



2016 First Semiannual Monitoring (SA1) Report

Site Management Plan Monitoring

**Former Clifton Manufactured Gas Plant
Staten Island, New York
NYSDEC Site No.: 2-43-023
Order on Consent Index #: D2-0001-98-04**

**Prepared for:
National Grid, USA
287 Maspeth Avenue, Brooklyn, NY 11211**

**Prepared by:
AECOM
125 Broad Street
New York, NY 10004
Project No. 60137363-600**

November 2016



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Prepared By: Sara Meissner



Reviewed By: Robert Forstner, PE

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List of Acronyms

DNAPL	Dense Non-Aqueous Phase Liquid
EC	Engineering Control
ECL	Environmental Conservation Law
ft	feet
IC	institutional controls
MGP	Manufactured Gas Plant
MNA	Monitored Natural Attenuation
NYSDEC	New York State Department of Environmental Conservation
Report	2016 Fifth Semiannual Groundwater Monitoring Report
SA	Semi-Annual
Site	Former Clifton Manufactured Gas Plant located in Staten Island, New York
SMP	Site Management Plan
SPDES	State Pollutant Discharge Elimination System
USEPA	United States Environmental Protection Agency
WWTP	Waste Water Treatment Plant

1.0 Introduction

This First Semiannual (SA1) Monitoring Report (Report) (January – June 2016) has been prepared by AECOM, on behalf of National Grid, to evaluate the on-going performance and effectiveness of the engineering and institutional controls at the Former Clifton Manufactured Gas Plant (the Site, Figure 1), located in Staten Island, New York. This Report summarizes and documents the result of the first round of semiannual monitoring activities completed at the Site from January through June 2016. Activities were completed in accordance with the New York State Department of Environmental Conservation (NYSDEC) approved Site Management Plan (AECOM, 2016; SMP). This is the first Report since the SMP was finalized in January 2016. Interim monitoring activities were completed from 2014 through 2015, and were reported upon separately.

The Site was remediated in accordance with the NYSDEC Records of Decision and, as documented in the SMP. Manufactured Gas Plant (MGP)-related residuals still present in Site soils and groundwater are being managed in accordance with the SMP. The SMP provides details of institutional controls (ICs) and engineering controls (ECs) that restrict exposure to the MGP-related residuals. The SMP will include Environmental Easements (currently pending finalization), when they are executed in accordance with New York State Environmental Conservation Law (ECL) Article 71, Title 36.

This Report includes details on the following activities completed at the Site during the reporting period:

- Dense Non-Aqueous Phase Liquid (DNAPL) gauging and recovery
- State Pollutant Discharge Elimination System (SPDES) permit-required sampling.

2.0 Background

The Site is located in Staten Island, New York. The Site, as defined in the SMP, includes all or portions of 25 Willow Avenue and 40 Willow Avenue (Figure 2). The off-site areas, as defined in the SMP, include all or portions of 1 Edgewater Street, 89 Willow Avenue, 53 Lynhurst Avenue, properties east of 25 Willow Avenue (Block 2822, Lots 21, 22, 23, 24, and 26), and New York City rights-of-way along Willow Avenue, Bay Street, and Edgewater Street (Figure 2).

The SMP, approved by the NYSDEC in January 2016, concludes the remedy implementation at the Site. The SMP outlines a number of ECs/ ICs required to manage the remaining contamination at the site. In particular, these ECs include:

- subsurface vertical DNAPL barrier walls;
- a containment cell;
- a Containment Pad Depressurization System;
- soil cover systems;
- composite cover systems;
- passive DNAPL collection systems; and
- monitored natural attenuation (MNA) of remaining contamination in groundwater.

ICs place restrictions on certain site activities and require periodic monitoring to evaluate the performance and effectiveness of the site remedy for reducing and mitigating remaining impacts at the site and off-site areas.

An interim monitoring program of similar scope was in place for approximately two years, from 2014 through 2015, prior to approval of the SMP.

3.0 Monitoring Activities

3.1 Groundwater Monitoring

The SMP calls for MNA of site-related groundwater impacts and annual monitoring via a network of wells. This work is scheduled for late 2016, and will be described in the annual Periodic Review Report.

