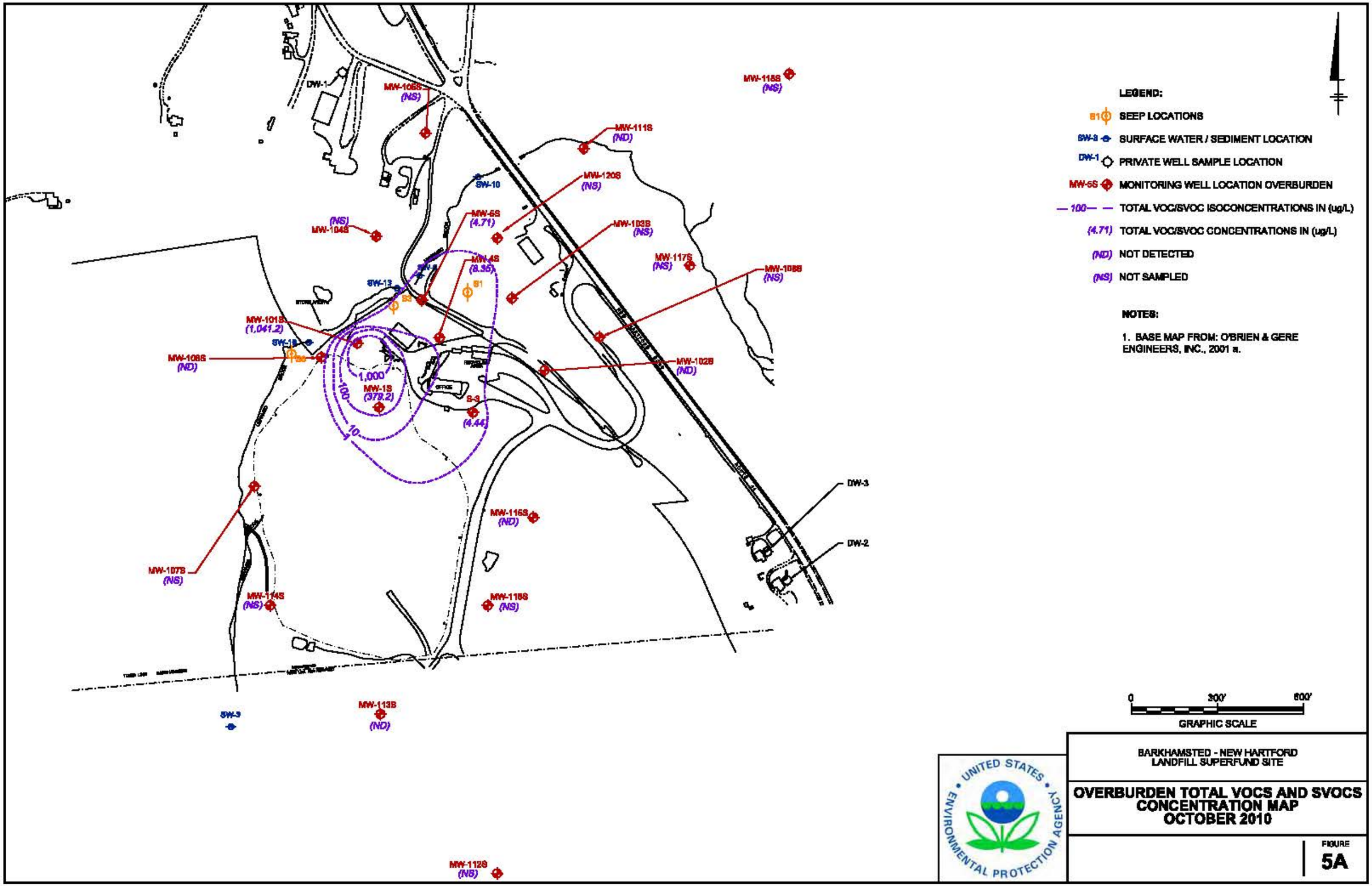
GRAPHIC SCALE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

BARKHAMSTED - NEW HARTFORD LANDFILL SUPERFUND SITE

SHALLOW BEDROCK TOTAL BTEX CONCENTRATION MAP APRIL 2010

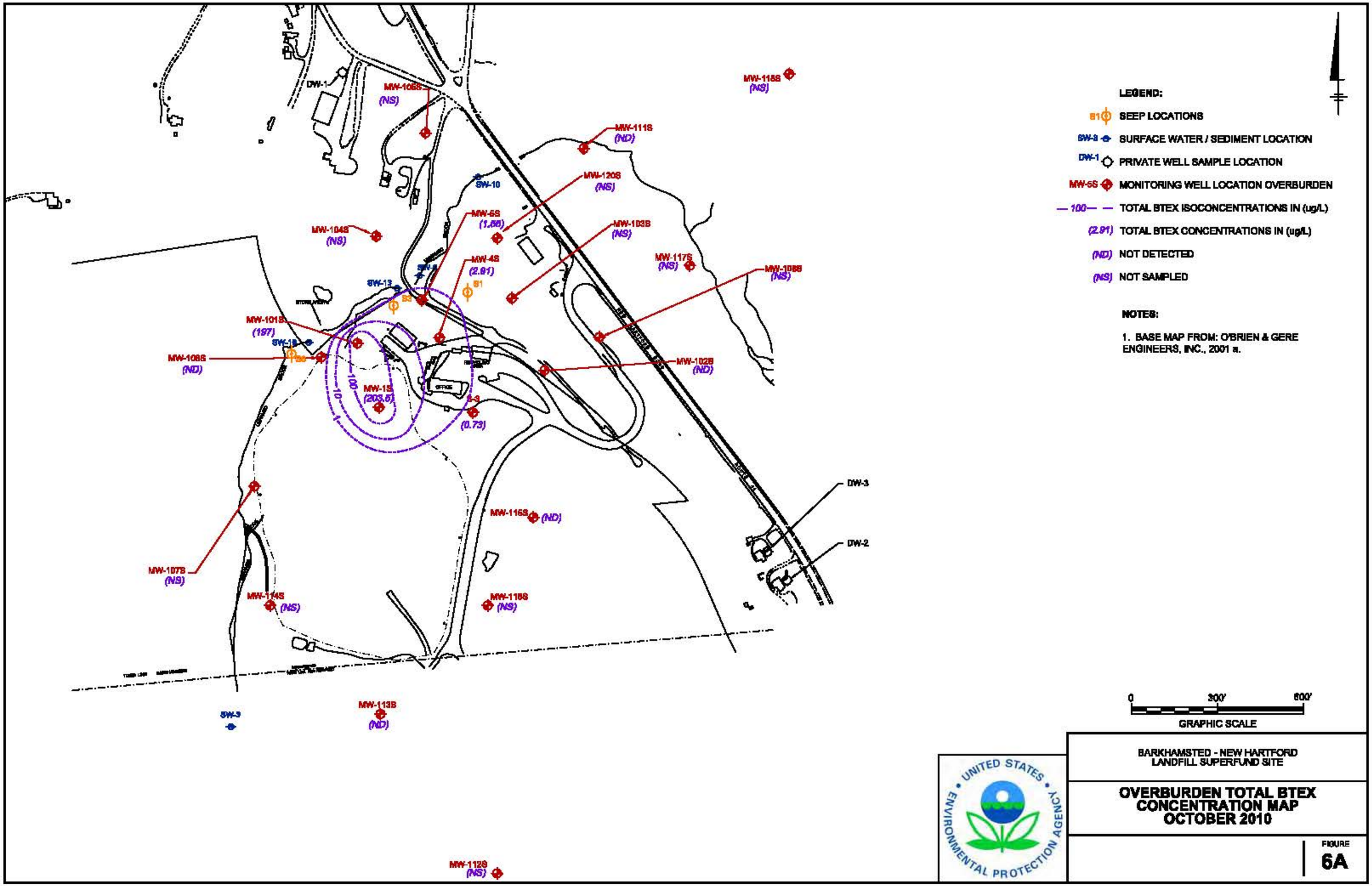
FIGURE **8A**



BARKHAMSTED - NEW HARTFORD
LANDFILL SUPERFUND SITE

OVERBURDEN TOTAL VOCS AND SVOCS CONCENTRATION MAP
OCTOBER 2010

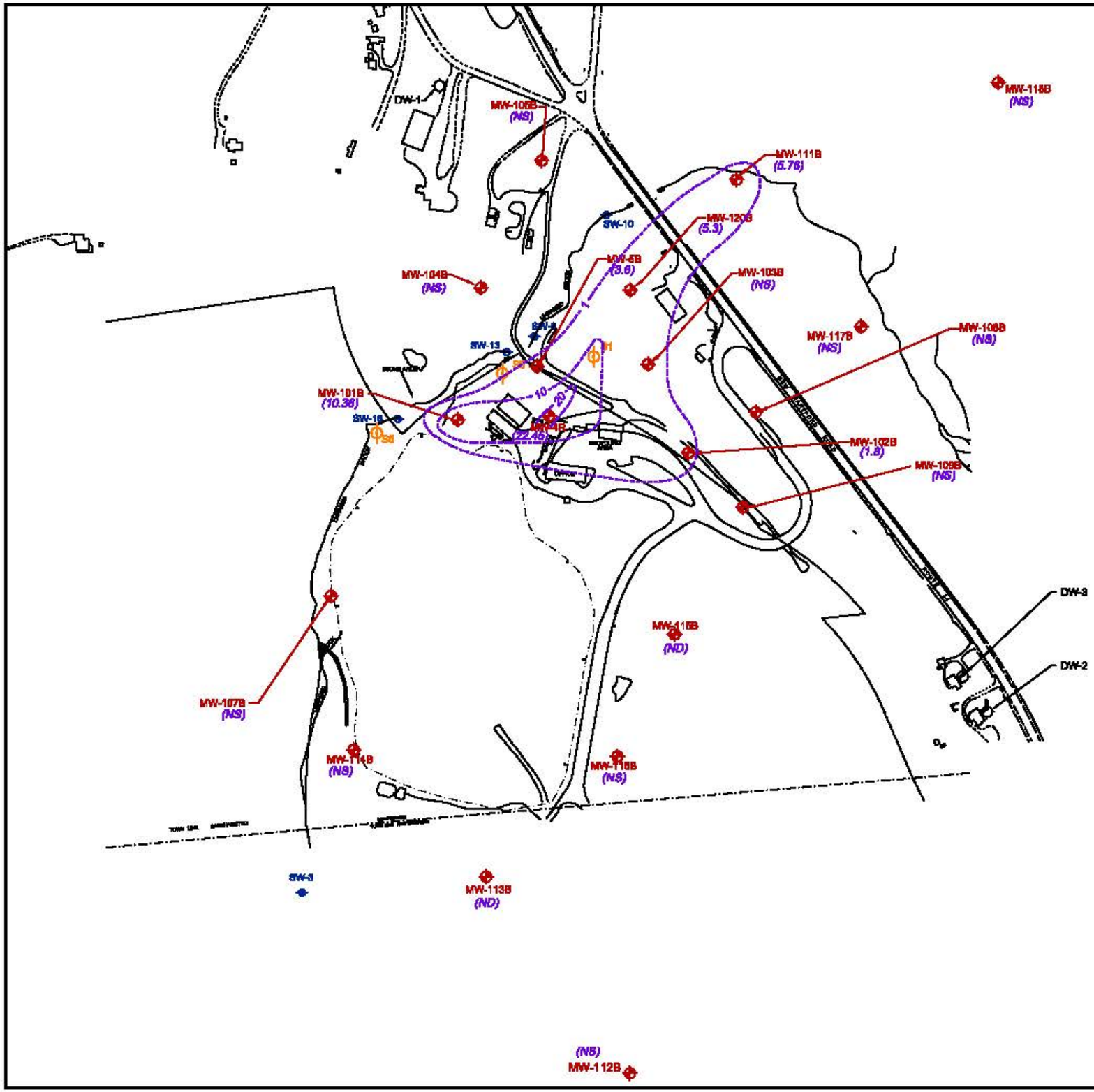
FIGURE
5A



BARKHAMSTED - NEW HARTFORD LANDFILL SUPERFUND SITE

OVERBURDEN TOTAL BTEX CONCENTRATION MAP OCTOBER 2010

FIGURE **6A**



LEGEND:

- S1 SEEP LOCATIONS
- SW-9 SURFACE WATER / SEDIMENT LOCATION
- DW-1 PRIVATE WELL SAMPLE LOCATION
- MW-5S MONITORING WELL LOCATION OVERBURDEN
- 10 TOTAL VOC/SVOC ISOCONCENTRATIONS IN (ug/L)
- (5.76) TOTAL VOC/SVOC CONCENTRATIONS IN (ug/L)
- (ND) NOT DETECTED
- (NS) NOT SAMPLED

NOTES:

1. BASE MAP FROM: O'BRIEN & GERE ENGINEERS, INC., 2001 a.
2. SOME DETECTIONS IN OUTLYING LOCATIONS MAY BE EXCLUDED IN TOTAL VOC AND SVOC ISOCONCENTRATION CONTOURS, AS THEY WERE BELIEVED TO BE ANOMALIES IN LABORATORY DATA, MOSTLY ASSOCIATED WITH SVOCs.

0 300' 600'

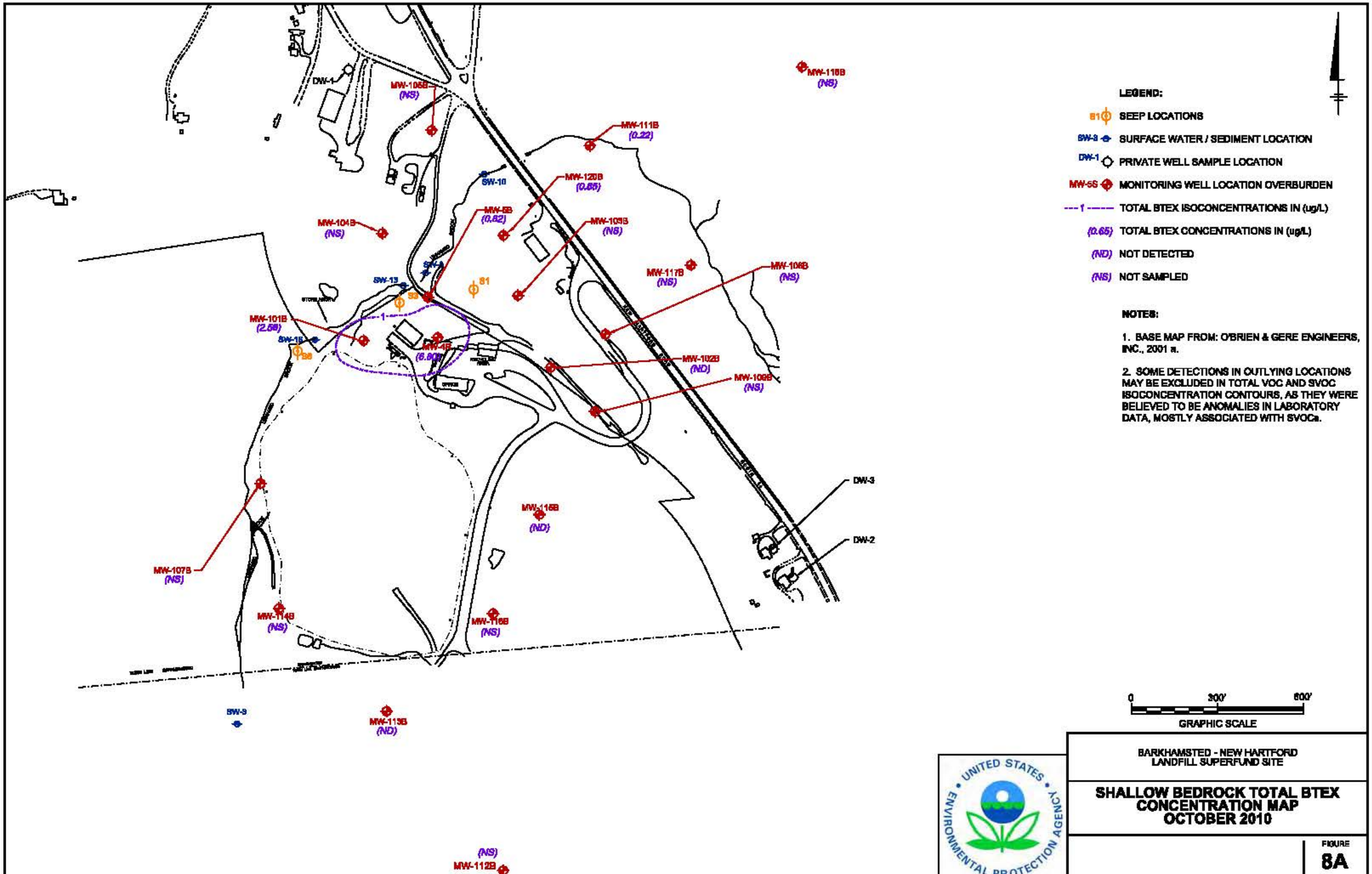
GRAPHIC SCALE

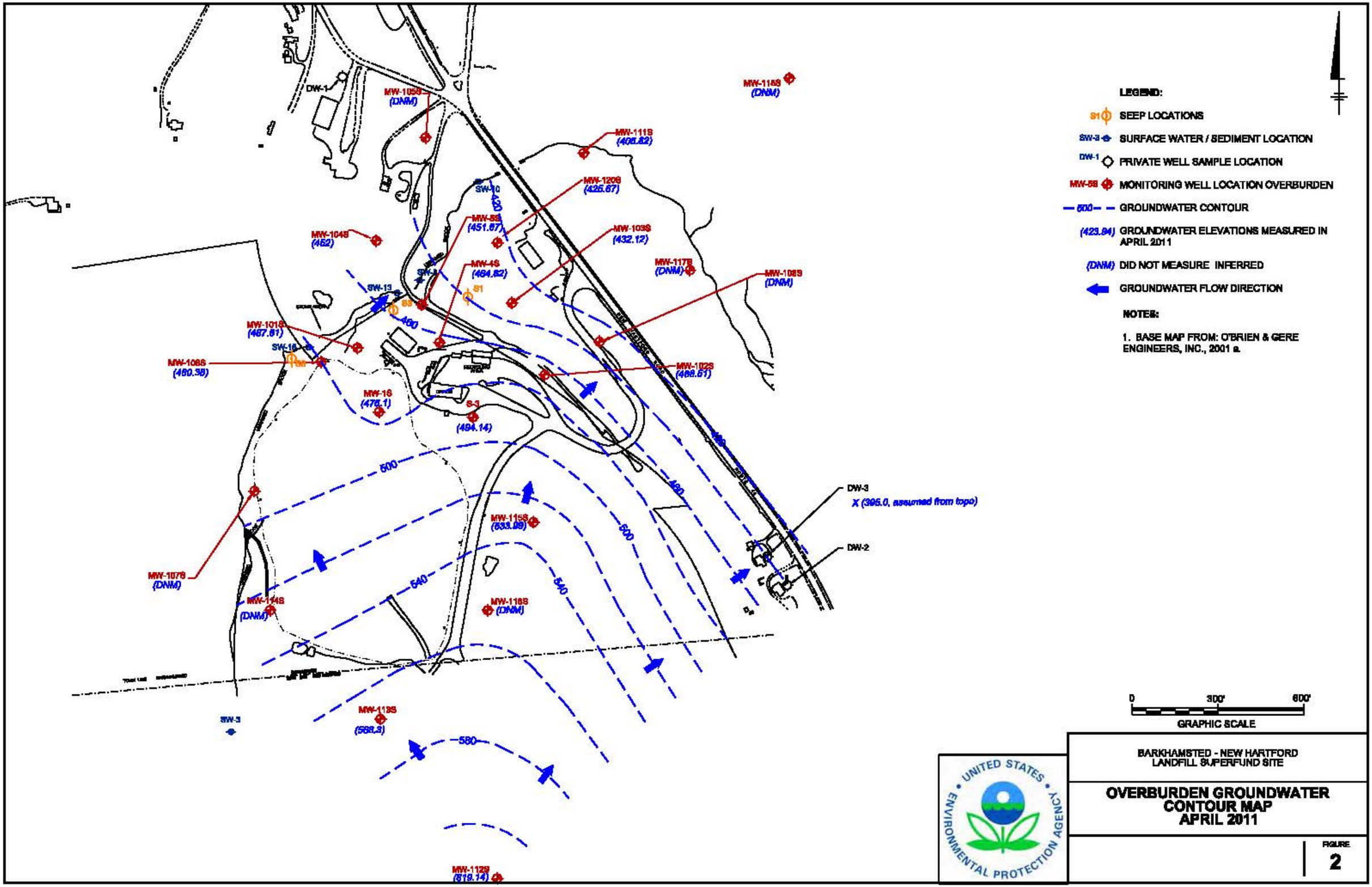
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