3.2 Containment Pad Depressurization System

A depressurization pump and treat system was installed in 2015 on the 40 Willow Avenue property to maintain the integrity of the containment cell that was constructed on a portion of the 40 Willow Avenue property. The system removes groundwater from the containment cell so that pressure does not build up within it and potentially cause a failure. The Containment Pad Depressurization System is comprised of a groundwater extraction pump, wastewater treatment plant (WWTP), and discharge to New York Harbor via a storm sewer line under a SPDES permit equivalent. The Draft Containment Pad Depressurization System Construction Completion Report (AECOM, 2016a) provides details of the construction of the system. Start-up of the system was completed in and routine operation of the system began in January 2016.

As required by the SPDES permit equivalent, effluent from the containment pad depressurization system was sampled on a daily basis during the first seven days of system operation in January 2016, and on a monthly basis thereafter. Effluent sample results for January through June 2016 are summarized in Table 1. Due to pump and wiring faults, the system did not operate for most of February and April 2016 while the malfunctions were diagnosed and repaired; as a result there are no effluent monitoring results available for these months.

Total discharge flow and pH nominally exceeded SPDES permit equivalent limitations during the initial startup period in January, when effluent samples were collected on a daily basis. However the high discharge flows during system startup were temporary as the system was being calibrated. Monthly effluent sample results since then demonstrate that the containment pad depressurization system has generally been operating in accordance with the terms of the SPDES permit equivalent during the period of this Report.

3.3 DNAPL Collection System Monitoring

The Site DNAPL collection system is being monitored and DNAPL recovery is occurring in accordance with the SMP. Previous Interim Status Reports (AECOM, 2014b, AECOM, 2015a, AECOM, 2015b and AECOM, 2016b) described in detail the initial testing and results, and gauging and removal program that has been implemented to date.

3.3.1 DNAPL Recovery Well Network

There are 26 passive DNAPL recovery wells at the site for gauging of DNAPL levels, if any, and recovery of DNAPL, if present. Well construction details are summarized in Table 2, and details including construction logs and development logs are provided in the Construction Completion Report (AECOM, 2014a) and SMP (AECOM, 2016c). Three DNAPL recovery wells were installed in 2009 within the containment cell on the 40 Willow Avenue property and twenty-three DNAPL recovery wells were installed in 2013 adjacent to the vertical subsurface DNAPL barrier wall (slurry wall) along Willow Avenue and Bay Street. The DNAPL recovery well network along Willow Avenue including the containment cell and along Bay Street is shown in Figures 3 and 4, respectively.

3.3.2 O&M DNAPL Gauging

As called for in the SMP, the DNAPL recovery wells are gauged on a bi-weekly, monthly, quarterly or annual basis to check for the presence of DNAPL. The recovery wells are gauged using a weighted stainless steel measuring tape as well as an Oil/Water Interface probe. Observations of blebs and sheens on the interface probe measuring tape are noted but not used to calculate DNAPL thickness. Observations from the weighted measuring tape are used to determine DNAPL thickness because the wire of the Oil/Water Interface probe can become thickly coated with DNAPL and not sink fully, providing inaccurate data. The results from the gauging events are included in Table 3.

3.3.3 O&M DNAPL Removal and Disposal

As called for in the SMP and Record of Decision, DNAPL is removed from wells where present and removable. Since completion of a Baildown Test (AECOM, 2014b), DNAPL accumulated within the recovery wells has been removed as appropriate to the rate of DNAPL accumulation in each recovery well. Following gauging, DNAPL is removed from the wells with measurable and recoverable DNAPL. DNAPL is removed using the AECOM air lift™ (compressed air vacuum), peristaltic pumps or steel bailers as appropriate, based on the rate of accumulation and viscosity of the DNAPL at each recovery well. DNAPL removed from the recovery wells is containerized in 55-gallon drums, which are staged on-site in drum containment sheds until transported for off-site disposal.

The volume for each recovery event and the cumulative volume of DNAPL and water (fluid mixture) recovered from each recovery well between January 2010 and June 2016 is provided in Table 4. In summary, by the end of June 2016, the following cumulative volumes have been removed from nine (9) recovery wells:

- RW-2011 – A total of 428 gallons of fluid mixture;
- RW-205D – A total of 338 gallons of fluid mixture;
- RW-206IB – A total of 86 gallons of fluid mixture;
- RW-207I – A total of 133 gallons of fluid mixture;
- RW-208I – An average of 16 gallons of fluid mixture has been recovered on a bi-weekly basis for a total of 1,001 gallons;
- RW-209S – A total of 42 gallons of fluid mixture;
- RW-211I – A total of 77 gallons of fluid mixture;
- NRW-02I – A total of 58 gallons of fluid mixture; and
- NRW-03D – A total of 32 gallons of fluid mixture.

In accordance with the requirements of the SMP and revisions to the recovery well monitoring program approved as part of the Fourth Semi-Annual Interim Monitoring Report, National Grid will continue DNAPL recovery efforts according to the following schedule:

- RW-208I on a bi-weekly basis;
- RW-201I and RW-205D on a monthly basis;
- RW-206IB, RW-207I, RW-209S, and RW-211I on a quarterly basis; and
- The remaining eighteen (18) recovery wells on an annual basis (if DNAPL is present).

3.4 Cover System Monitoring

As described in the SMP, there are two cover systems installed at the Site and off-Site areas (Figure 5):

- A soil cover system comprised of a minimum of 24-inches of clean fill placed over the Site (25 Willow Avenue) and off-site areas (89 Willow Avenue); and
- A composite cover system comprised of a minimum of 6-inches of concrete cap, concrete foundations, soil, and/or asphalt placed on the Site (40 Willow Avenue) and off-Site areas (1 Edgewater Street, 89 Willow Avenue, 53 Lyndhurst Avenue, properties east of 25 Willow Avenue, and New York City rights-of-way).

During other monitoring activities at the Site, the cover system is observed. From January through June 2016, there were no changes to the cover systems. The site-wide annual inspection will be completed in the second part of 2016, and will be reported on in the next report.

2.2 DNAPL Barrier Monitoring

There has been no activity or event on-site that is known to have impacted the subsurface remedial infrastructure (vertical barrier walls and the containment cell) from January through June 2016.

4.0 Summary

National Grid has conducted Site management activities in accordance with the SMP since it was approved in January 2016. In accordance with the SMP, the remaining 2016 monitoring and inspections will include:

- Annual groundwater monitoring,
- On-going DNAPL gauging and recovery,
- On-going SPDES permit-required sampling, and
- Annual site-wide inspection.

National Grid will submit the Second Semi-annual Monitoring and First Periodic Review Report following completion of the activities in the second part of 2016.

5.0 References

- AECOM, 2014a. *Construction Completion Report, Former Clifton MGP Site Operable Unit 2*, February 2014.
- AECOM, 2014b. *Interim Status Report – Interim Monitoring Program, Former Clifton Manufactured Gas Plant*, July 25, 2014.
- AECOM, 2014c. *Post-Remediation Groundwater Monitoring Work Plan*, August 15, 2014.
- AECOM, 2015a. *Second Semi-Annual 2014 Interim Status Report – Interim Monitoring Program, Former Clifton Manufactured Gas Plant*, February 17, 2015.
- AECOM, 2015b. *Third Semi-Annual Interim Status Report (Jan-June, 2015) – Interim Monitoring Program, Former Clifton Manufactured Gas Plant*, August 3, 2015.
- AECOM, 2016a. *Draft Containment Pad Depressurization System Construction Completion Report*. July 12, 2016.
- AECOM, 2016b. *Fourth Semi-Annual Interim Status Report (July-December 2015) – Interim Monitoring Program*, July 7, 2016.
- AECOM, 2016c. *Site Management Plan, Former Clifton Manufactured Gas Plant Site*, January 2016.