BARKHAMSTED - NEW HARTFORD LANDFILL SUPERFUND SITE

SHALLOW BEDROCK TOTAL SVOCS AND VOCS CONCENTRATION MAP OCTOBER 2010

FIGURE **7A**

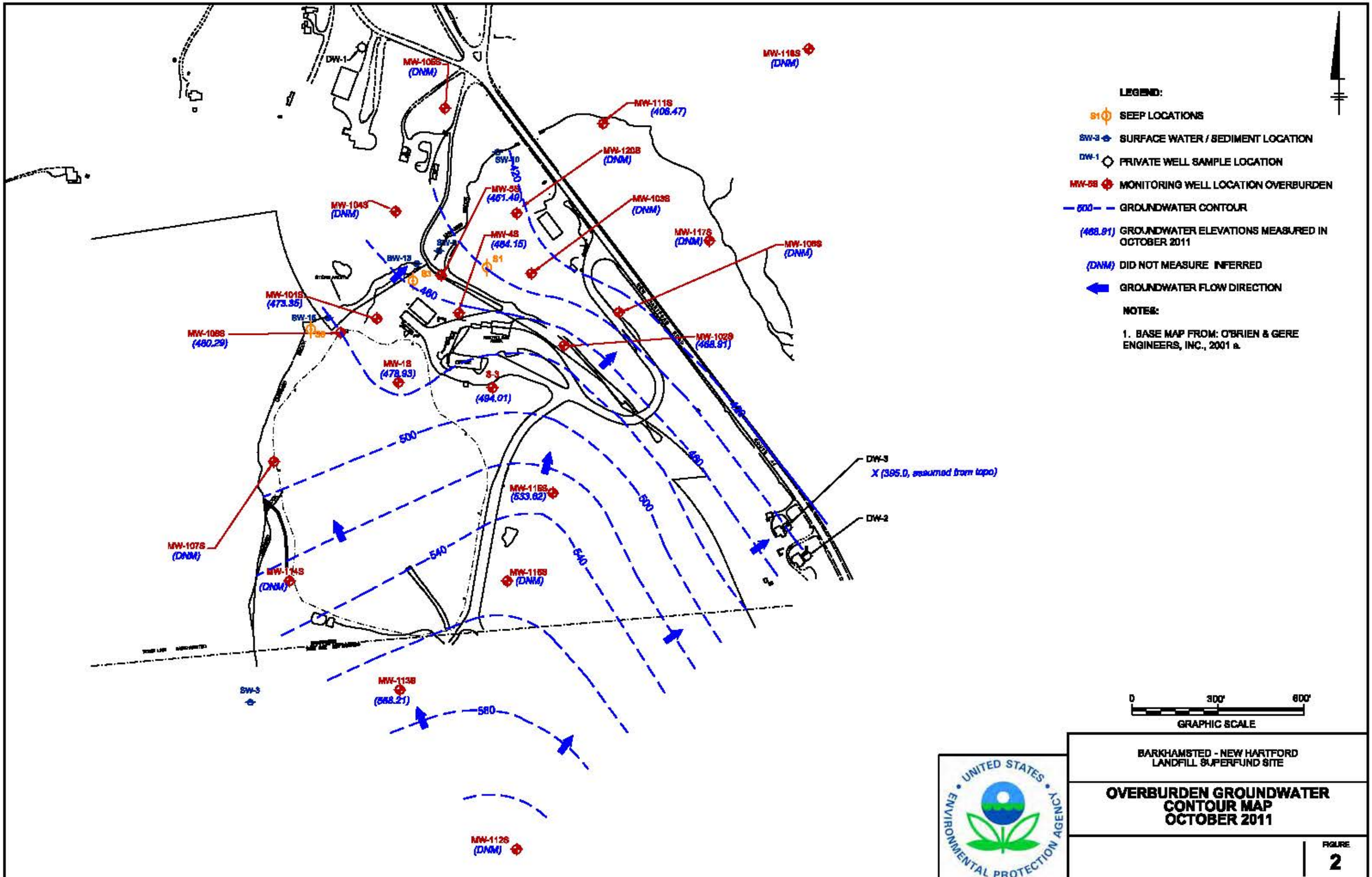

LEGEND:
S1 SEEP LOCATIONS
SW-9 SURFACE WATER / SEDIMENT LOCATION
DW-1 PRIVATE WELL SAMPLE LOCATION
MW-5S MONITORING WELL LOCATION OVERBURDEN
1 TOTAL BTEX ISOCONCENTRATIONS IN (ug/L)
(0.65) TOTAL BTEX CONCENTRATIONS IN (ug/L)
(ND) NOT DETECTED
(NS) NOT SAMPLED
NOTES:
1. BASE MAP FROM: O'BRIEN & GERE ENGINEERS, INC., 2001 a.
2. SOME DETECTIONS IN OUTLYING LOCATIONS MAY BE EXCLUDED IN TOTAL VOC AND SVOC ISOCONCENTRATION CONTOURS, AS THEY WERE BELIEVED TO BE ANOMALIES IN LABORATORY DATA, MOSTLY ASSOCIATED WITH SVOCs.
0 300' 600'
GRAPHIC SCALE
DW-1
MW-105B (NS)
MW-116B (NS)
MW-111B (0.22)
MW-120B (0.65)
SW-10
MW-5B (0.82)
MW-109B (NS)
MW-104B (NS)
SW-11
S1
MW-117B (NS)
MW-106B (NS)
MW-101B (2.58)
SW-15
S2
1
MW-4B (6.90)
MW-102B (ND)
MW-108B (NS)
DW-3
DW-2
MW-115B (ND)
MW-107B (NS)
MW-114B (NS)
MW-116B (NS)
SW-9
MW-113B (ND)
(NS)
MW-112B
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
BARKHAMSTED - NEW HARTFORD LANDFILL SUPERFUND SITE
SHALLOW BEDROCK TOTAL BTEX CONCENTRATION MAP OCTOBER 2010
FIGURE
8A



BARKHAMSTED - NEW HARTFORD LANDFILL SUPERFUND SITE

OVERBURDEN GROUNDWATER CONTOUR MAP APRIL 2011

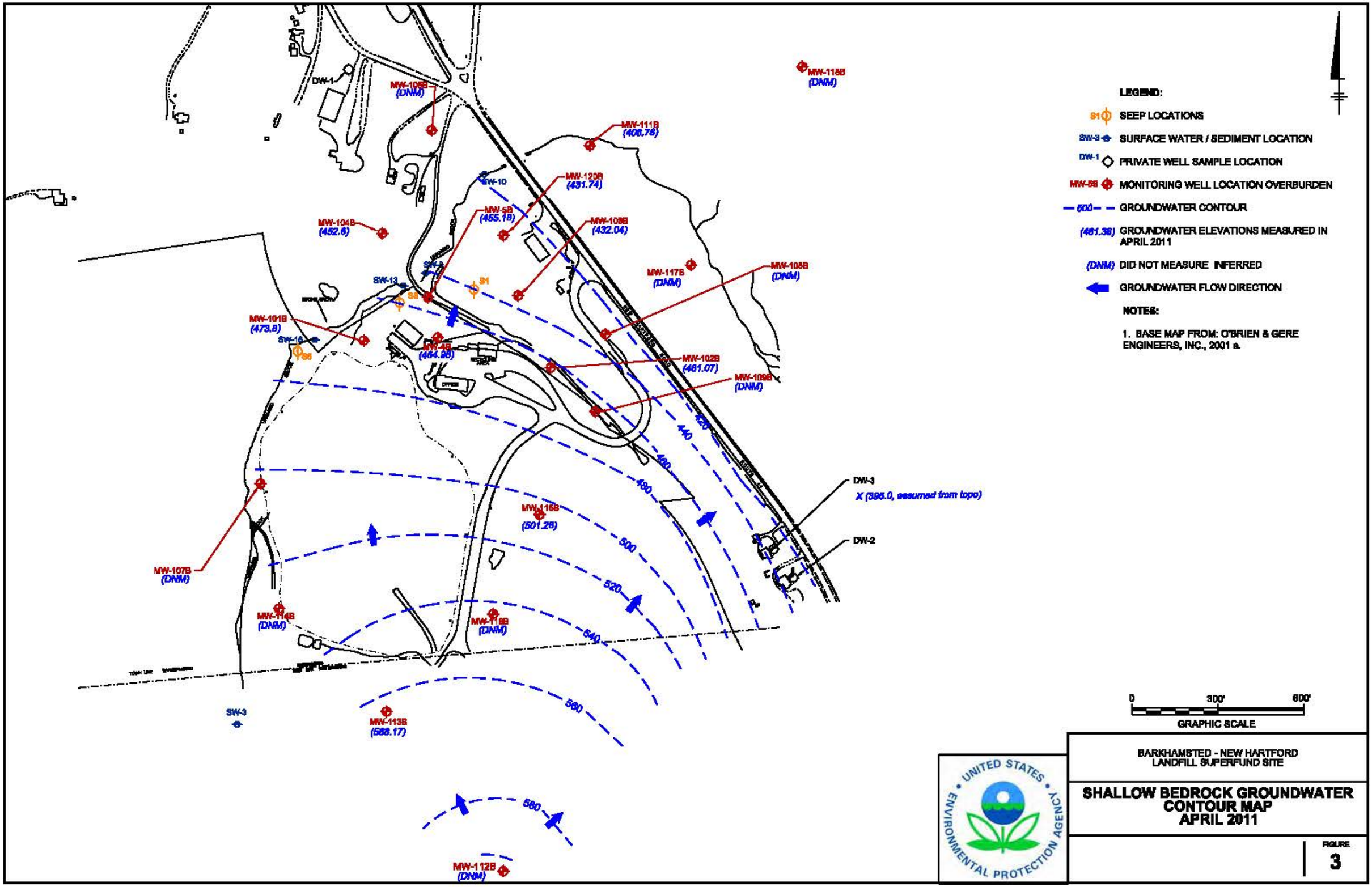
FIGURE 2

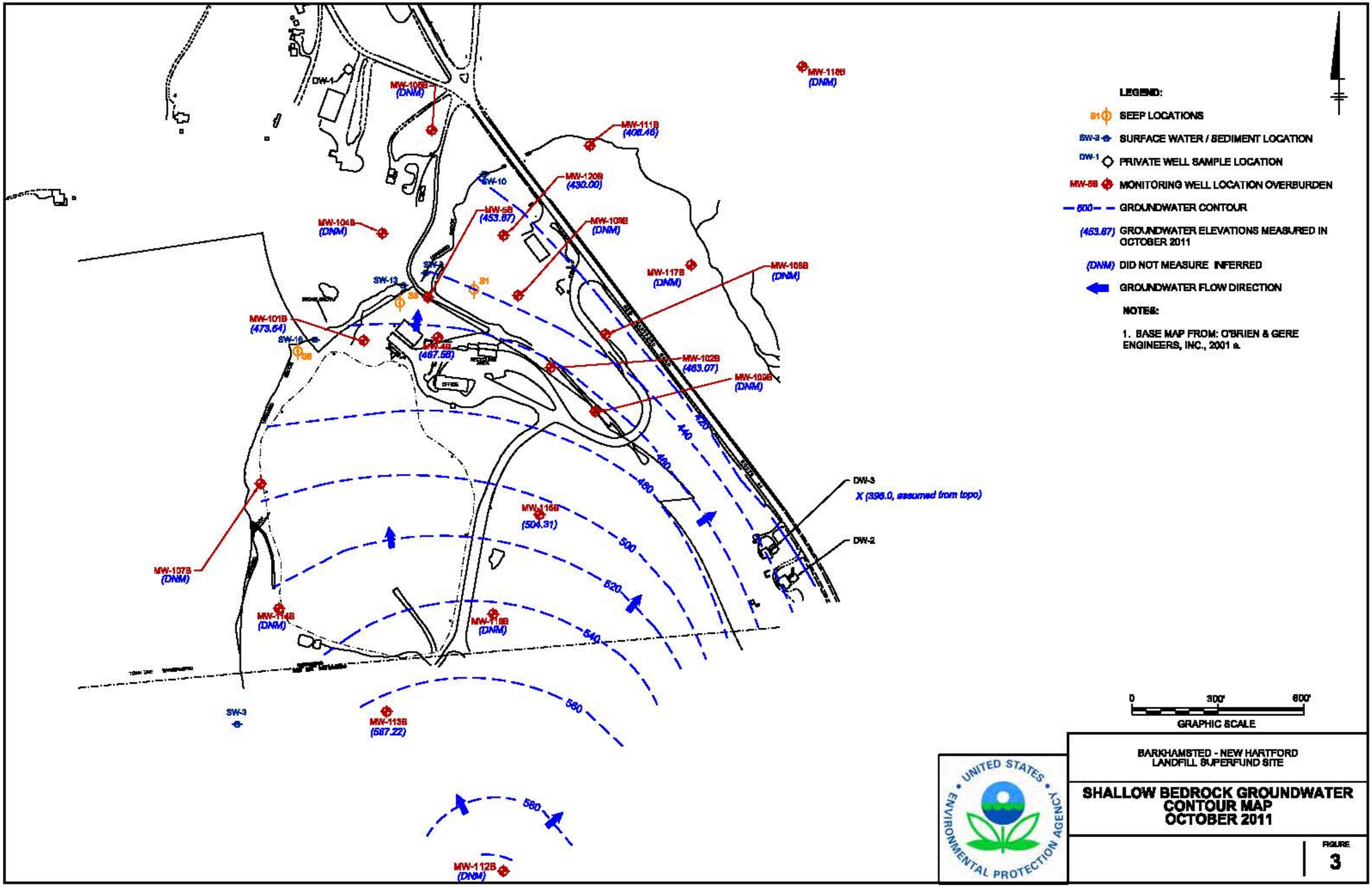


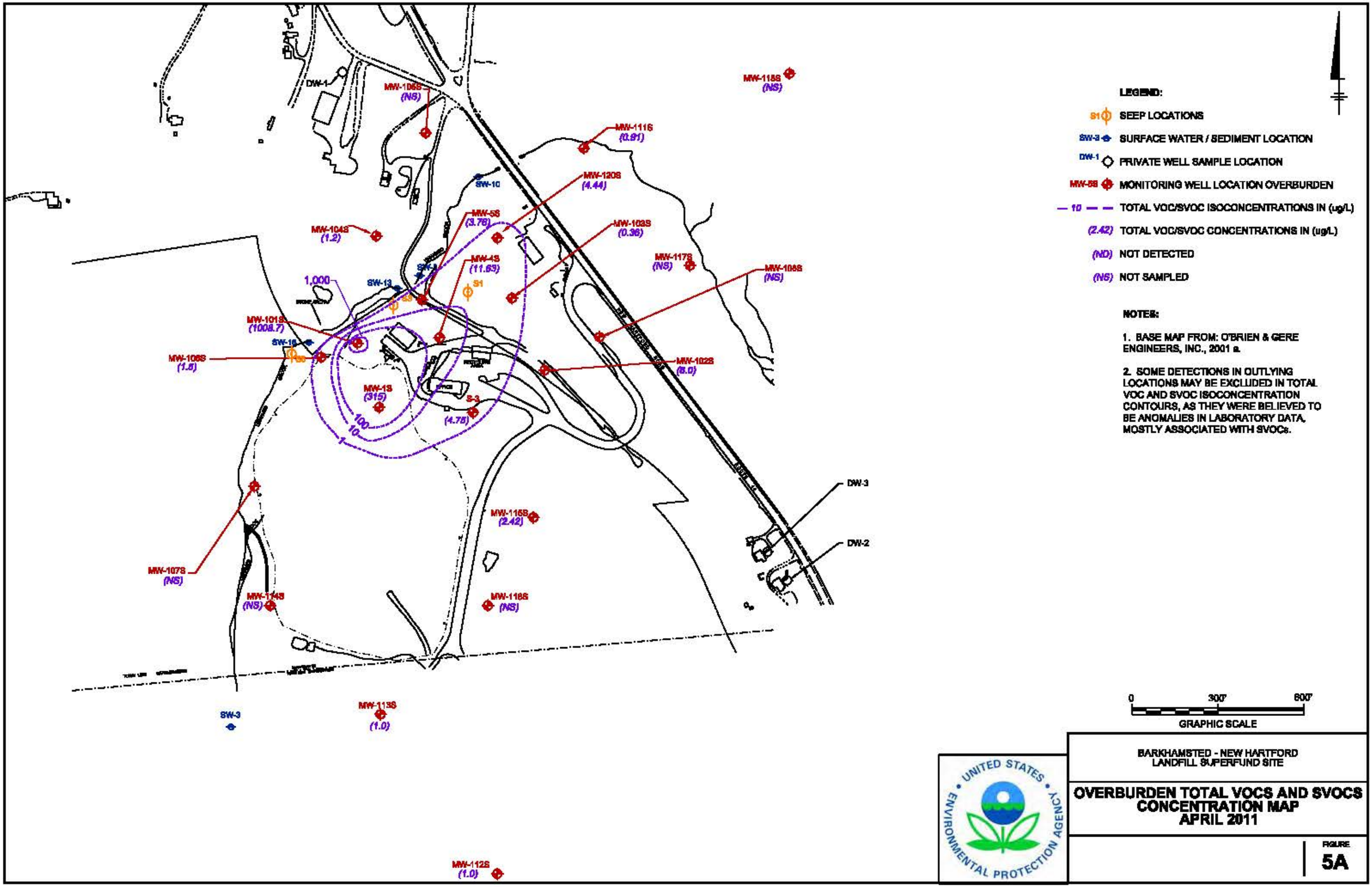
BARKHAMSTED - NEW HARTFORD LANDFILL SUPERFUND SITE

OVERBURDEN GROUNDWATER CONTOUR MAP OCTOBER 2011

FIGURE 2


LEGEND:
S1 SEEP LOCATIONS
SW-3 SURFACE WATER / SEDIMENT LOCATION
DW-1 PRIVATE WELL SAMPLE LOCATION
MW-5B MONITORING WELL LOCATION OVERBURDEN
500 GROUNDWATER CONTOUR
(461.36) GROUNDWATER ELEVATIONS MEASURED IN APRIL 2011
(DNM) DID NOT MEASURE INFERRED
GROUNDWATER FLOW DIRECTION
NOTES:
1. BASE MAP FROM: O'BRIEN & GERE ENGINEERS, INC., 2001 a.
DW-1
MW-105B (DNM)
MW-118B (DNM)
MW-111B (408.78)
MW-120B (431.74)
MW-5B (455.18)
MW-108B (432.04)
MW-104B (452.6)
MW-117B (DNM)
MW-106B (DNM)
SW-10
SW-9
SW-13
S1
S2
MW-101B (473.8)
SW-16
S5
MW-4B (464.98)
MW-102B (461.07)
MW-109B (DNM)
420
440
460
480
500
520
540
560
580
MW-116B (501.26)
MW-107B (DNM)
MW-114B (DNM)
MW-119B (DNM)
SW-3
MW-113B (588.17)
MW-112B (DNM)
DW-3
X (395.0, assumed from topo)
DW-2
0
300'
600'
GRAPHIC SCALE
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
BARKHAMSTED - NEW HARTFORD LANDFILL SUPERFUND SITE
SHALLOW BEDROCK GROUNDWATER CONTOUR MAP APRIL 2011
FIGURE
3


LEGEND:
S1 SEEP LOCATIONS
SW-3 SURFACE WATER / SEDIMENT LOCATION
DW-1 PRIVATE WELL SAMPLE LOCATION
MW-5B MONITORING WELL LOCATION OVERBURDEN
500 GROUNDWATER CONTOUR
(453.67) GROUNDWATER ELEVATIONS MEASURED IN OCTOBER 2011
(DNM) DID NOT MEASURE INFERRED
GROUNDWATER FLOW DIRECTION
NOTES:
1. BASE MAP FROM: O'BRIEN & GERE ENGINEERS, INC., 2001 a.
0 300' 600'
GRAPHIC SCALE
BARKHAMSTED - NEW HARTFORD LANDFILL SUPERFUND SITE
SHALLOW BEDROCK GROUNDWATER CONTOUR MAP OCTOBER 2011
FIGURE 3
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
DW-1
MW-105B (DNM)
MW-116B (DNM)
MW-111B (408.46)
MW-120B (430.00)
MW-5B (453.67)
MW-109B (DNM)
MW-104B (DNM)
MW-117B (DNM)
MW-105B (DNM)
SW-10
SW-9
SW-13
S1
S3
MW-101B (473.64)
SW-16
S6
MW-4B (467.58)
MW-102B (463.07)
MW-108B (DNM)
DW-3
X (395.0, assumed from topo)
DW-2
MW-116B (504.31)
MW-107B (DNM)
MW-114B (DNM)
MW-118B (DNM)
SW-3
MW-113B (587.22)
MW-112B (DNM)
420
440
460
480
500
520
540
560
580