Tables

Table 1
Containment Pad Depressurization System
SPDES Equivalent Monitoring Results
National Grid Former Clifton MGP Site
Staten Island, New York

Sample ID	SPDES Permit Equivalent				WWTP7-01-011516		WWTP7-02-011616		WWTP7-03-011716		WWTP7-04-011816		WWTP7-05-011916		WWTP7-06-011916		WWTP7-07-012116		WWTP7-08-032316	
	Date Sampled	Discharge Limitations		Minimum Monitoring Requirements ^{1,2}		1/15/2016		1/16/2016		1/17/2016		1/18/2016		1/19/2016		1/20/2016		1/21/2016		3/24/2016
Parameter	Daily Max	Units	Measurement Frequency	Sample Type	Result	Units	Result	Units	Result	Units	Result	Units	Result	Units	Result	Units	Result	Units	Result	Units
Flow	1,440	GPD	Continuous	Meter	1,467	GPD	226	GPD	516	GPD	1,681	GPD	613	GPD	433	GPD	452	GPD	300	GPD
pH (range)	6.5 - 8.5	SU	Monthly	Grab	8.58 J	SU	8.5 J	SU	8.27 J	SU	7.87 J	SU	7.82 J	SU	7.84 J	SU	7.23 J	SU	7.7 J	SU
TSS	20	mg/l	Monthly	Grab	< 1 U	mg/l	< 1 U	mg/l	< 1 U	mg/l	< 1 U	mg/l	< 1 U	mg/l	< 1 U	mg/l	< 1 U	mg/l	< 1 U	mg/l
Benzene	5	ug/l	Monthly	Grab	< 0.09 U	ug/l	0.42 J	ug/l	0.4 J	ug/l	< 0.09 U	ug/l	< 0.09 U	ug/l	< 0.09 U	ug/l	< 0.09 U	ug/l	< 1 U	ug/l
Ethylbenzene	5	ug/l	Monthly	Grab	< 0.3 U	ug/l	< 0.3 U	ug/l	< 0.3 U	ug/l	< 0.3 U	ug/l	< 0.3 U	ug/l	< 0.3 U	ug/l	< 0.3 U	ug/l	< 1 U	ug/l
o-Xylene	5	ug/l	Monthly	Grab	< 0.32 U	ug/l	< 0.32 U	ug/l	< 0.32 U	ug/l	< 0.32 U	ug/l	< 0.32 U	ug/l	< 0.32 U	ug/l	< 0.32 U	ug/l	< 1 U	ug/l
m/p-Xylene	10	ug/l	Monthly	Grab	0.69 J	ug/l	0.54 J	ug/l	0.67 J	ug/l	0.46 J	ug/l	< 0.28 U	ug/l	0.33 J	ug/l	0.39 J	ug/l	< 1 U	ug/l
Toluene	5	ug/l	Monthly	Grab	< 0.25 U	ug/l	< 0.25 U	ug/l	< 0.25 U	ug/l	< 0.25 U	ug/l	< 0.25 U	ug/l	< 0.25 U	ug/l	< 0.25 U	ug/l	< 1 U	ug/l
Acenaphthene	10	ug/l	Monthly	Grab	< 0.88 U	ug/l	< 0.88 U	ug/l	< 0.88 U	ug/l	< 0.88 U	ug/l	< 0.9 U	ug/l	< 0.9 U	ug/l	< 0.96 U	ug/l	< 10 U	ug/l
Acenaphthylene	10	ug/l	Monthly	Grab	< 0.65 U	ug/l	< 0.65 U	ug/l	< 0.65 U	ug/l	< 0.65 U	ug/l	< 0.66 U	ug/l	< 0.66 U	ug/l	< 0.71 U	ug/l	< 10 U	ug/l
Anthracene	10	ug/l	Monthly	Grab	< 0.57 U	ug/l	< 0.57 U	ug/l	< 0.57 U	ug/l	< 0.57 U	ug/l	< 0.58 U	ug/l	< 0.58 U	ug/l	< 0.62 U	ug/l	< 10 U	ug/l
Benz(a)anthracene	10	ug/l	Monthly	Grab	< 0.037 U	ug/l	< 0.037 U	ug/l	< 0.037 U	ug/l	< 0.037 U	ug/l	< 0.038 U	ug/l	< 0.038 U	ug/l	< 0.04 U	ug/l	< 0.052 U	ug/l