LEGEND:

- S1 SEEP LOCATIONS
- SW-3 SURFACE WATER / SEDIMENT LOCATION
- DW-1 PRIVATE WELL SAMPLE LOCATION
- MW-5S MONITORING WELL LOCATION OVERBURDEN
- 10 TOTAL VOC/SVOC ISOCONCENTRATIONS IN (ug/L)
- (2.42) TOTAL VOC/SVOC CONCENTRATIONS IN (ug/L)
- (ND) NOT DETECTED
- (NS) NOT SAMPLED

NOTES:

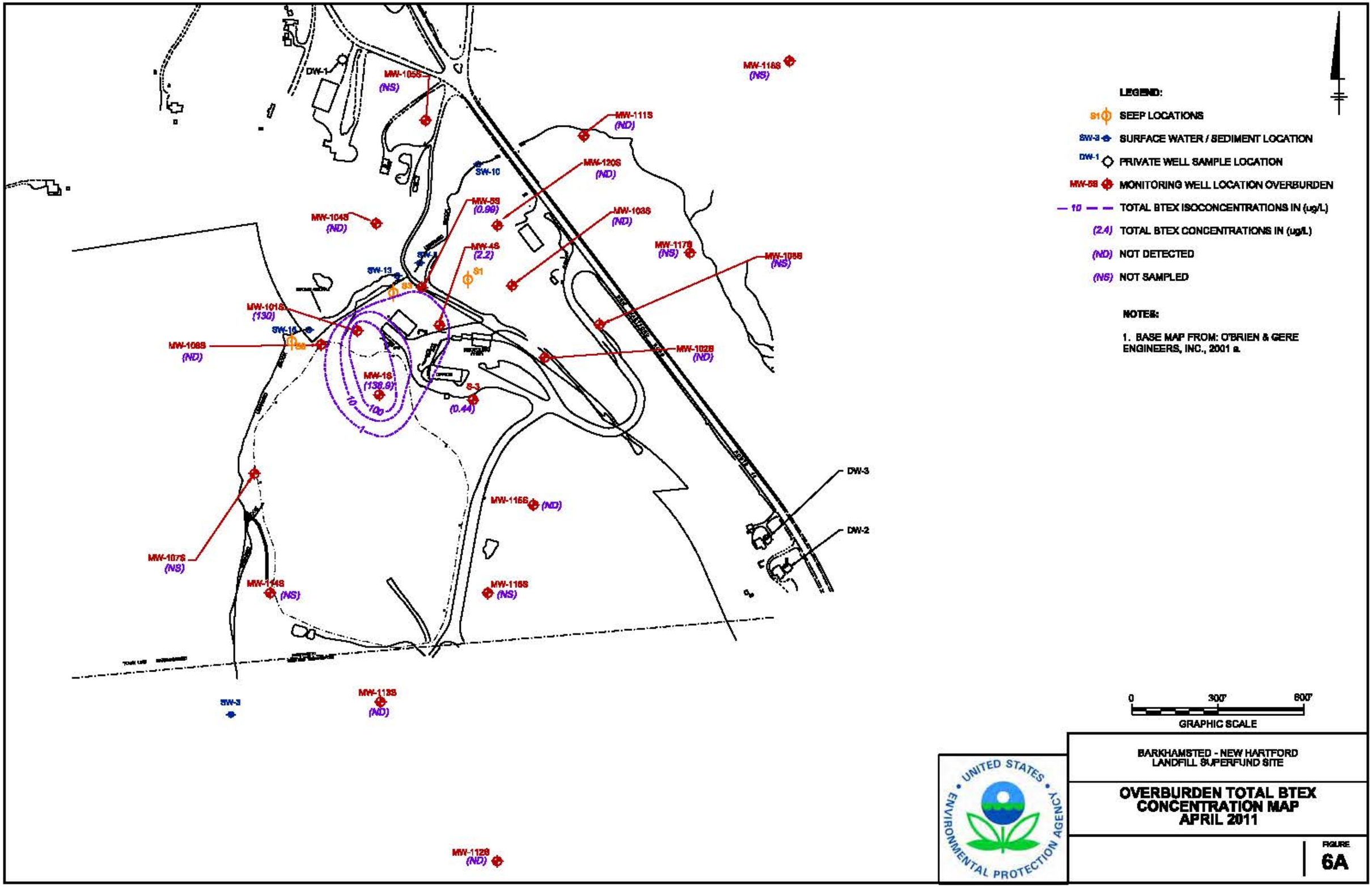
1. BASE MAP FROM: O'BRIEN & GERE ENGINEERS, INC., 2001 a.

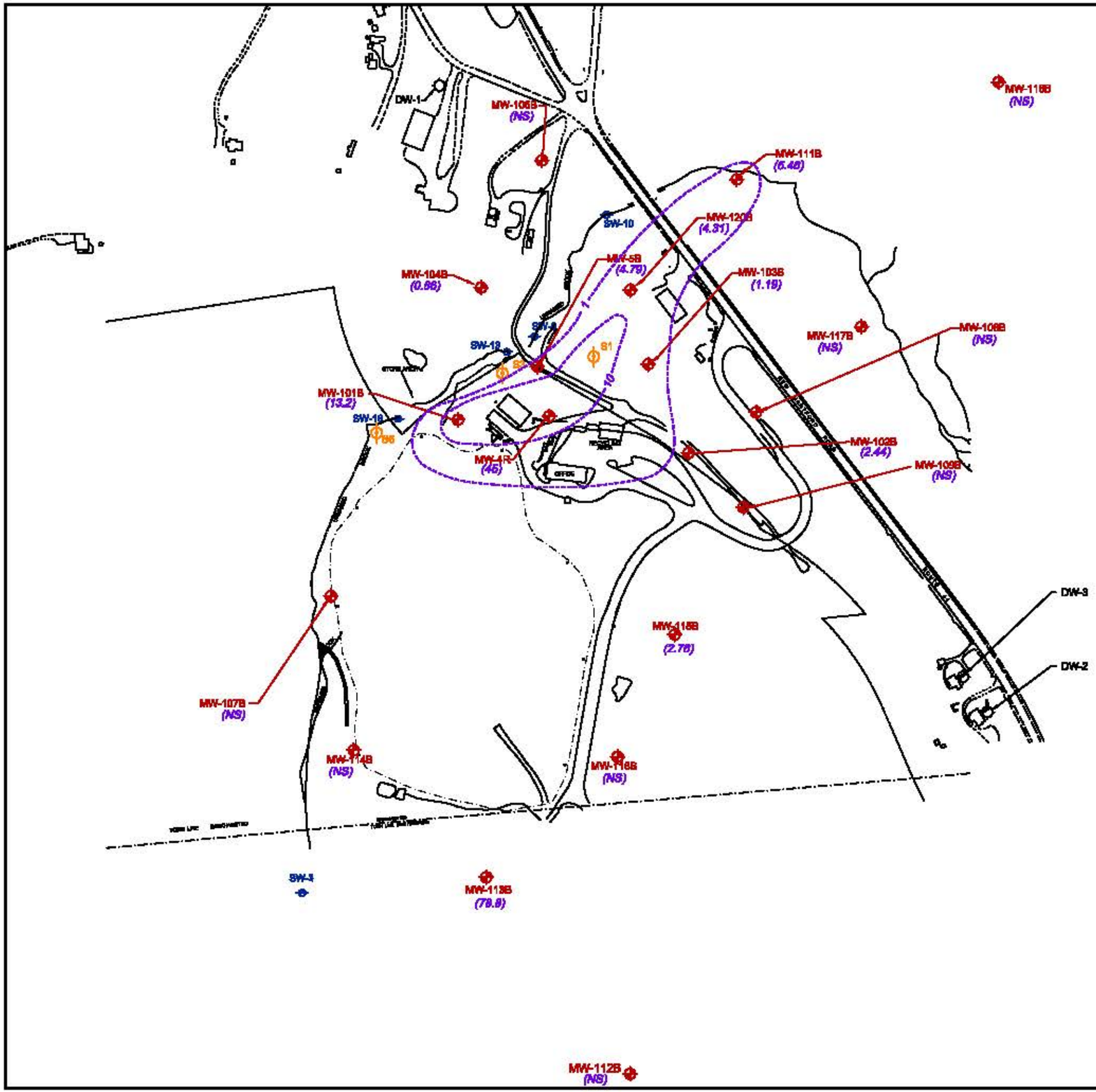
2. SOME DETECTIONS IN OUTLYING LOCATIONS MAY BE EXCLUDED IN TOTAL VOC AND SVOC ISOCONCENTRATION CONTOURS, AS THEY WERE BELIEVED TO BE ANOMALIES IN LABORATORY DATA, MOSTLY ASSOCIATED WITH SVOCs.

BARKHAMSTED - NEW HARTFORD LANDFILL SUPERFUND SITE

OVERBURDEN TOTAL VOCS AND SVOCS CONCENTRATION MAP APRIL 2011

FIGURE **5A**


LEGEND:
S1 SEEP LOCATIONS
SW-3 SURFACE WATER / SEDIMENT LOCATION
DW-1 PRIVATE WELL SAMPLE LOCATION
MW-5S MONITORING WELL LOCATION OVERBURDEN
10 TOTAL BTEX ISOCONCENTRATIONS IN (ug/L)
(2.4) TOTAL BTEX CONCENTRATIONS IN (ug/L)
(ND) NOT DETECTED
(NS) NOT SAMPLED
NOTES:
1. BASE MAP FROM: O'BRIEN & GERE ENGINEERS, INC., 2001 a.
0 300' 600'
GRAPHIC SCALE
BARKHAMSTED - NEW HARTFORD LANDFILL SUPERFUND SITE
OVERBURDEN TOTAL BTEX CONCENTRATION MAP APRIL 2011
FIGURE 6A
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
DW-1
MW-105S (NS)
MW-118S (NS)
MW-111S (ND)
MW-120S (ND)
SW-10
MW-5S (0.99)
MW-104S (ND)
MW-103S (ND)
MW-4S (2.2)
S1
MW-117S (NS)
MW-106S (NS)
SW-1
SW-13
MW-101S (130)
SW-15
MW-108S (ND)
MW-102S (ND)
MW-1S (130.9)
10
100
1
S-1 (0.44)
DW-3
MW-116S (ND)
DW-2
MW-107S (NS)
MW-114S (NS)
MW-115S (NS)
SW-3
MW-113S (ND)
MW-112S (ND)



LEGEND:

- S1 SEEP LOCATIONS
- SW-3 SURFACE WATER / SEDIMENT LOCATION
- DW-1 PRIVATE WELL SAMPLE LOCATION
- MW-5B MONITORING WELL LOCATION OVERBURDEN
- --- 10 ------ TOTAL VOC/SVOC ISOCONCENTRATIONS IN (ug/L)
- (2.44) TOTAL VOC/SVOC CONCENTRATIONS IN (ug/L)
- (ND) NOT DETECTED
- (NS) NOT SAMPLED

NOTES:

1. BASE MAP FROM: O'BRIEN & GERE ENGINEERS, INC., 2001 a.

2. SOME DETECTIONS IN OUTLYING LOCATIONS MAY BE EXCLUDED IN TOTAL VOC AND SVOC ISOCONCENTRATION CONTOURS, AS THEY WERE BELIEVED TO BE ANOMALIES IN LABORATORY DATA, MOSTLY ASSOCIATED WITH SVOCs.

0 300' 600'

GRAPHIC SCALE

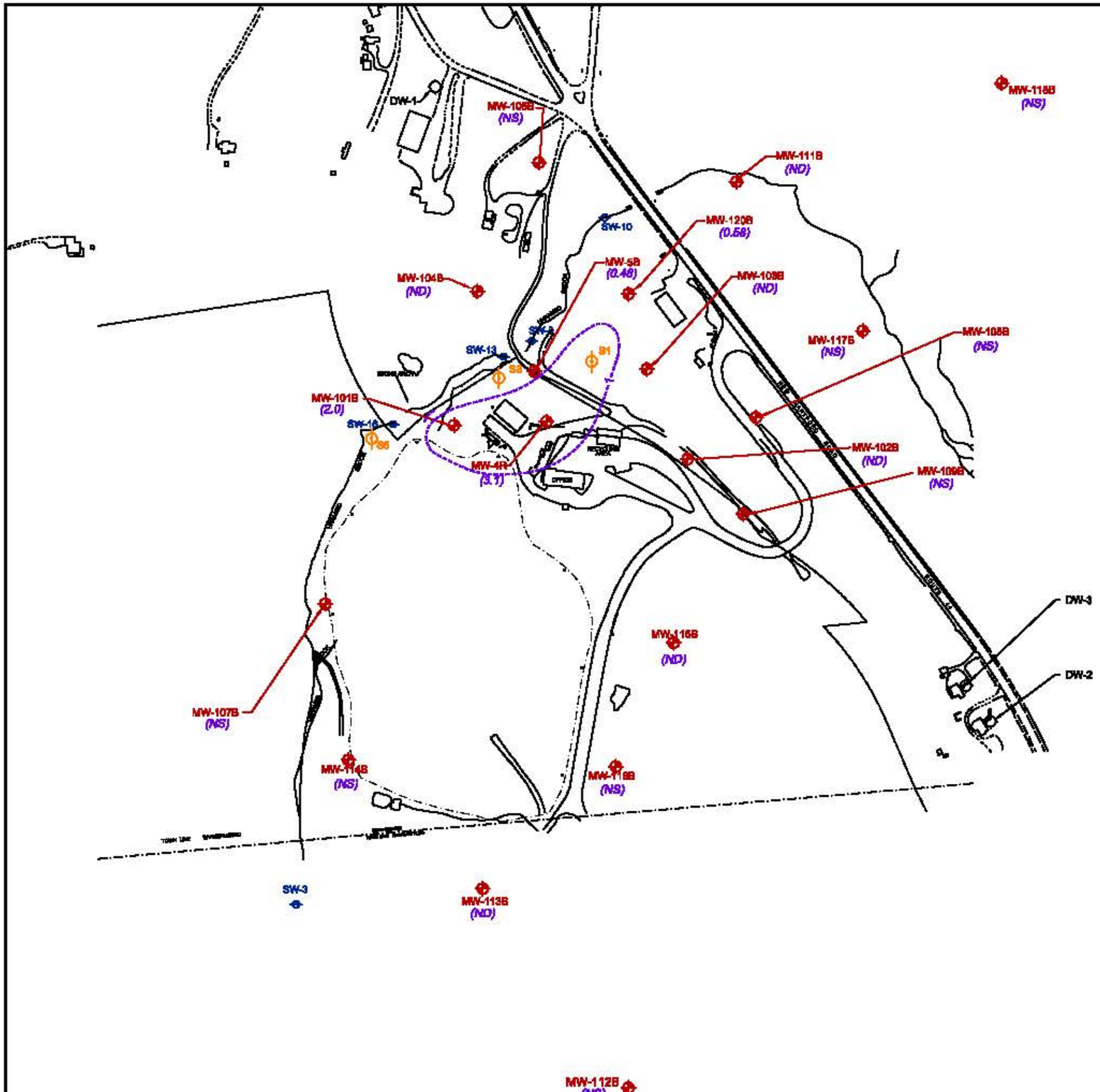
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

BARKHAMSTED - NEW HARTFORD LANDFILL SUPERFUND SITE

SHALLOW BEDROCK TOTAL VOCS AND SVOCS CONCENTRATION MAP APRIL 2011

FIGURE

7A



LEGEND:

- S1 SEEP LOCATIONS
- SW-3 SURFACE WATER / SEDIMENT LOCATION
- DW-1 PRIVATE WELL SAMPLE LOCATION
- MW-5B MONITORING WELL LOCATION OVERBURDEN
- 1 TOTAL BTEX ISOCONCENTRATIONS IN (ug/L)
- (0.68) TOTAL BTEX CONCENTRATIONS IN (ug/L)
- (ND) NOT DETECTED
- (NS) NOT SAMPLED

NOTES:

1. BASE MAP FROM: O'BRIEN & GERE ENGINEERS, INC., 2001 a.

0 300' 600'

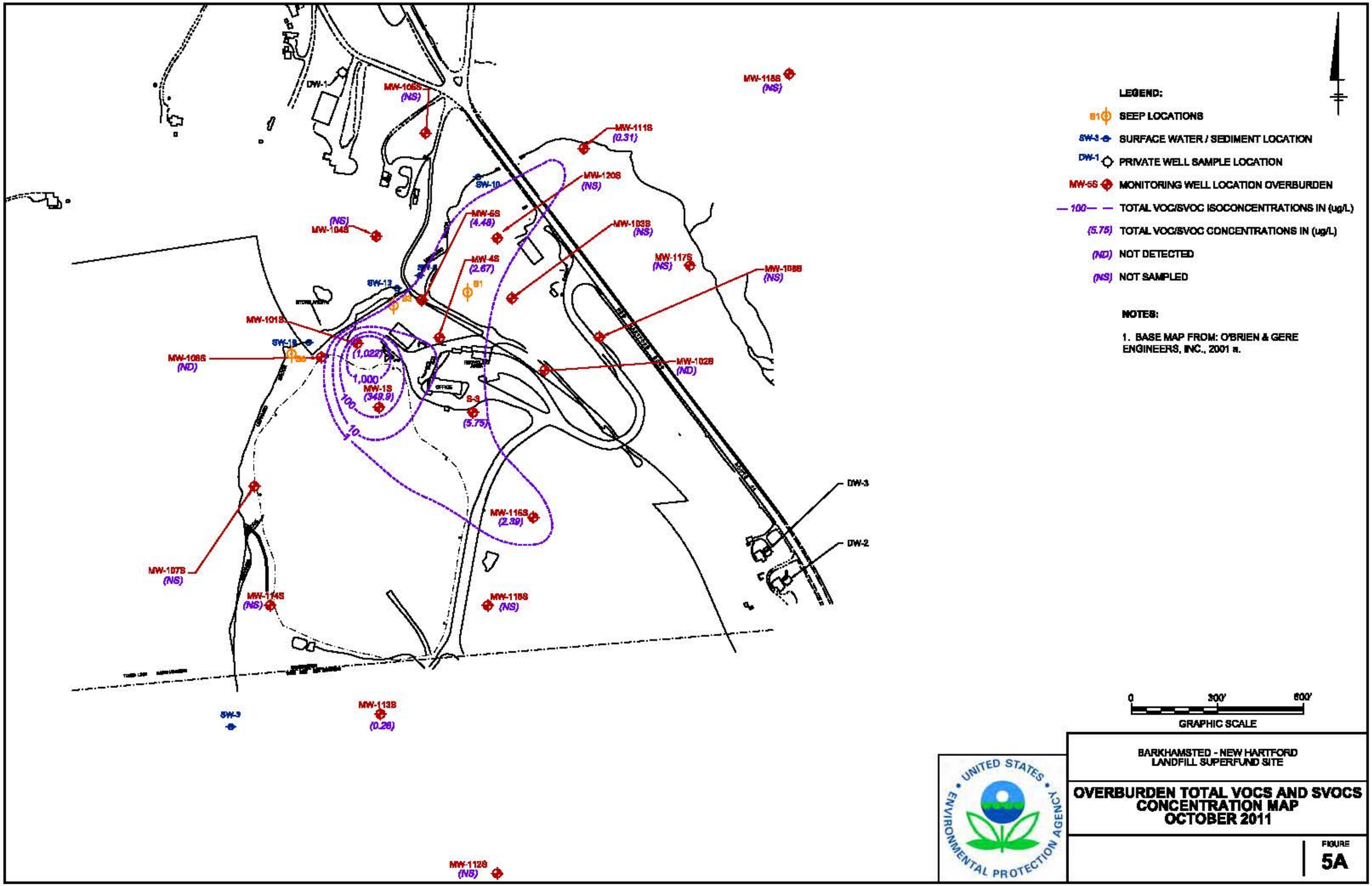
GRAPHIC SCALE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