Benzo(a)pyrene	0.09	ug/l	Monthly	Grab	< 0.026 U	ug/l	< 0.026 U	ug/l	< 0.026 U	ug/l	< 0.026 U	ug/l	< 0.027 U	ug/l	< 0.027 U	ug/l	< 0.028 U	ug/l	< 0.052 U	ug/l
Benzo(b)fluoranthene	10	ug/l	Monthly	Grab	0.026 J	ug/l	0.031 J	ug/l	0.028 J	ug/l	0.032 J	ug/l	0.023 J	ug/l	< 0.012 U	ug/l	< 0.013 U	ug/l	< 0.052 U	ug/l
Benzo(ghi)perylene	10	ug/l	Monthly	Grab	< 0.75 UJ	ug/l	< 0.75 UJ	ug/l	< 0.75 UJ	ug/l	< 0.75 UJ	ug/l	< 0.77 U	ug/l	< 0.77 UJ	ug/l	< 0.82 U	ug/l	< 10 U	ug/l
Chrysene	10	ug/l	Monthly	Grab	< 0.67 U	ug/l	< 0.67 U	ug/l	< 0.67 U	ug/l	< 0.67 U	ug/l	< 0.68 U	ug/l	< 0.68 U	ug/l	< 0.73 U	ug/l	< 2.1 U	ug/l
Fluoranthene	10	ug/l	Monthly	Grab	< 0.72 U	ug/l	< 0.72 U	ug/l	< 0.72 U	ug/l	< 0.72 U	ug/l	< 0.73 U	ug/l	< 0.73 U	ug/l	< 0.78 U	ug/l	< 10 U	ug/l
Fluorene	10	ug/l	Monthly	Grab	< 0.8 U	ug/l	< 0.8 U	ug/l	< 0.8 U	ug/l	< 0.8 U	ug/l	< 0.82 U	ug/l	< 0.82 U	ug/l	< 0.87 U	ug/l	< 10 U	ug/l
Indeno(1,2,3-cd)pyrene	10	ug/l	Monthly	Grab	< 0.21 U	ug/l	< 0.21 U	ug/l	< 0.21 U	ug/l	< 0.21 U	ug/l	< 0.21 U	ug/l	< 0.21 U	ug/l	< 0.23 U	ug/l	< 1 U	ug/l
Naphthalene	50	ug/l	Monthly	Grab	< 0.8 U	ug/l	< 0.8 U	ug/l	< 0.8 U	ug/l	< 0.8 U	ug/l	< 0.82 U	ug/l	< 0.82 U	ug/l	< 0.87 U	ug/l	< 10 U	ug/l
Phenanthrene	10	ug/l	Monthly	Grab	< 0.65 U	ug/l	< 0.65 U	ug/l	< 0.65 U	ug/l	< 0.65 U	ug/l	< 0.66 U	ug/l	< 0.66 U	ug/l	< 0.71 U	ug/l	< 10 U	ug/l
Pyrene	10	ug/l	Monthly	Grab	< 0.83 U	ug/l	< 0.83 U	ug/l	< 0.83 U	ug/l	< 0.83 U	ug/l	< 0.85 U	ug/l	< 0.85 U	ug/l	< 0.9 U	ug/l	< 10 U	ug/l
Arsenic	10	ug/l	Monthly	24 hr comp	< 0.71 U	ug/l	0.8 J	ug/l	0.82 J	ug/l	0.83 J	ug/l	< 0.71 U	ug/l	0.76 J	ug/l	0.8 J	ug/l	< 0.71 U	ug/l
Nickel	80	ug/l	Monthly	24 hr comp	< 1.6 U	ug/l	< 1.6 U	ug/l	< 1.6 U	ug/l	3.2 J	ug/l	< 1.6 U	ug/l	< 1.6 U	ug/l	< 1.6 U	ug/l	< 1.6 U	ug/l
Cyanide, Total	Monitor	mg/l	Monthly	Grab	< 0.004 U	mg/l	< 0.004 U	mg/l	< 0.004 U	mg/l	< 0.004 U	mg/l	< 0.004 U	mg/l	< 0.004 U	mg/l	< 0.004 U	mg/l	< 0.01 U	mg/l
Cyanide, Available	0.01	mg/l	Monthly	Grab	< 0.0011 U	mg/l	< 0.0011 U	mg/l	< 0.0011 U	mg/l	< 0.0011 U	mg/l	< 0.0011 U	mg/l	< 0.0011 U	mg/l	< 0.0011 U	mg/l	< 0.002 U	mg/l
Turbidity	No increase that will cause a substantial visible contrast to Natural Conditions		Monthly	Visual	0.127 J	NTU	0.174 J	NTU	0.279 J	NTU	0.299 J	NTU	0.386 J	NTU	0.406 J	NTU	0.546	NTU	0.332 J	NTU