BARKHAMSTED - NEW HARTFORD LANDFILL SUPERFUND SITE

SHALLOW BEDROCK TOTAL BTEX CONCENTRATION MAP APRIL 2011

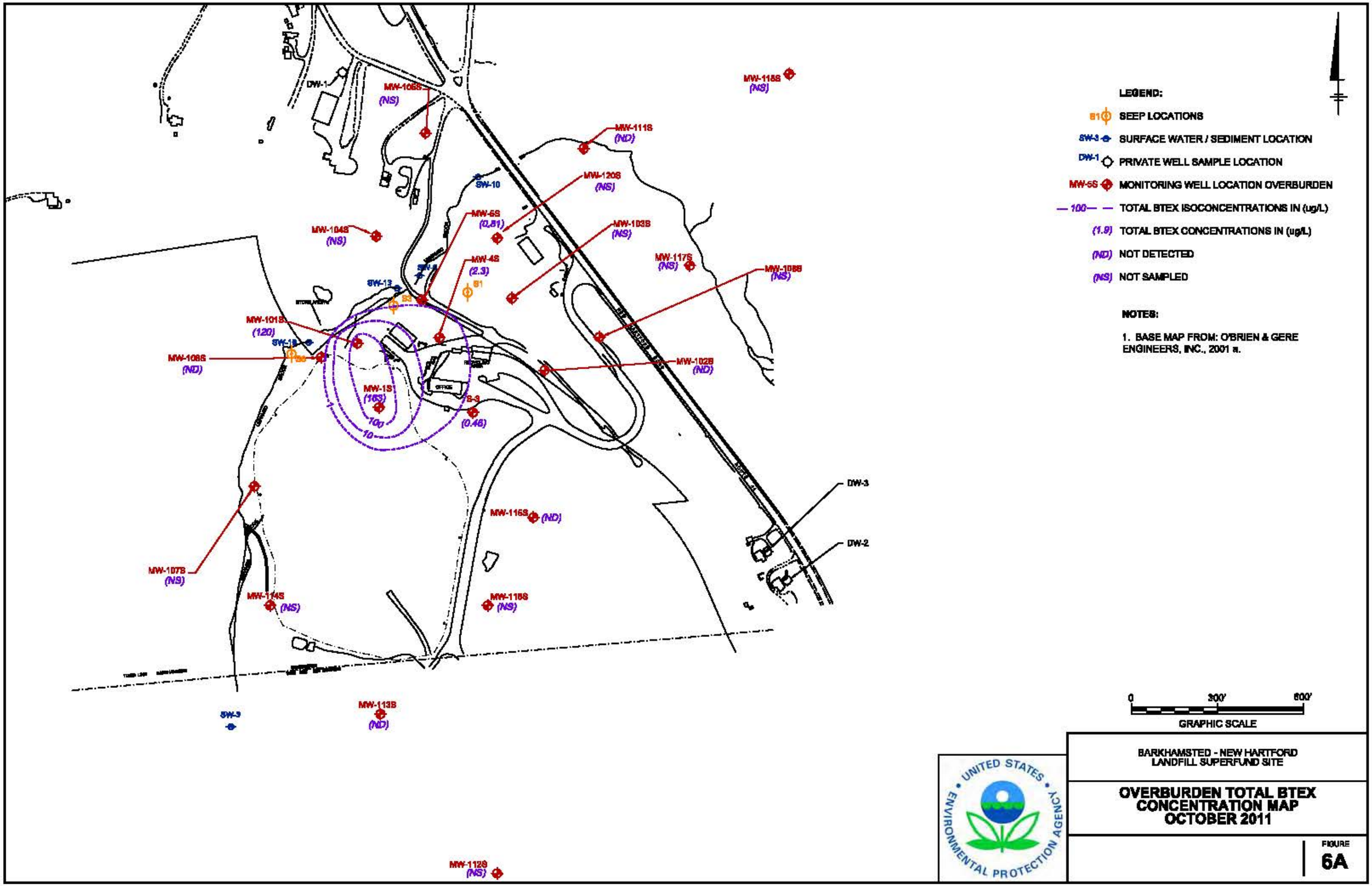
FIGURE **8A**



BARKHAMSTED - NEW HARTFORD LANDFILL SUPERFUND SITE

OVERBURDEN TOTAL VOCS AND SVOCS CONCENTRATION MAP OCTOBER 2011

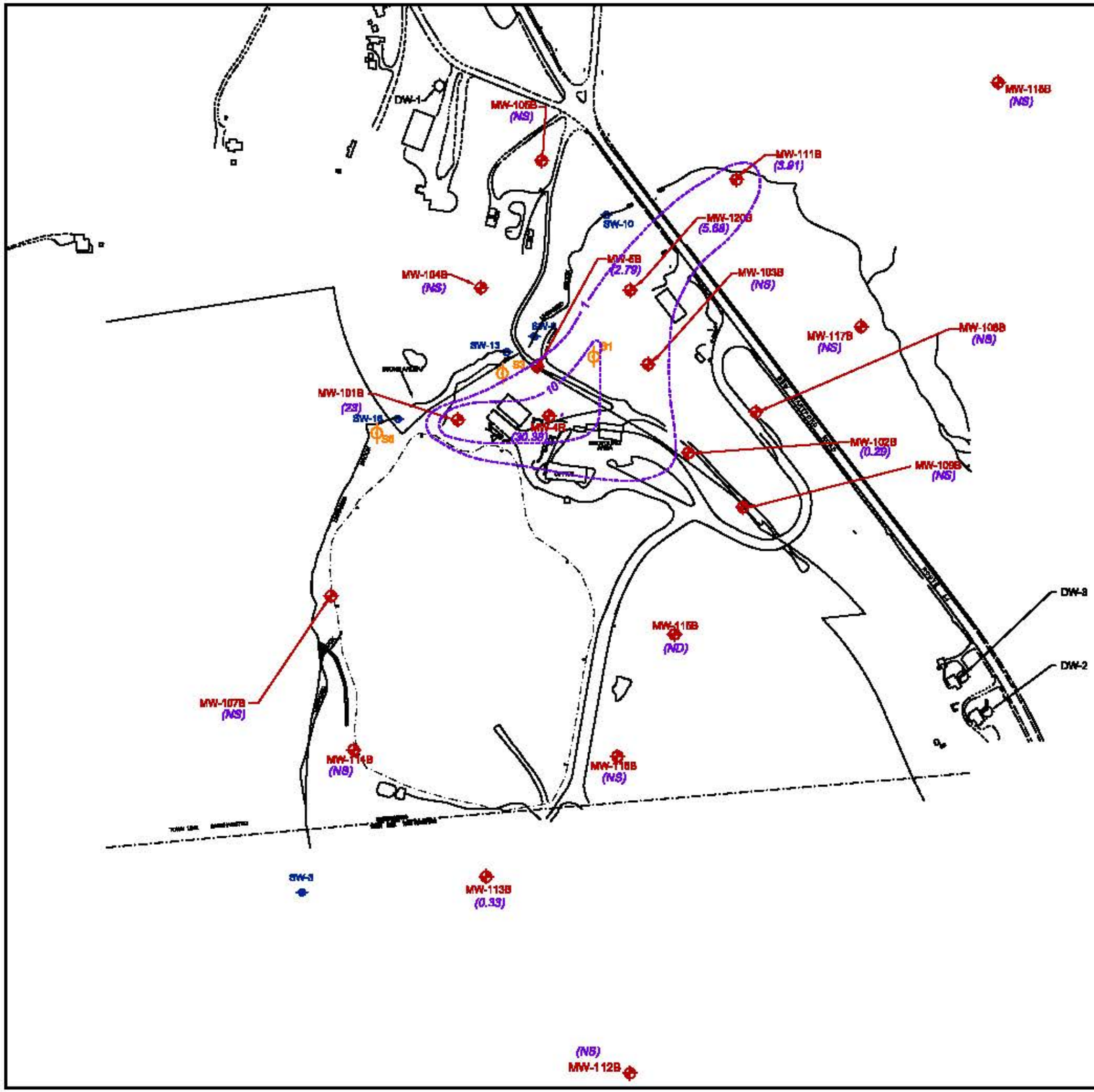
FIGURE **5A**



BARKHAMSTED - NEW HARTFORD LANDFILL SUPERFUND SITE

OVERBURDEN TOTAL BTEX CONCENTRATION MAP OCTOBER 2011

FIGURE **6A**



LEGEND:

- S1 — SEEP LOCATIONS
- SW-3 — SURFACE WATER / SEDIMENT LOCATION
- DW-1 — PRIVATE WELL SAMPLE LOCATION
- MW-5S — MONITORING WELL LOCATION OVERBURDEN
- 10 — TOTAL VOC/SVOC ISOCONCENTRATIONS IN (ug/L)
- (3.1) — TOTAL VOC/SVOC CONCENTRATIONS IN (ug/L)
- (ND) — NOT DETECTED
- (NS) — NOT SAMPLED

NOTES:

1. BASE MAP FROM: O'BRIEN & GERE ENGINEERS, INC., 2001 a.

2. SOME DETECTIONS IN OUTLYING LOCATIONS MAY BE EXCLUDED IN TOTAL VOC AND SVOC ISOCONCENTRATION CONTOURS, AS THEY WERE BELIEVED TO BE ANOMALIES IN LABORATORY DATA, MOSTLY ASSOCIATED WITH SVOCs.

0 300' 600'

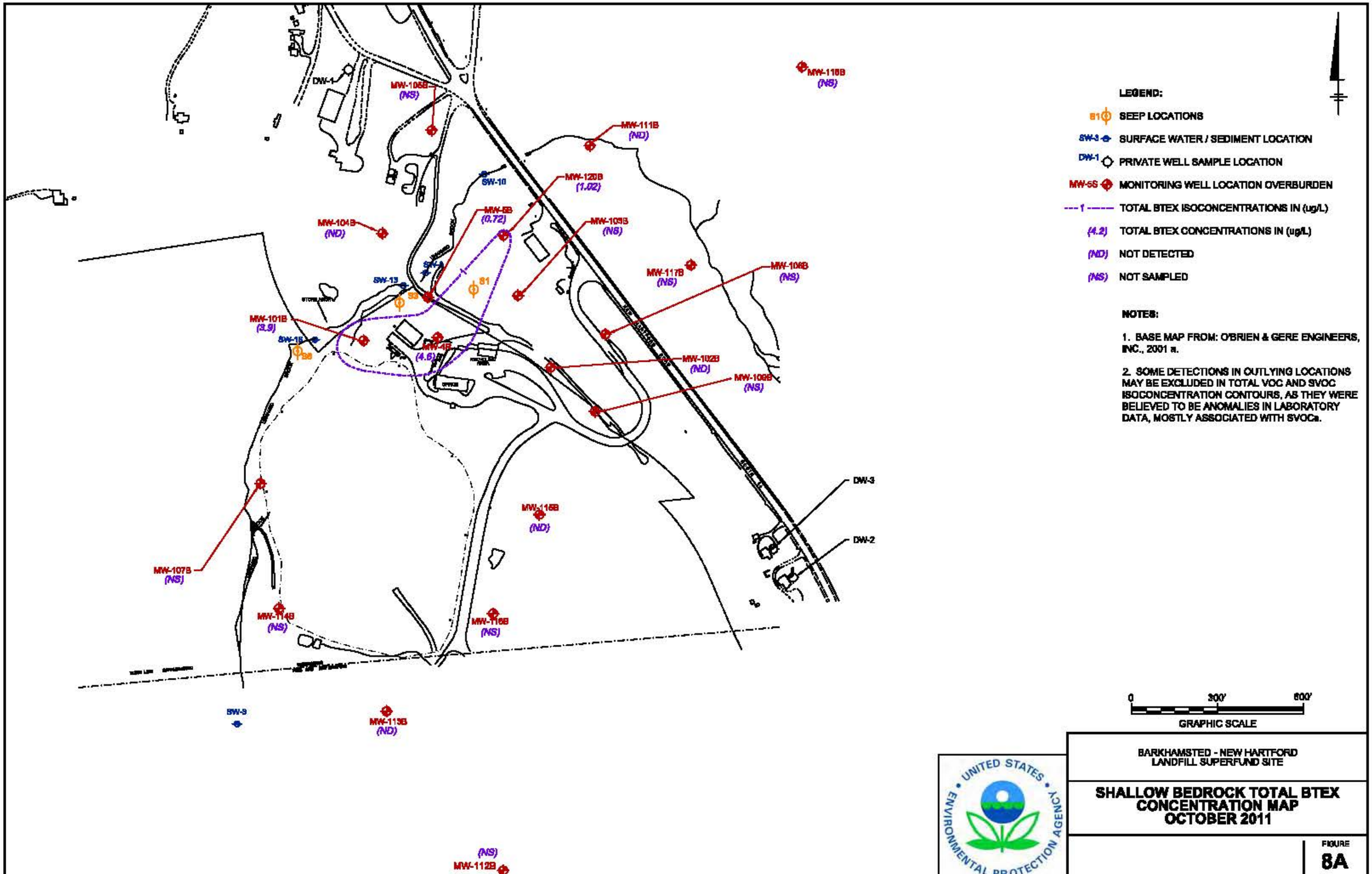
GRAPHIC SCALE

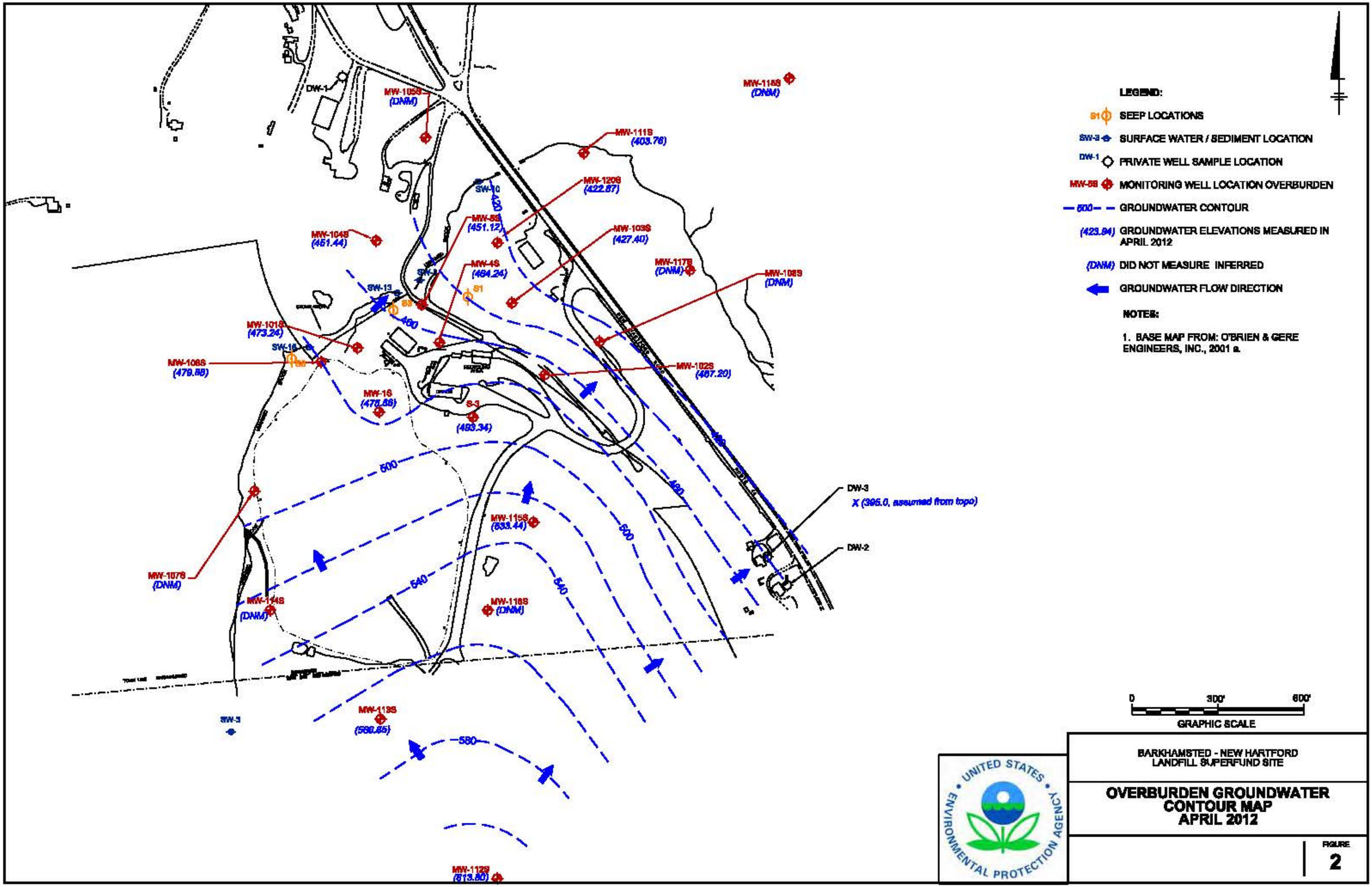
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

BARKHAMSTED - NEW HARTFORD LANDFILL SUPERFUND SITE

SHALLOW BEDROCK TOTAL VOCS AND SVOCS CONCENTRATION MAP OCTOBER 2011

FIGURE **7A**

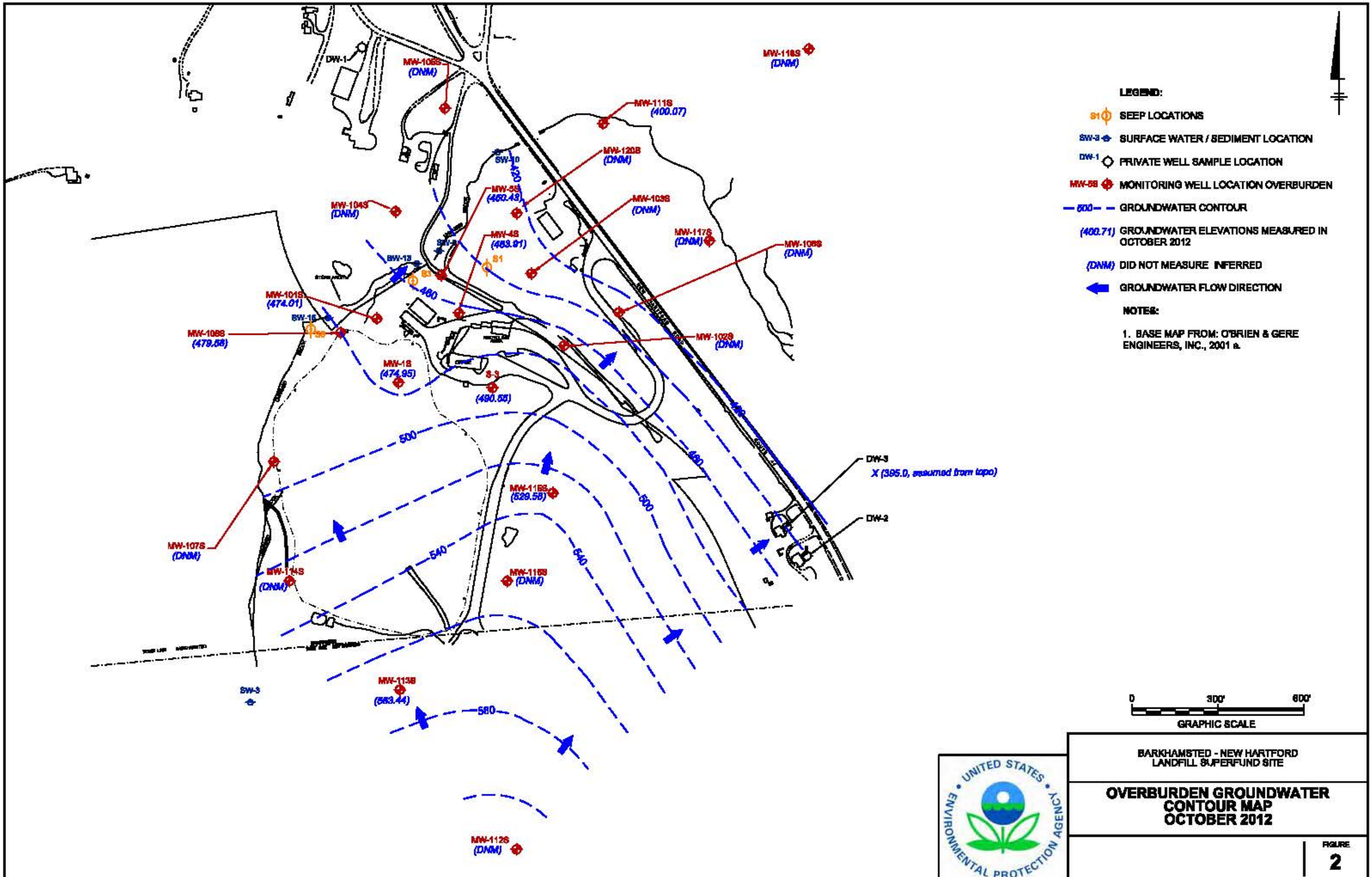

LEGEND:
SEEP LOCATIONS
SURFACE WATER / SEDIMENT LOCATION
PRIVATE WELL SAMPLE LOCATION
MONITORING WELL LOCATION OVERBURDEN
TOTAL BTEX ISOCONCENTRATIONS IN (ug/L)
(4.2) TOTAL BTEX CONCENTRATIONS IN (ug/L)
(ND) NOT DETECTED
(NS) NOT SAMPLED
NOTES:
1. BASE MAP FROM: O'BRIEN & GERE ENGINEERS, INC., 2001 a.
2. SOME DETECTIONS IN OUTLYING LOCATIONS MAY BE EXCLUDED IN TOTAL VOC AND SVOC ISOCONCENTRATION CONTOURS, AS THEY WERE BELIEVED TO BE ANOMALIES IN LABORATORY DATA, MOSTLY ASSOCIATED WITH SVOCs.
0
300'
600'
GRAPHIC SCALE
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
BARKHAMSTED - NEW HARTFORD LANDFILL SUPERFUND SITE
SHALLOW BEDROCK TOTAL BTEX CONCENTRATION MAP OCTOBER 2011
FIGURE
8A
DW-1
DW-2
DW-3
MW-105B (NS)
MW-116B (NS)
MW-111B (ND)
MW-120B (1.02)
MW-6B (0.72)
MW-109B (NS)
MW-104B (ND)
MW-117B (NS)
MW-108B (NS)
MW-101B (3.9)
MW-4B (4.6)
MW-102B (ND)
MW-106B (NS)
MW-115B (ND)
MW-107B (NS)
MW-114B (NS)
MW-116B (NS)
MW-113B (ND)
MW-112B (NS)
SW-10
SW-13
SW-15
SW-9
S1
S2
S3



BARKHAMSTED - NEW HARTFORD LANDFILL SUPERFUND SITE

OVERBURDEN GROUNDWATER CONTOUR MAP APRIL 2012

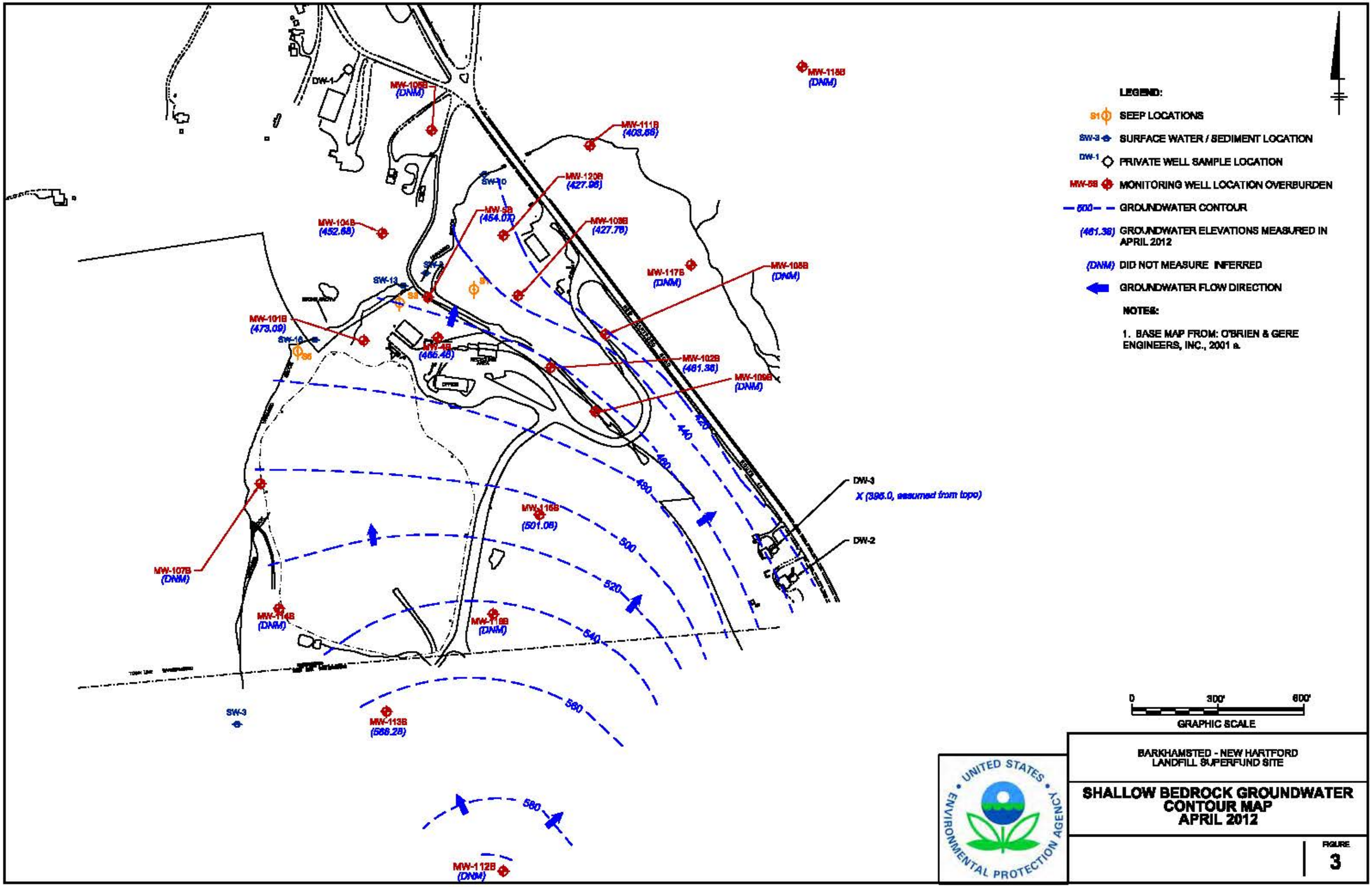
FIGURE 2



BARKHAMSTED - NEW HARTFORD LANDFILL SUPERFUND SITE

OVERBURDEN GROUNDWATER CONTOUR MAP OCTOBER 2012

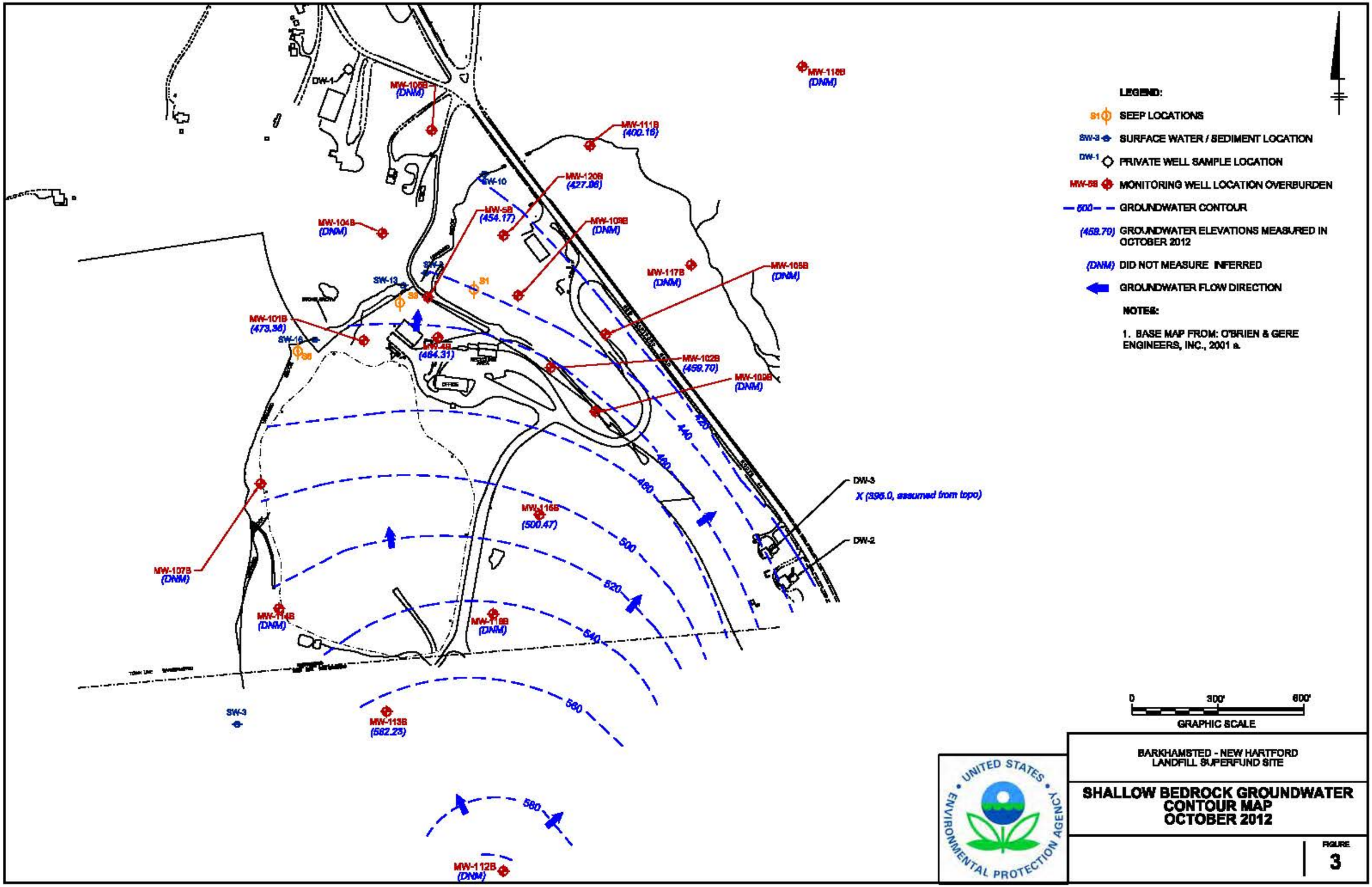
FIGURE 2

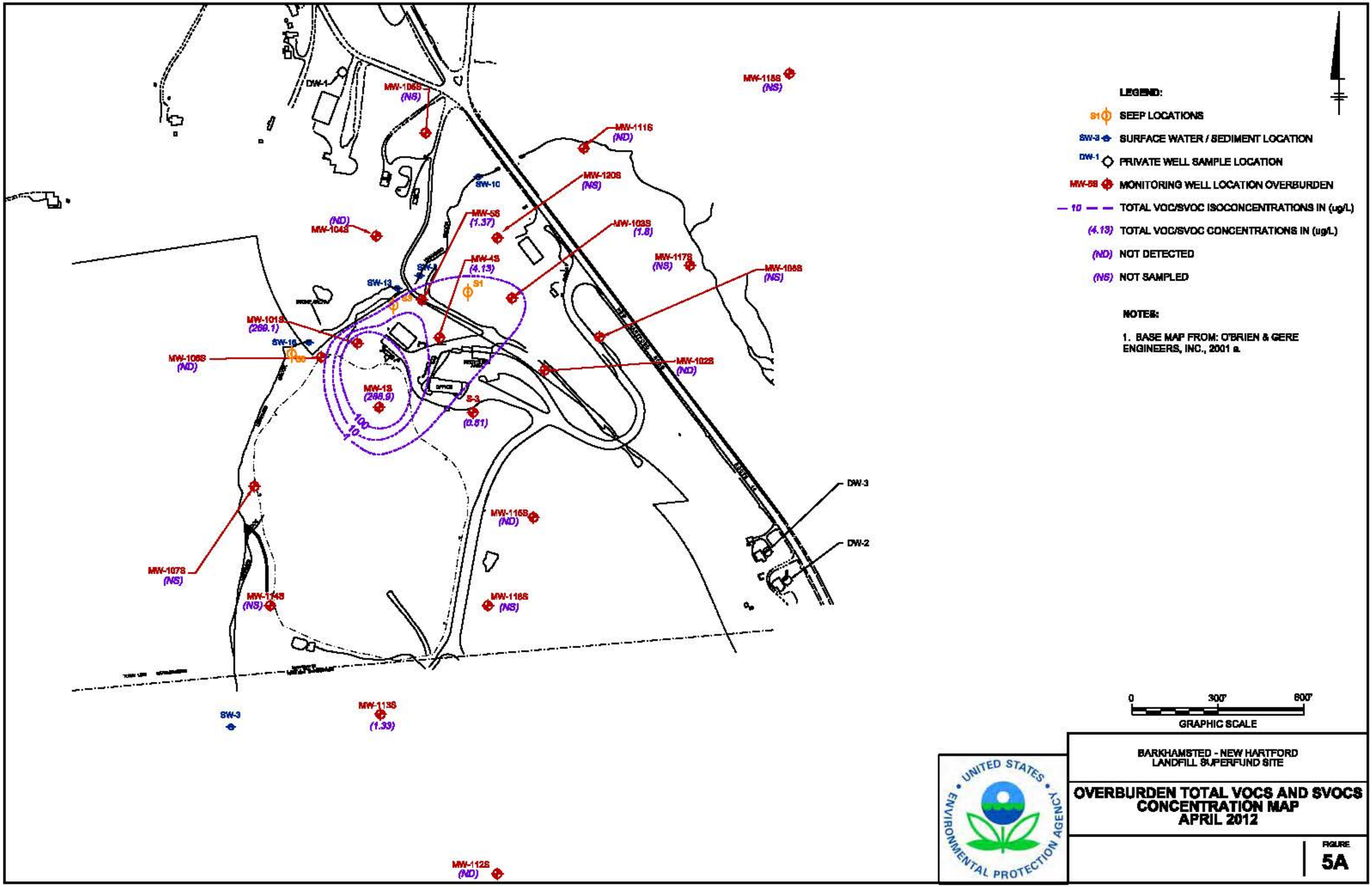


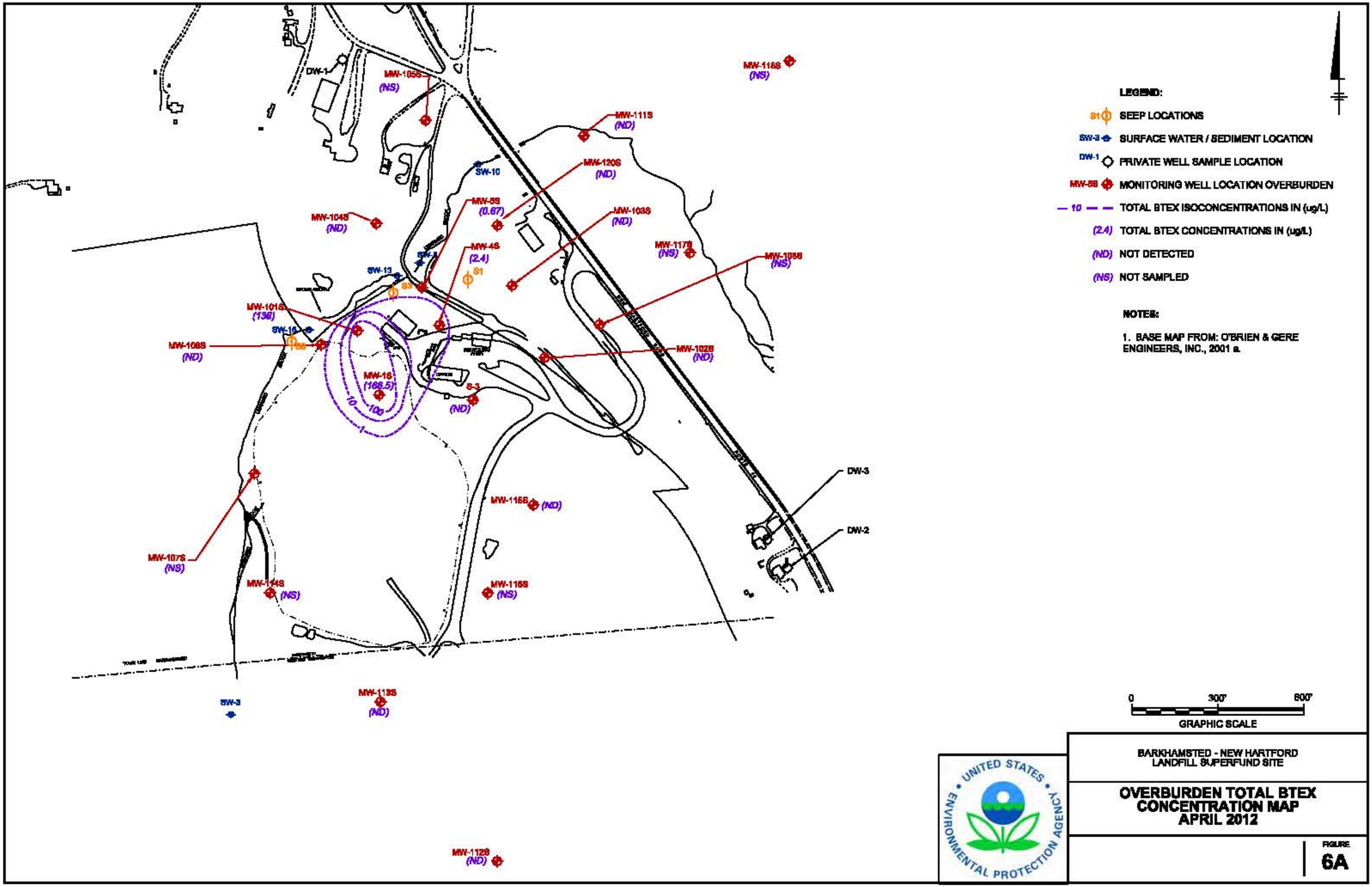
BARKHAMSTED - NEW HARTFORD LANDFILL SUPERFUND SITE

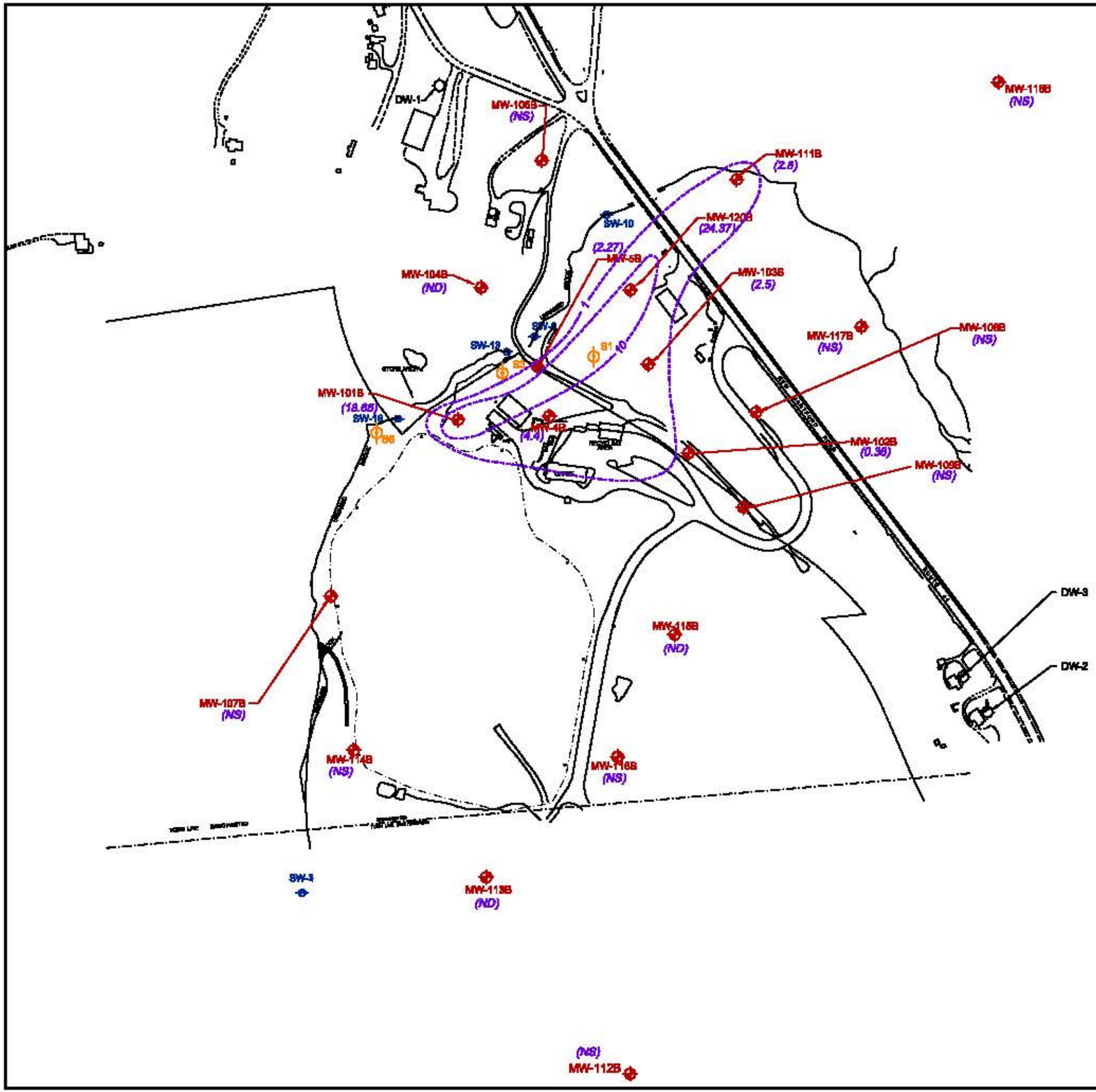
SHALLOW BEDROCK GROUNDWATER CONTOUR MAP APRIL 2012

FIGURE 3


LEGEND:
S1 SEEP LOCATIONS
SW-3 SURFACE WATER / SEDIMENT LOCATION
DW-1 PRIVATE WELL SAMPLE LOCATION
MW-5B MONITORING WELL LOCATION OVERBURDEN
500 GROUNDWATER CONTOUR
(459.70) GROUNDWATER ELEVATIONS MEASURED IN OCTOBER 2012
(DNM) DID NOT MEASURE INFERRED
GROUNDWATER FLOW DIRECTION
NOTES:
1. BASE MAP FROM: O'BRIEN & GERE ENGINEERS, INC., 2001 a.
0 300' 600'
GRAPHIC SCALE
BARKHAMSTED - NEW HARTFORD LANDFILL SUPERFUND SITE
SHALLOW BEDROCK GROUNDWATER CONTOUR MAP OCTOBER 2012
FIGURE 3
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
DW-1
MW-105B (DNM)
MW-116B (DNM)
MW-111B (400.16)
MW-120B (427.86)
SW-10
MW-5B (454.17)
MW-109B (DNM)
MW-104B (DNM)
MW-117B (DNM)
MW-108B (DNM)
SW-9
SW-13
S1
S3
MW-101B (473.36)
SW-16
S6
MW-4B (464.31)
MW-102B (459.70)
MW-103B (DNM)
440
420
480
460
DW-3
X (395.0, assumed from topo)
DW-2
MW-116B (500.47)
500
MW-107B (DNM)
520
MW-114B (DNM)
MW-118B (DNM)
540
SW-3
MW-113B (582.23)
560
580
MW-112B (DNM)


LEGEND:
S1 SEEP LOCATIONS
SW-3 SURFACE WATER / SEDIMENT LOCATION
DW-1 PRIVATE WELL SAMPLE LOCATION
MW-5S MONITORING WELL LOCATION OVERBURDEN
10 TOTAL VOC/SVOC ISOCONCENTRATIONS IN (ug/L)
(4.13) TOTAL VOC/SVOC CONCENTRATIONS IN (ug/L)
(ND) NOT DETECTED
(NS) NOT SAMPLED
NOTES:
1. BASE MAP FROM: O'BRIEN & GERE ENGINEERS, INC., 2001 a.
0 300' 600'
GRAPHIC SCALE
BARKHAMSTED - NEW HARTFORD LANDFILL SUPERFUND SITE
OVERBURDEN TOTAL VOCS AND SVOCS CONCENTRATION MAP APRIL 2012
FIGURE 5A
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
DW-1
MW-105S (NS)
MW-115S (NS)
MW-111S (ND)
MW-120S (NS)
SW-10
MW-5S (1.37)
MW-103S (1.8)
MW-104S (ND)
MW-4S (4.13)
MW-117S (NS)
MW-108S (NS)
SW-9
SW-13
S1
S3
MW-101S (269.1)
SW-16
MW-106S (ND)
MW-102S (ND)
MW-1S (268.9)
S-3 (0.61)
100
10
1
DW-3
DW-2
MW-116S (ND)
MW-107S (NS)
MW-114S (NS)
MW-118S (NS)
SW-3
MW-113S (1.33)