Notes:

Qualifiers

Bold indicates compound was detected

J - The analyte was positively identified. The associated numerical value is the approximate concentration of the analyte in the sample.

U - The material was analyzed for, but not detected above the level of the reported sample quantitation limit.

UJ - The analyte was analyzed for, but was not detected. The reported quantitation limit is approximated and may be inaccurate or imprecise.

Gray-shaded values exceed a discharge limitation.

Mass loading calculations utilize half the value for all non-detect results

¹ Monitor these parameters daily for 7 consecutive days. If the sampling results for all parameters comply with the limits, the monitoring frequency becomes MONTHLY. If monthly sampling results do not comply with the limit for any parameter, the monitoring frequency becomes DAILY again until the sampling results for all parameters comply with the limits. Thereafter the monitoring frequency changes to MONTHLY.

² The system was not operational in February and April due to repair and maintenance.

**Table 1
Containment Pad Depressurization System
SPDES Equivalent Monitoring Results
National Grid Former Clifton MGP Site
Staten Island, New York**

Sample ID	SPDES Permit Equivalent				WWTP-051716		WWTP-061716	
	Discharge Limitations		Minimum Monitoring Requirements ^{1,2}		5/17/2016		6/17/2016	
Parameter	Daily Max	Units	Measurement Frequency	Sample Type	Result	Units	Result	Units
Flow	1,440	GPD	Continuous	Meter	441	GPD	212	GPD
pH (range)	6.5 - 8.5	SU	Monthly	Grab	8.5 J	SU	7.69 J	SU
TSS	20	mg/l	Monthly	Grab	< 1 U	mg/l	4.3 U	mg/l
Benzene	5	ug/l	Monthly	Grab	< 1 U	ug/l	< 1 U	ug/l
Ethylbenzene	5	ug/l	Monthly	Grab	< 1 U	ug/l	< 1 U	ug/l
o-Xylene	5	ug/l	Monthly	Grab	< 1 U	ug/l	< 1 U	ug/l
m/p-Xylene	10	ug/l	Monthly	Grab	< 1 U	ug/l	< 1 U	ug/l
Toluene	5	ug/l	Monthly	Grab	< 1 U	ug/l	< 1 U	ug/l
Acenaphthene	10	ug/l	Monthly	Grab	< 10 U	ug/l	< 10 U	ug/l
Acenaphthylene	10	ug/l	Monthly	Grab	< 10 U	ug/l	< 10 U	ug/l
Anthracene	10	ug/l	Monthly	Grab	< 10 U	ug/l	< 10 U	ug/l
Benz(a)anthracene	10	ug/l	Monthly	Grab	< 0.05 U	ug/l	< 0.052 U	ug/l
Benzo(a)pyrene	0.09	ug/l	Monthly	Grab	< 0.05 U	ug/l	< 0.052 U	ug/l
Benzo(b)fluoranthene	10	ug/l	Monthly	Grab	< 0.05 U	ug/l	< 0.052 U	ug/l
Benzo(ghi)perylene	10	ug/l	Monthly	Grab	< 10 U	ug/l	< 10 U	ug/l
Chrysene	10	ug/l	Monthly	Grab	< 2 U	ug/l	< 2.1 U	ug/l
Fluoranthene	10	ug/l	Monthly	Grab	< 10 U	ug/l	< 10 U	ug/l
Fluorene	10	ug/l	Monthly	Grab	< 10 U	ug/l	< 10 U	ug/l
Indeno(1,2,3-cd)pyrene	10	ug/l	Monthly	Grab	< 1 U	ug/l	< 1 U	ug/l
Naphthalene	50	ug/l	Monthly	Grab	< 10 U	ug/l	< 10 U	ug/l
Phenanthrene	10	ug/l	Monthly	Grab	< 10 U	ug/l	< 10 U	ug/l
Pyrene	10	ug/l	Monthly	Grab	< 10 U	ug/l	< 10 U	ug/l
Arsenic	10	ug/l	Monthly	24 hr comp	< 0.71 U	ug/l	< 0.71 U	ug/l
Nickel	80	ug/l	Monthly	24 hr comp	2 J	ug/l	2.6 J	ug/l
Cyanide, Total	Monitor	mg/l	Monthly	Grab	< 0.01 U	mg/l	< 0.01 U	mg/l
Cyanide, Available	0.01	mg/l	Monthly	Grab	< 0.002 U	mg/l	< 0.002 U	mg/l
Turbidity	No increase that will cause a substantial visible contrast to Natural Conditions		Monthly	Visual	1.01 J	NTU	0.324 J	NTU

Notes:

Qualifiers

Bold indicates compound was detected

J - The analyte was positively identified. The associated numerical value is the approximate concentration of the analyte in the sample.

U - The material was analyzed for, but not detected above the level of the reported sample quantitation limit.

UJ - The analyte was analyzed for, but was not detected. The reported quantitation limit is approximated and may be inaccurate or imprecise.

Gray-shaded values exceed a discharge limitation.

Mass loading calculations utilize half the value for all non-detect results

¹ Monitor these parameters daily for 7 consecutive days. If the sampling results for all parameters comply with the limits, the monitoring frequency becomes MONTHLY. If monthly sampling results do not comply with the limit for any parameter, the monitoring frequency becomes DAILY again until the sampling results for all parameters comply with the limits. Thereafter the monitoring frequency changes to MONTHLY.

² The system was not operational in February and April due to repair and maintenance.

**Table 2
DNAPL Recovery Well Construction Details
National Grid Former Clifton MGP Site
Staten Island, New York**

DNAPL Recovery Well ID	Ground Surface Elevation ¹	Top of Vault Elevation	Top of Riser Pipe Elevation	Depth of Well (feet bgs)	Screen Interval	Top of Screen (feet bgs)	Bottom of Screen (feet bgs)	Diameter (inches)	Top of Screen Elevation	Bottom of Screen Elevation	Protective Casing	Riser Type	Screen Type	Screen Slotted Size/Diameter (inches)	Sump Type	Sump Length (feet)
RW-200S	9.2	9.57	NM	23	10.0 - 20.0	10	20	4.0	-0.8	-10.8	Flush-Mount	PVC	Wire Wrap SS	0.02/4.0	SS	3.0
RW-200I	9.2	9.58	NM	37	24.0 - 34.0	24	34	4.0	-14.8	-24.8	Flush-Mount	PVC	Wire Wrap SS	0.02/4.0	SS	3.0
RW-201S	9.2	9.57	8.77	29	14.0 - 24.0	14	24	6.0	-4.8	-14.8	Flush-Mount	PVC	Wire Wrap SS	0.02/6.0	SS	5.0
RW-201I	8.9	9.37	8.6	37.5	22.5-32.5	23	33	6.0	-13.6	-23.6	Flush-Mount	PVC	Wire Wrap SS	0.02/4.0	SS	5.0
RW-202S	9.85	9.94	9.64	25	10.0 - 20.0	10	20	6.0	-0.2	-10.2	Flush-Mount	PVC	Wire Wrap SS	0.02/4.0	SS	5.0
RW-202I	9.85	9.85	9.48	42	27.0 - 37.0	27	37	6.0	-17.2	-27.2	Flush-Mount	PVC	Wire Wrap SS	0.02/4.0	SS	5.0
RW-203S	9.3	9.16	8.67	27	14.0 - 24.0	14	24	4.0	-4.7	-14.7	Flush-Mount	PVC	Wire Wrap SS	0.02/4.0	SS	3.0
RW-203I	9.3	9.14	8.54	37	24.0 - 34.0	24	34	4.0	-14.7	-24.7	Flush-Mount	PVC	Wire Wrap SS	0.02/4.0	SS	3.0
RW-204I	9.12	9.35	8.6	43	30.0 - 40.0	30	40	4.0	