MW-112S (ND)


LEGEND:
S1 SEEP LOCATIONS
SW-3 SURFACE WATER / SEDIMENT LOCATION
DW-1 PRIVATE WELL SAMPLE LOCATION
MW-5S MONITORING WELL LOCATION OVERBURDEN
10 TOTAL BTEX ISOCONCENTRATIONS IN (ug/L)
(2.4) TOTAL BTEX CONCENTRATIONS IN (ug/L)
(ND) NOT DETECTED
(NS) NOT SAMPLED
NOTES:
1. BASE MAP FROM: O'BRIEN & GERE ENGINEERS, INC., 2001 a.
0 300' 600'
GRAPHIC SCALE
BARKHAMSTED - NEW HARTFORD LANDFILL SUPERFUND SITE
OVERBURDEN TOTAL BTEX CONCENTRATION MAP APRIL 2012
FIGURE 6A
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
DW-1
MW-105S (NS)
MW-118S (NS)
MW-111S (ND)
MW-120S (ND)
SW-10
MW-5S (0.67)
MW-104S (ND)
MW-103S (ND)
MW-117S (NS)
MW-108S (NS)
MW-4S (2.4)
S1
SW-1
SW-13
S4
MW-101S (136)
SW-15
MW-109S (ND)
S5
MW-102S (ND)
MW-1S (166.5)
10
100
1
S-1 (ND)
DW-3
MW-115S (ND)
DW-2
MW-107S (NS)
MW-114S (NS)
MW-116S (NS)
SW-3
MW-113S (ND)
MW-112S (ND)



LEGEND:

- S1 — SEEP LOCATIONS
- SW-3 — SURFACE WATER / SEDIMENT LOCATION
- DW-1 — PRIVATE WELL SAMPLE LOCATION
- MW-5B — MONITORING WELL LOCATION OVERBURDEN
- --- 10 ------ TOTAL VOC/SVOC ISOCONCENTRATIONS IN (ug/L)
- (2.5) TOTAL VOC/SVOC CONCENTRATIONS IN (ug/L)
- (ND) NOT DETECTED
- (NS) NOT SAMPLED

NOTES:

1. BASE MAP FROM: O'BRIEN & GERE ENGINEERS, INC., 2001 a.

2. SOME DETECTIONS IN OUTLYING LOCATIONS MAY BE EXCLUDED IN TOTAL VOC AND SVOC ISOCONCENTRATION CONTOURS, AS THEY WERE BELIEVED TO BE ANOMALIES IN LABORATORY DATA, MOSTLY ASSOCIATED WITH SVOCs.

0 300' 600'

GRAPHIC SCALE

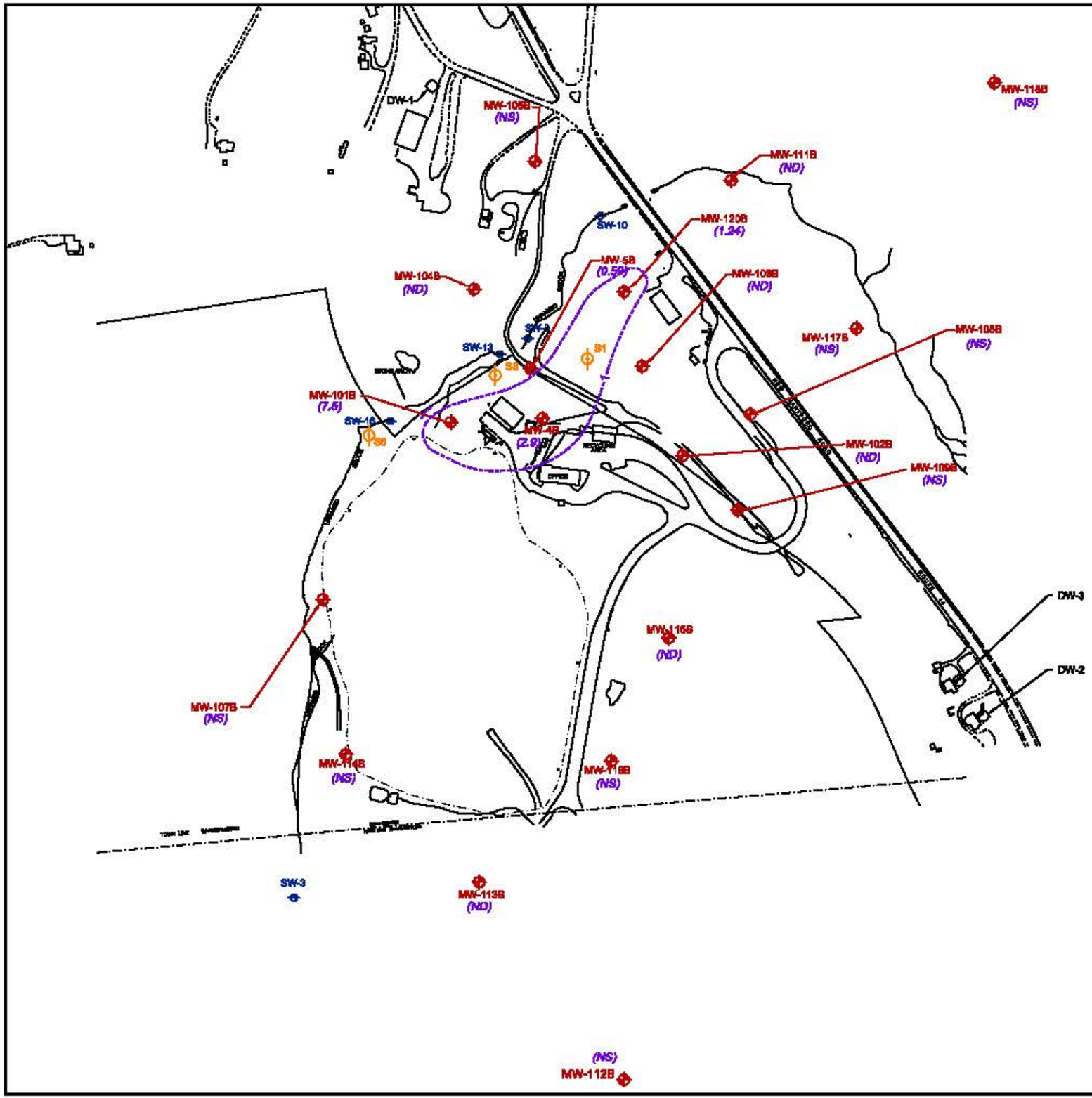
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

BARKHAMSTED - NEW HARTFORD LANDFILL SUPERFUND SITE

SHALLOW BEDROCK TOTAL SVOCS AND VOCS CONCENTRATION MAP APRIL 2012

FIGURE

7A



LEGEND:

- S1 SEEP LOCATIONS
- SW-3 SURFACE WATER / SEDIMENT LOCATION
- DW-1 PRIVATE WELL SAMPLE LOCATION
- MW-5B MONITORING WELL LOCATION OVERBURDEN
- 1 TOTAL BTEX ISOCONCENTRATIONS IN (ug/L)
- (8.6) TOTAL BTEX CONCENTRATIONS IN (ug/L)
- (ND) NOT DETECTED
- (NS) NOT SAMPLED

NOTES:

1. BASE MAP FROM: O'BRIEN & GERE ENGINEERS, INC., 2001 a.

2. SOME DETECTIONS IN OUTLYING LOCATIONS MAY BE EXCLUDED IN TOTAL VOC AND SVOC ISOCONCENTRATION CONTOURS, AS THEY WERE BELIEVED TO BE ANOMALIES IN LABORATORY DATA, MOSTLY ASSOCIATED WITH SVOCs.

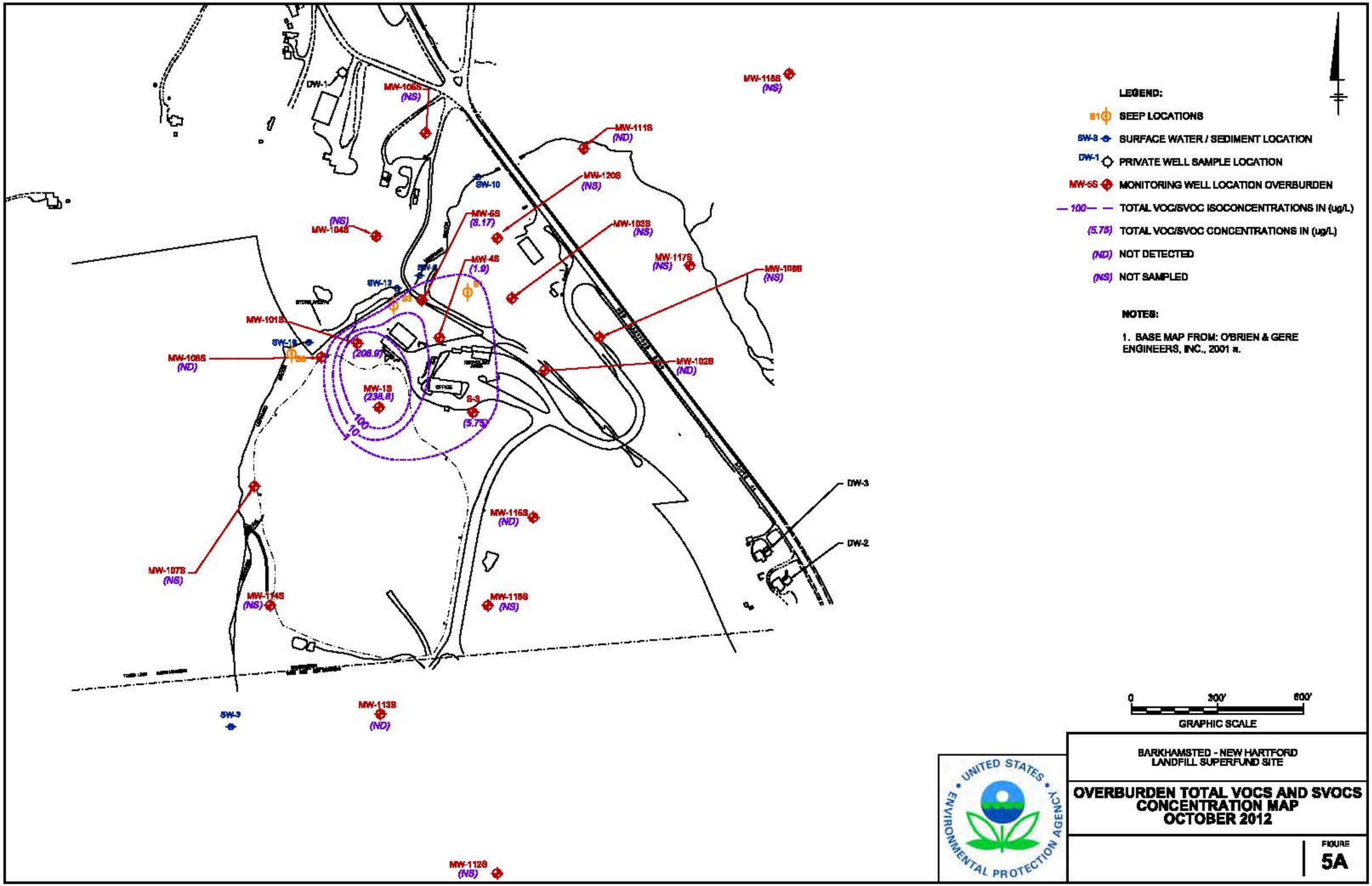
0 300' 600'
GRAPHIC SCALE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

BARKHAMSTED - NEW HARTFORD LANDFILL SUPERFUND SITE

SHALLOW BEDROCK TOTAL BTEX CONCENTRATION MAP APRIL 2012

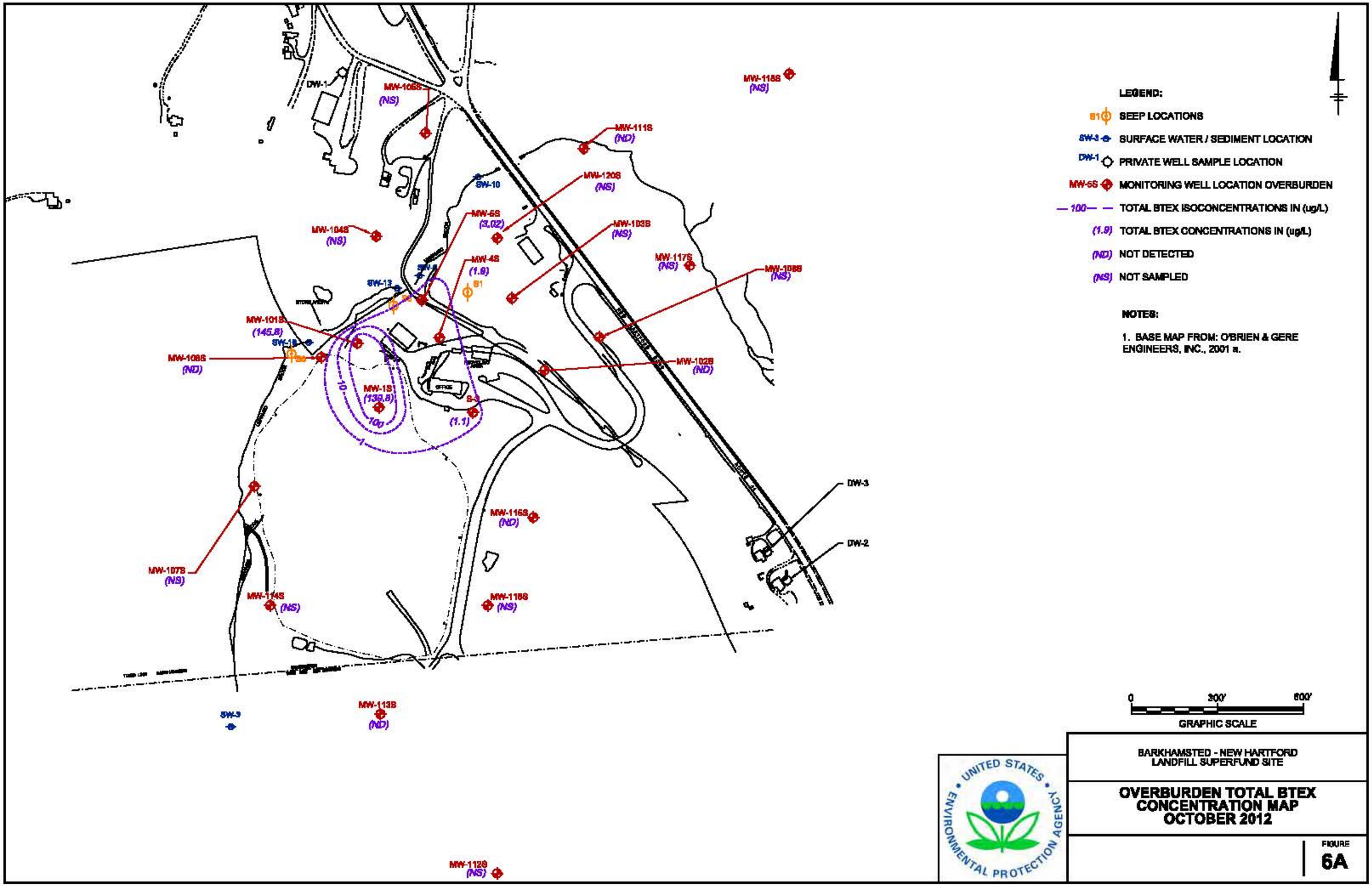
FIGURE 8A



BARKHAMSTED - NEW HARTFORD LANDFILL SUPERFUND SITE

OVERBURDEN TOTAL VOCS AND SVOCS CONCENTRATION MAP OCTOBER 2012

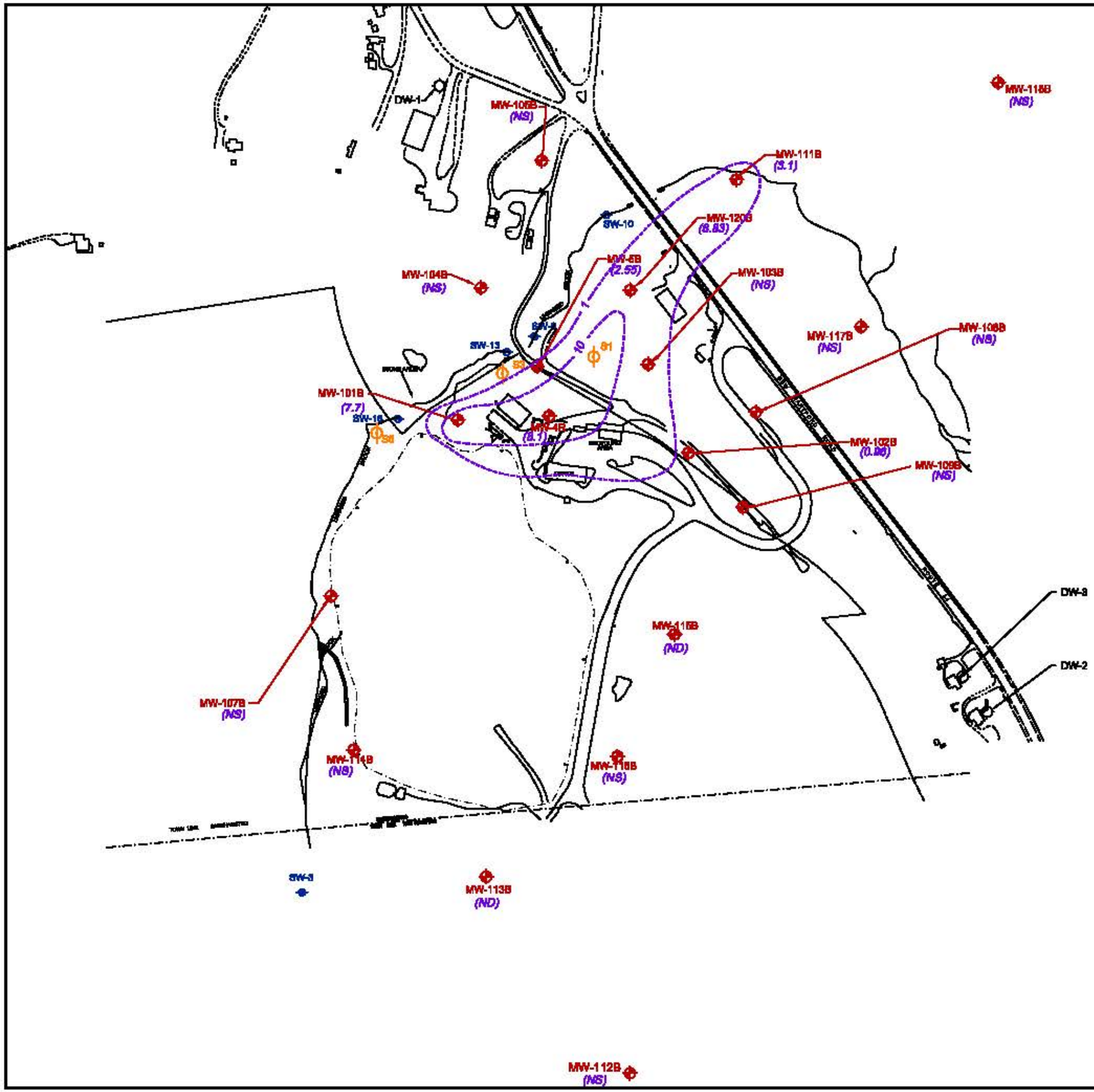
FIGURE **5A**



BARKHAMSTED - NEW HARTFORD LANDFILL SUPERFUND SITE

OVERBURDEN TOTAL BTEX CONCENTRATION MAP OCTOBER 2012

FIGURE **6A**



LEGEND:

- S1 SEEP LOCATIONS
- SW-3 SURFACE WATER / SEDIMENT LOCATION
- DW-1 PRIVATE WELL SAMPLE LOCATION
- MW-5S MONITORING WELL LOCATION OVERBURDEN
- 10 TOTAL VOC/SVOC ISOCONCENTRATIONS IN (ug/L)
- (3.1) TOTAL VOC/SVOC CONCENTRATIONS IN (ug/L)
- (ND) NOT DETECTED
- (NS) NOT SAMPLED

NOTES:

1. BASE MAP FROM: O'BRIEN & GERE ENGINEERS, INC., 2001 a.

2. SOME DETECTIONS IN OUTLYING LOCATIONS MAY BE EXCLUDED IN TOTAL VOC AND SVOC ISOCONCENTRATION CONTOURS, AS THEY WERE BELIEVED TO BE ANOMALIES IN LABORATORY DATA, MOSTLY ASSOCIATED WITH SVOCs.

0 300' 600'

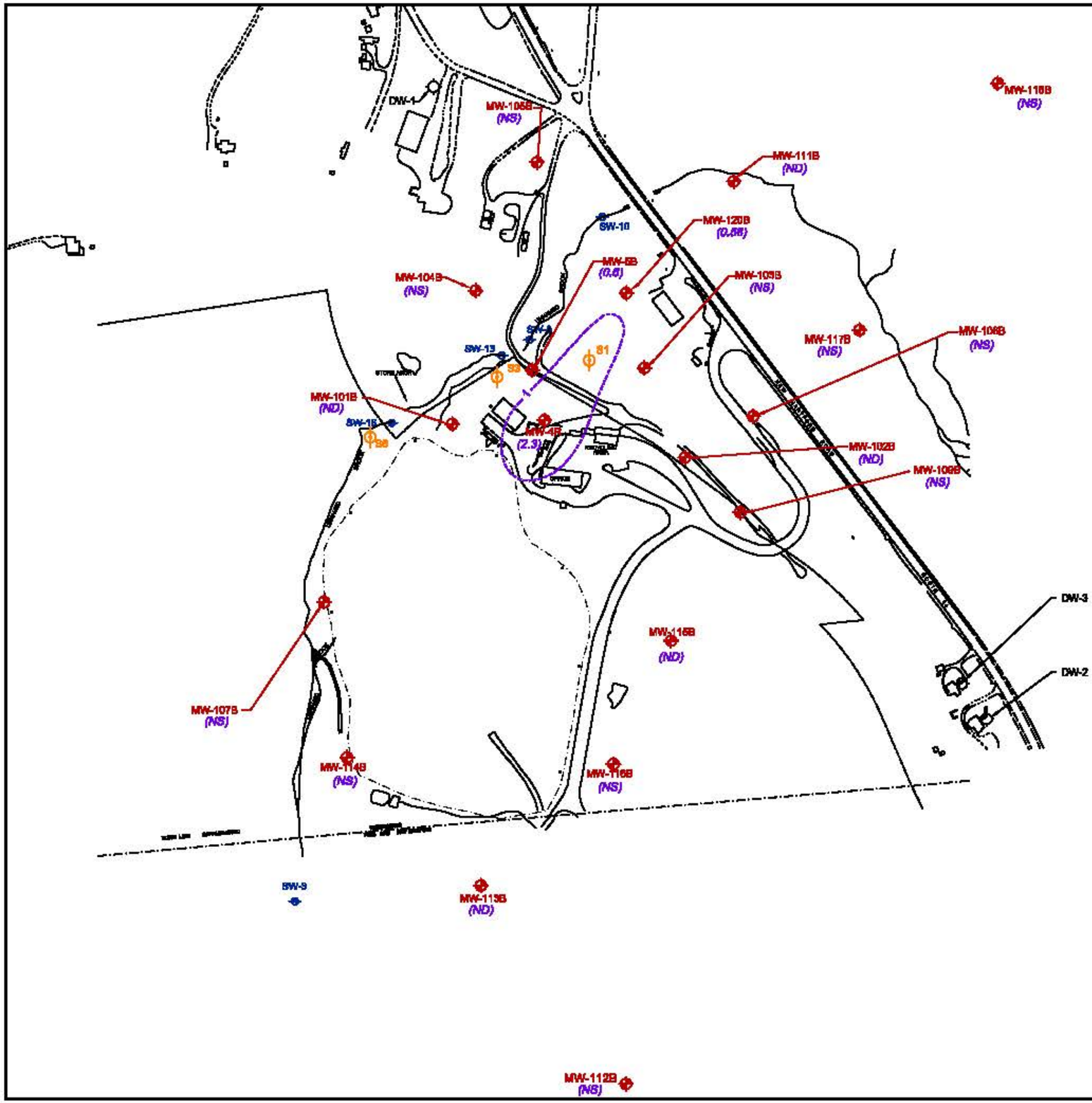
GRAPHIC SCALE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

BARKHAMSTED - NEW HARTFORD LANDFILL SUPERFUND SITE

SHALLOW BEDROCK TOTAL VOCS AND SVOCS CONCENTRATION MAP OCTOBER 2012

FIGURE **7A**



LEGEND:

- S1 SEEP LOCATIONS
- SW-3 SURFACE WATER / SEDIMENT LOCATION
- DW-1 PRIVATE WELL SAMPLE LOCATION
- MW-5S MONITORING WELL LOCATION OVERBURDEN
- ---1------ TOTAL BTEX ISOCONCENTRATIONS IN (ug/L)
- (4.2) TOTAL BTEX CONCENTRATIONS IN (ug/L)
- (ND) NOT DETECTED
- (NS) NOT SAMPLED

NOTES:

1. BASE MAP FROM: O'BRIEN & GERE ENGINEERS, INC., 2001 a.

2. SOME DETECTIONS IN OUTLYING LOCATIONS MAY BE EXCLUDED IN TOTAL VOC AND SVOC ISOCONCENTRATION CONTOURS, AS THEY WERE BELIEVED TO BE ANOMALIES IN LABORATORY DATA, MOSTLY ASSOCIATED WITH SVOCs.

0 300' 600'

GRAPHIC SCALE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

BARKHAMSTED - NEW HARTFORD LANDFILL SUPERFUND SITE

SHALLOW BEDROCK TOTAL BTEX CONCENTRATION MAP OCTOBER 2012

FIGURE **8A**

APPENDIX F

Five-Year Review Site Inspection Checklist

I. SITE INFORMATION	
Site Name: Barkhamsted Landfill	**Date of Inspection:** 4/18/13
Location and Region: Barkhamsted, CT	**EPA ID:** CTD980732333
Agency, office, or company leading the five-year review: EPA-Region I	Weather/temperature: Overcast / 59 F
Remedy Includes (Check all that apply)	
☒ Landfill cover/containment ☐ Access Controls ☒ Institutional Controls ☐ Groundwater pump and treatment ☐ Surface water collection and treatment	☒ Monitored Natural Attenuation ☐ Groundwater containment ☐ Vertical Barrier Walls ☐ Other
Attachments: ☐ Inspection team roster	☐ Site Map

II. INTERVIEWS (Check all that apply)

1. **O&M Site Manager**: Jim Hart General Manager
(Name) (Title) (Date)
Interviewed Jim Hart at site ☐ At office ☐ By phone Tel. No. _____
Problems, suggestions; ☐ Report attached

2. **O&M Site staff** :
(Name) (Title) (Date)

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply

Agency Town of Barkhamsted
Contact Donald Stein 1st Selectman 5/8/13 860-379-8285
(Name) (Title) (Date) (Phone No.)
Problems; suggestions; ☒ Report attached Interview Record Attached

Agency Connecticut Department of Energy and Environmental Protection
Contact Maurice Hamel Superv., Rem. Div. 860-424-3787
(Name) (Title) (Date) (Phone No.)
Problems; suggestions; ☒ Report attached Interview Record Attached

Agency
Contact
(Name) (Title) (Date) (Phone No.)
Problems; suggestions; ☐ Report attached

Agency
Contact _____
(Name) (Title) (Date) (Phone No.)
Problems; suggestions; ☐ Report attached

4. **Other Interviews** (optional) ☒ Report attached. Interview Records Attached

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)			
1. **O&M Documents**			
☒ O&M Manual	☒ Readily Available	☐ Up to Date	☐ N/A
☒ As-built drawings	☒ Readily Available	☐ Up to Date	☐ N/A
☐ Maintenance Logs	☐ Readily Available	☐ Up to Date	☐ N/A
Remarks:			
2. **Site-Specific Health and Safety Plan**	☒ Readily Available	☐ Up to Date	☐ N/A
Contingency Plan/Emergency Response Plan	☒ Readily Available	☐ Up to Date	☐ N/A
Remarks:			
3. **O&M and OSHA Training Records**	☐ Readily Available	☐ Up to Date	☒ N/A
Remarks:			
4. **Permits and Service Agreements**			
☐ Air Discharge Permit	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Effluent Discharge	☐ Readily Available	☐ Up to Date	☒ N/A
☒ Waste Disposal, POTW	☐ Readily Available	☒ Up to Date	☐ N/A
☐ Other permits	☐ Readily Available	☐ Up to Date	☒ N/A
Remarks:			
5. **Gas Generation Records**	☐ Readily Available	☐ Up to Date	☒ N/A
Remarks:			
6. **Settlement Monument Records**	☐ Readily Available	☐ Up to Date	☒ N/A
Remarks:			
7. **Groundwater Monitoring Records**	☒ Readily Available	☒ Up to Date	☐ N/A
Remarks:			
8. **Leachate Extraction Records**	☒ Readily Available	☒ Up to Date	☐ N/A
Remarks:			
9. **Discharge Compliance Records**	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Air	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Water (effluent)	☐ Readily Available	☐ Up to Date	☒ N/A
Remarks:			
10. **Daily Access/Security Logs**	☐ Readily Available	☐ Up to Date	☒ N/A
Remarks:			

IV. O&M COSTS

1. **O&M Organization**

☐ State in-house ☐ Contractor for State
☒ PRP in-house ☒ Contractor for PRP
☐ Federal Facility in-house ☐ Contractor for Federal Facility
☐ Other O&M costs not provided.

2. **O&M Cost Records**

☐ Readily Available ☐ Up to date
☐ Funding mechanism/agreement in place
Original O&M cost estimate ☐ Breakdown attached

Total annual cost by year for review period if available

From	_____ (Date)	To _____ (Date)	_____ (Total Cost)	☐ Breakdown attached
From	_____ (Date)	To _____ (Date)	_____ (Total Cost)	☐ Breakdown attached
From	_____ (Date)	To _____ (Date)	_____ (Total Cost)	☐ Breakdown attached
From	_____ (Date)	To _____ (Date)	_____ (Total Cost)	☐ Breakdown attached
From	_____ (Date)	To _____ (Date)	_____ (Total Cost)	☐ Breakdown attached

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons:

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** | ☒ Location shown on site map | ☒ Gates secured | ☐ N/A

Remarks: Damaged fence near office observed by C Woods

B. Other Access Restrictions

2. **Signs and other security measures** | ☐ Location shown on site map | ☒ N/A

Remarks: Signs along perimeter warning to keep out

C. Institutional Controls (IC)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented	☐ Yes	☒ No	☐ N/A
Site conditions imply ICs being fully enforced	☒ Yes	☐ No	☐ N/A

Type of monitoring (e.g., self-reporting, drive-by)
Frequency
Responsible party/agency CTDEEP

Contact	Maurice Hamel	Supervisor, Rem. Div.	6/19/2008	(860) 424-3787
	(Name)	(Title)	(Date)	(Tel No.)

Reporting is up-to-date	☐ Yes	☐ No	☒ N/A
Reports are verified by the lead agency	☐ Yes	☐ No	☒ N/A
Specific requirements in deed or decision documents have been met	☒ Yes	☐ No	☐ N/A
Violations have been reported	☐ Yes	☐ No	☒ N/A

Other problems or suggestions: ☐ Report attached
CTDEEP manages the Environmental Land Use Restrictions (ELURs) which are recorded on the deed.

2. Adequacy ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A
Remarks

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ☒ No vandalism evident
Remarks:

2. **Land use changes on site** ☒ N/A
Remarks:

3. **Land use changes off site** ☒ N/A
Remarks:

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map ☐ Roads Adequate ☐ N/A
Remarks: Good condition

B. **Other Site Conditions**
Remarks:

VII. LANDFILL COVERS ☒ Applicable ☐ N/A		
A. Landfill Surface		
1. **Settlement** (Low spots) Areal Extent Remarks:	☐ Location shown on site map Depth	☒ Settlement not evident
2. **Cracks** Lengths Remarks:	☐ Location shown on site map Widths	☒Cracking not evident Depths
3. **Erosion** Areal Extent Remarks:	☐ Location shown on site map Depth	☒Erosion not evident
4. **Holes** Areal Extent 3 inches across Remarks: Small burrows; not very deep and maybe just getting started; observed in two locations	☒Location shown on site map Depth 3 to 4 inches	☐Holes not evident
5. **Vegetative Cover** ☒ Grass ☒ Cover properly established ☒ No signs of stress ☐ Trees/Shrubs (indicate size and locations on a diagram) Remarks:		
6. **Alternative Cover** (armored rock, concrete, etc.) ☐ Applicable ☒ N/A Remarks:		
7. **Bulges** Areal Extent Remarks:	☐ Location shown on site map Height	☒Bulges not evident
8. **Wet Areas/Water Damage** ☒Wet Areas/water damage not evident ☐ Wet Areas ☐ Ponding ☒ Seeps ☐ Soft subgrade Remarks:	☐ Location shown on site map ☐ Location shown on site map ☒ Location shown on site map ☐ Location shown on site map	Areal Extent Areal Extent Areal Extent ~ 40 ft with iron staining in channel Areal Extent
9. **Slope Instability** Areal Extent: Remarks:	☐ Slides ☐ Location shown on site map	☒No evidence of slope instability

B. Benches ☒ Applicable ☐ N/A (Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)		
1. **Flows Bypass Bench** Remarks:	☐ Location shown on site map	☒N/A or okay
2. **Bench Breached** Remarks:	☐ Location shown on site map	☒N/A or okay
3. **Bench Overtopped** Remarks:	☐ Location shown on site map	☐N/A or okay
C. Letdown Channels ☒ Applicable ☐ N/A (Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off the landfill cover without creating erosion gullies.)		
1. **Settlement** Areal extent Remarks:	☐ Location shown on site map Depth	☒No evidence of settlement
2. **Material Degradation** Areal extent Remarks:	☐ Location shown on site map Depth	☒No evidence of degradation
3. **Erosion** Areal extent Remarks:	☐ Location shown on site map Depth	☒No evidence of erosion
4. **Undercutting** Areal extent Remarks:	☐ Location shown on site map Depth	☒No evidence of undercutting
5. **Obstructions** ☐ Location shown on site map Remarks:	Type Areal extent	☒No obstructions
6. **Excessive Vegetative Growth** ☒ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow ☐ Location shown on site map Remarks:	Type Areal extent	

Five-Year Review Site Inspection Checklist

D. Cover Penetrations ☒ Applicable ☐ N/A

1. **Gas Vents** ☐ Active ☒ Passive
☐ Properly Secured/Locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leaking at penetration ☐ Needs maintenance ☐ N/A
Remarks:

2. **Gas Monitoring Probes**
☐ Properly Secured/Locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leaking at penetration ☐ Needs maintenance ☒ N/A
Remarks:

3. **Monitoring Wells** (within surface of landfill)
☒ Properly Secured/Locked ☒ Functioning ☒ Routinely sampled ☒ Good condition
☐ Evidence of leaking at penetration ☐ Needs maintenance ☐ N/A
Remarks:

4. **Leachate Extraction Wells**
☐ Properly Secured/Locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leaking at penetration ☐ Needs maintenance ☒ N/A
Remarks:

5. **Settlement Monuments**
☐ Located ☐ Routinely sampled ☒ N/A
Remarks:

E. Gas Collection and Treatment ☐ Applicable ☒ N/A

1. **Gas Treatment Facilities**
☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs maintenance
Remarks:

2. **Gas Collection Wells, Manifolds and Piping**
☐ Good condition ☐ Needs maintenance
Remarks:

3. **Gas Monitoring Facilities** (e.g., gas monitoring of adjacent homes or buildings)
☐ Good condition ☐ Needs maintenance ☐ N/A
Remarks:

Five-Year Review Site Inspection Checklist

F. Cover Drainage Layer ☒ Applicable ☐ N/A 1. **Outlet Pipes Inspected** ☒ Functioning ☐ N/A Remarks: Outlet pipes functioning and flow observed. One pipe broken with pieces pushed together; One pipe pitched up at 2 degrees with minor flow
2. **Outlet Rock Inspected** ☐ Functioning ☒ N/A Remarks:
G. Detention/Sediment Ponds ☐ Applicable ☒ N/A 1. **Siltation** Areal Extent Depth ☐ Siltation not evident Remarks:
2. **Erosion** Areal Extent Depth ☐ Erosion not evident Remarks:
3. **Outlet Works** ☐ Functioning ☒ N/A Remarks:
4. **Dam** ☐ Functioning ☒ N/A Remarks:
H. Retaining Walls ☐ Applicable ☒ N/A 1. **Deformations** ☐ Location shown on site map ☐ Deformation not evident Horizontal displacement Vertical displacement Rotational displacement Remarks:
I. Perimeter Ditches/Off-Site Discharge ☐ Applicable ☒ N/A 1. **Siltation** ☐ Location shown on site map ☐ Siltation not evident Areal extent Depth Remarks:
2. **Vegetative Growth** ☐ Location shown on site map ☒ N/A ☐ Vegetation does not impede flow Areal extent Type Remarks:
3. **Erosion** ☐ Location shown on site map ☒ N/A Areal extent Type Remarks:
4. **Discharge Structure** ☐ Functioning ☒ N/A Remarks:

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A	
1. **Settlement** ☐ Location shown on site map ☐ Settlement not evident Areal extent Type Remarks:	
2. **Performance Monitoring** Type of monitoring ☐ Performance not monitored Frequency ☐ Evidence of breaching Head differential Remarks:	
IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable ☒ N/A	
A. Groundwater Extraction Wells, Pumps and Pipelines ☐ Applicable ☒ N/A	
1. **Pumps, Wellhead Plumbing and Electrical** ☐ Good condition ☐ All required wells properly operating ☐ Needs maintenance ☐ N/A Remarks:	
2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances** ☐ Good condition ☐ Needs maintenance Remarks:	
3. **Spare Parts and Equipment** ☐ Readily Available ☐ Good condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:	
B. Surface Water Collection Structures, Pumps and Pipelines ☐ Applicable ☒ N/A	
1. **Collection Structures, Pumps and Electrical** ☐ Good condition ☐ Needs maintenance Remarks:	
2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances** ☐ Good condition ☐ Needs maintenance Remarks:	
3. **Spare Parts and Equipment** ☐ Readily Available ☐ Good condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:	

C. Treatment System ☐ Applicable ☒ N/A

1. **Treatment Train** (Check components that apply)
☐ Metals Removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters
☐ Additive (e.g., chelation agent, flocculent)
☐ Others
☐ Good condition ☐ Needs maintenance
☐ Sampling ports properly marked and functional
☐ Sampling/maintenance log displayed and up to date
☐ Equipment properly identified
Quantity of groundwater treated annually
Quantity of surface water treated annually
Remarks:

2. **Electrical Enclosures and Panels** (properly rated and functional)
☒ N/A ☐ Good condition ☐ Needs maintenance
Remarks:

3. **Tanks, Vaults, Storage Vessels**
☐ N/A ☒ Good condition ☐ Proper Secondary containment ☐ Needs maintenance
Remarks:

4. **Discharge Structures and Appurtenances**
☒ N/A ☐ Good condition ☐ Needs maintenance
Remarks:

5. **Treatment Building(s)**
☒ N/A ☐ Good condition (esp. roof and doorways ☐ Needs repair
☐ Chemicals and equipment properly stored
Remarks:

6. **Monitoring Wells** (pump and treat remedy)
☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☐ Good condition
☒ All required wells located ☐ Needs maintenance ☐ N/A
Remarks: Other monitoring wells at Site not in sampling program were unlocked (MW-114S) or open to the elements (MW-114B) and filled with water. Non-essential well MW-119F not located.

D. Monitoring Data

1. Monitoring Data
☒ Is routinely submitted on time ☒Is of acceptable quality
2. Monitoring Data Suggests:
☒ Groundwater plume is effectively contained ☒Contaminant concentrations are declining
Remarks:

E. Monitoring Natural Attenuation (MNA)

1. **Monitoring Wells** (MNA remedy)
☒ Properly secured/locked ☒ Functioning ☒Routinely sampled ☐ Good condition
☒ All required wells located ☐Needs maintenance ☐ N/A
Remarks:

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

The ROD selected Monitored Natural Attenuation coupled with institutional controls, public education, and long-term monitoring as the remedy. The contractor performing the long-term monitoring has provided data and progress reports on-time, and of acceptable quality.

For purposes of this Five-Year Review, the operations and maintenance of the Non-Time-Critical Response Action (NTCRA) is also considered part of the selected remedy. The NTCRA constructed the landfill cap and associated appurtenances. The operation and maintenance of this landfill was evaluated as part of this Five-Year Review. The landfill appears to be in good condition with minimal problems noted during the site visit.

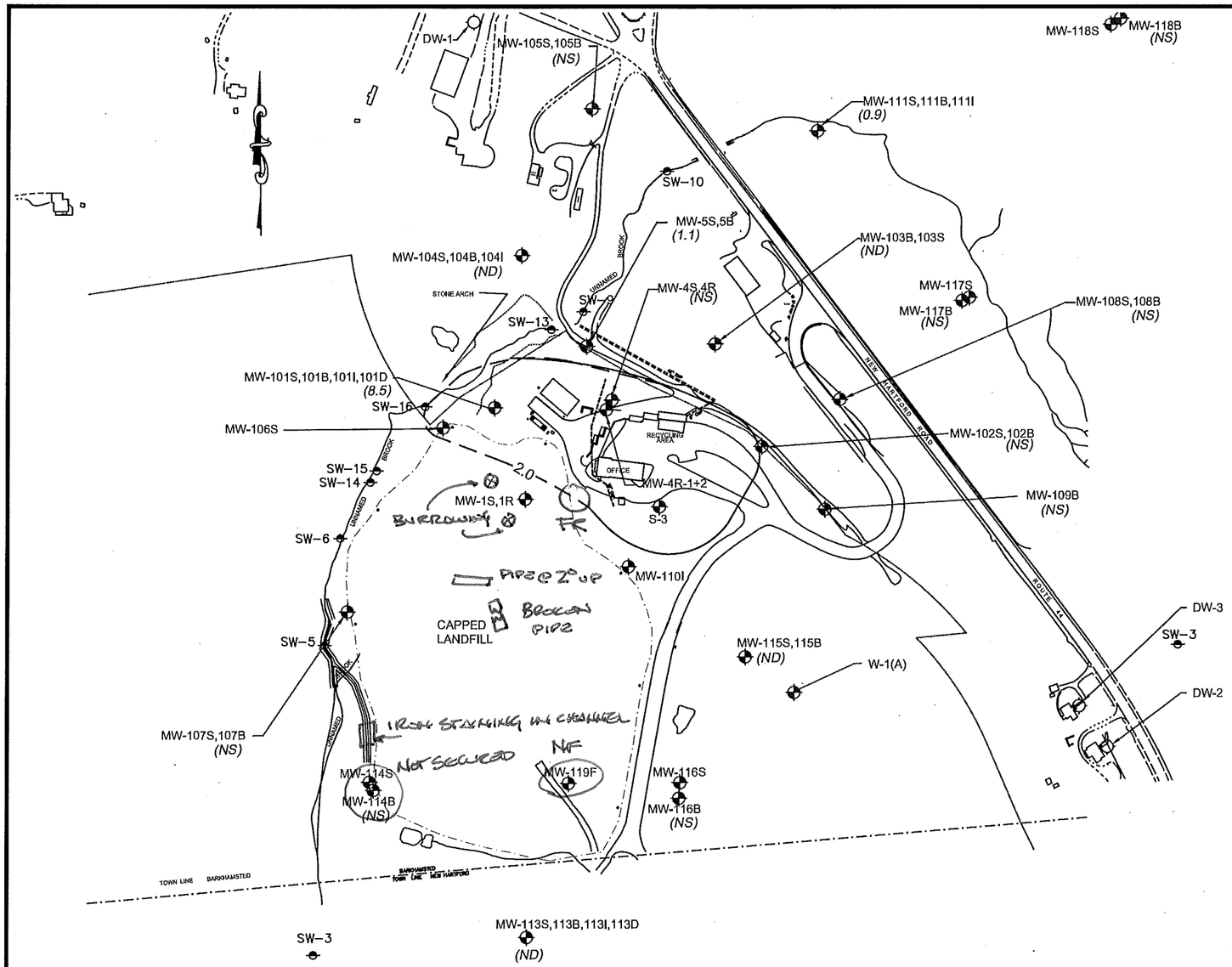
B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of the O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

The operations and maintenance of this landfill appears adequate. Damage to a perimeter fence was noted in the northeastern corner. Small animal burrows were noted in the north central portion of the landfill cap; however, it appeared that the animal had not progressed through the vegetated drainage layer. Drainage pipes located in the approximate center of the landfill were broken and/or noted to be pitched in slightly the wrong direction. No evidence of erosion due to these problems were noted.

INSPECTION NOTES 18 APRIL 2013

NF = NOT FOUND
FR = FENCE REPAIR NEEDED



LEGEND:

SW-3	SURFACE WATER / SEDIMENT
DW-1	PRIVATE WELL SAMPLE LOCATION
MW-5B	MONITORING WELL LOCATION
10	TOTAL BTEX ISOCONCENTRATION (ug/L) (DASHED WHERE INFERRED)
(1.1)	TOTAL BTEX CONCENTRATION (ug/L)
(ND)	NOT DETECTED
(NS)	NOT SAMPLED

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

DATE:	6/10/03
DRAWN BY:	PPH
REVIEWED BY:	AW
APPROVED BY:	AW
SCALE:	AS NOTED
FILE NO:	010-12392
JOB NO:	

TITLE: **SHALLOW BEDROCK TOTAL BTEX CONCENTRATION MAP - APRIL 30 - MAY 8, 2003**

LOCATION: **BARKHAMSTED - NEW HARTFORD LANDFILL SUPERFUND SITE**

FIGURE **7**

SITE INSPECTION PHOTOLOG
BARKHAMSTED LANDFILL, BARKHAMSTED, CONNECTICUT

SCENE: View facing southwest of the entrance road to the Barkhamsted Landfill

SCENE: View facing southwest of the main entrance gate to the landfill.

SCENE: View facing southeast of a damaged area of landfill perimeter fencing. This damage is located along the northeastern portion of the landfill.

SCENE: View facing southwest of the sedimentation basin at the southern extent of the landfill.

Notes:

1.Photographs included in this log were taken by Nobis on April 17, 2013.

Path: R:\80000 Task Orders\80086 Barkhamsted FY\R\Technical Data\GIS\Maps_and_Figures\Photolog1.mxd Date Printed: 6/18/2013

SITE INSPECTION PHOTOLOG
BARKHAMSTED LANDFILL, BARKHAMSTED, CONNECTICUT

SCENE: View of the main downchute structure. This downchute was repaired as a result of observations made during the initial Five-Year Review.

SCENE: View facing northwest of the drainage swale leaving the landfill site flowing southeast (towards the photographer).

SCENE: View facing east of a leachate seep in the area of MW-114S and MW-114B.

SCENE: View facing north of the unnamed stream flowing away from the photographer along the western extent of the landfilll.

Notes:

1.Photographs included in this log were taken by Nobis on April 17, 2013.

Path: R:\80000 Task Orders\80086 Barkhamsted FYR\Technical Data\GIS\Maps_and_Figures\Photolog2.mxd Date Printed: 6/18/2013

SITE INSPECTION PHOTOLOG
BARKHAMSTED LANDFILL, BARKHAMSTED, CONNECTICUT

SCENE: View of areas of animal burrowing near MW-18, 1R.

SCENE: View of a drain pipe located approximately 75 feet south of MW-18, 1R that is sloped improperly.

SCENE: View of a broken drain pipe located near the landfill peak.

SCENE: View of the leachate pumpout station. Note the underground stroage tank access manhole located behind and left of the pumpout.

Notes:

1.Photographs included in this log were taken by Nobis on April 17, 2013.

Path: R:\80000 Task Orders\80086 Barkhamsted FYR\Technical Data\GIS\Maps_and_Figures\Photolog3.mxd Date Printed: 6/18/2013

APPENDIX G

INTERVIEW RECORD

Site Name: Barkhamsted Landfill	**EPA ID No.: CTD980732333**
Subject: Third Five-Year Review	**Time: 15:30** **Date: 5/9/13**
Type: Telephone Visit Other **Location of Visit:**	Incoming Outgoing

Contact Made By:

Name: Denis McGrath	**Title: Project Manager**	**Organization: Nobis Engineering, Inc.**

Individual Contacted:

Name: Jim Hart	**Title: District Administrator**	**Organization: Regional Refuse District No. 1**

Telephone No: 860-379-1972 **Fax No:** **E-Mail Address:**	**Street Address:** **City, State, Zip:**

Summary Of Conversation

Q1: What is your overall impression of the project?
A1: The RRDD feels that the remedy is working well. The Site is out of the way and noone really thinks of it much. Most people don't even know the site is there.

Q2: Is the remedy functioning as intended?
A2: RRDD feels the remedy is functioning as intended.

Q3: Are there any development plans for the property or adjacent parcels?
A3: RRDD entertained the possibility of developing areas RRDD-owned property away from the Site; however, the cost for infrastructure improvements was deemed not worthwhile. RRDD is looking at possibly constructing a series of solar arrays on the cap. CT legislation is currently being debated regarding provisions necessary to make this a possibility.

Q4: Have there been any problems encountered with the remedy or deviations from established plans?
A4: No major O&M problems encountered.

Q5: Could you please describe any significant changes in the O&M activities or sampling processes over the previous five years?
A5: RRDD modified their mowing procedure to use a track-mounted skid-loader with a mower attachment to mow the landfill. The previous method employed damaged the vegetation and cause ruts in topsoil. The new method do esnot damage the vegetation and no longer ruts the topsoil. Additionally, the quantity of leachate recovered has decreased substantially in the last 3 to 4 years. Currently they are removing approxiamtely 6,000 gallons every 18 months where in previous years, as much as 18,000 gallons of leachate were removed in a year.

Q6: Has there been any notable trespassing or vandalism at the site within the previous five years?
A6: No trespassing or vandalism noted.

Q7: Please describe any O&M or sampling optimization actions the district has attempted/implemented.
A7: No opprtunity for optamization.

Q8: When was the transfer station and recycle center established on the Site?
A8: The lower area was constructed as part of the origional landfill in the 1970s. During landfill operations, the residents would dispose of their waste in this area as opposed to backing up to the landfill working face. The upper area was constructed to receive bulky waste in 1993.

Q9: When was the leachate overflow pond removed/filled?
A9: The leachate overflow pond was filled in approximately 1999 by the NTCRA contractor.

Q10: The 2003 Consent Decree required that a Remedial Action Work Plan, when was the document submitted or approved?
A10: RRDD was not familiar with this document.

Q11: Please describe the details pertaining to the new drinking water well for RRDD1.
A11: The new drinking water well was installed in a piece of purchased property southeast of the Site near the Jone's property, and outside of the ELUR. The well was installed in the late fall early winter of 2012. Prior to bringing the well on-sline, several samples were collected for bacterial analysis etc. Arcadis has collected a sample from the well during the April 2013 sampling round. RRDD intends to include sampling of this new drinking water well into the existing long-term monitoring program.

Q12: Does the district have any comments, suggestions, or recommendations to EPA regarding the project?
A12: The RRDD was unsure of the status of the current budget for response costs, and whether the fund was sufficient to see to completion.

INTERVIEW RECORD

Site Name: Barkhamsted Landfill		**EPA ID No.: CTD980732333**
Subject: Third Five-Year Review	**Time: 16:00**	**Date: 6/17/13**
Type: **Telephone** Visit Other **Location of Visit:**		**Incoming** Outgoing

Contact Made By:

Name: Denis McGrath	**Title: Project Manager**	**Organization: Nobis Engineering, Inc.**

Individual Contacted:

Name: Maurice Hamel	**Title: Project Manager**	**Organization: CT DEEP**

Telephone No: 860-424-3787 **Fax No:** **E-Mail Address: maurice.hamel@po.state.ct.us**	**Street Address: 79 Elm Street** **City, State, Zip: Hartford, Connecticut 01605**

Summary Of Conversation

Q1: What is your overall impression of the project?
A1: The site has been operating well on its own and hasn't required DEEP involvement.

Q2: Are there changes to State laws/regulations that could impact the remedy's protectiveness?
A2: None of the proposed changes to the Connecticut Regulations will impact the remedy's protectiveness.

Q3: Please describe any complaints or violations or other event requiring Departmental response. Has communication with those responsible for O&M been responsive?
A3: Other than occasional letter reports on the groundwater monitoring, the DEEP has not had any communication about this project.

Q4: Does the Department feel well informed regarding Site progress?
A4: Minimal communication has been provided aside from the pcassional report.

Q5: Has the Department been informed of any issues or problems associated with the Site?
A5: DEEP has not had any communications about any issues or problems with the Site, and assumes that there are no issues.

Q6: Does the Department have any comments, suggestions, or recommendations to EPA regarding the project?
A6: The DEEP has requested that the groundwater monitoring progress reports provide analytical data as well, when collected. DEEP is concearned that minimal analytical data is available in their files for public review.

INTERVIEW RECORD

Site Name: Barkhamsted Landfill		**EPA ID No.: CTD980732333**
Subject: Third Five-Year Review	**Time: 16:30**	**Date: 5/8/13**
Type: **Telephone** Visit Other **Location of Visit:**		**Incoming** Outgoing

Contact Made By:

Name: Denis McGrath	**Title: Project Manager**	**Organization: Nobis Engineering, Inc.**

Individual Contacted:

Name: Donald Stein	**Title: Town's First Selectman**	**Organization: Town of Barkhamsted**

Telephone No: 860 379-8285 **Fax No:** **E-Mail Address:**	**Street Address: 67 Ripley Hill Road** **City, State, Zip: Pleasant Valley, Connecticut 06063-0558**

Summary Of Conversation

Q1: What is your overall impression of the project?

A1: Noone in the Town is particularly interested in the project now. During the initial change from landfilling to transfer station, it was mildly difficult, but since then it has been fine.

Q2: Has the Town been made aware of any concerns associated with the Site?

A2: The Town is not aware of any complaints regarding the Site.

Q3: Have there been any changes in land use, zoning, or recent redevelopment at or near the Site?

A3: The Town is unaware of changes in land use or zoning. The only development near the Site has been the reconstruction of the Town garage.

Q4: Is the drinking water supply well installed on the Town Garage property actively used as a supply?

A4: No. The Town Garage receives water from a potable supply well located east of the Site and outside of the ELUR along Route 44.

Q5: Has the Town Health Department received any requests to install drinking water supply wells on any of the properties subject to the ELURs?

A5: The Town is unaware of any changes in current drinking water supply wells or requests to install drinking water wells on properties subject to the ELURs.

Q6: Has the Town been informed of any issues or problems associated with the Site?

A6: The Town is unaware of any issues regarding the Site.

Q7: Does the Town feel well informed regarding Site progress?

A7: The Town has not had any reason to inquire much about the Site with EPA. If the Town had questions regarding the Site, the Administrator of RRDD is contacted.

Q8: Does the Town have any comments, suggestions, or recommendations to EPA regarding the project?

A8: The only comment the Town would have is to get the ELURs lifted as soon as possible.

INTERVIEW RECORD

Site Name: Barkhamsted Landfill	**EPA ID No.: CTD980732333**	
Subject: Third Five-Year Review	**Time:**	**Date:**
Type: Telephone Visit Other **Location of Visit:**	Incoming Outgoing	

Contact Made By:

Name: Denis McGrath	**Title: Project Manager**	**Organization: Nobis Engineering, Inc.**

Individual Contacted:

Name: Louis Beauchemin (recent purchaser)	**Title: Nearby Resident**	**Organization: Neighbor**

Telephone No: 860-371-0063 **Fax No:** **E-Mail Address:**	**Street Address: 9 New Hartford Road** **City, State, Zip: Barkhamsted, Connecticut**

Summary Of Conversation

Q1: Do you have any concerns regarding the operations at the landfill site?
A1:

Q2: Are you aware of any discussions regarding site redevelopment at or near the landfill site?
A2:

Q3: Have you noticed any trespassing or other activities at the landfill site during off-hours?
A3:

Q4: Do you have any concerns regarding the operations or maintenance of the landfill?
A4: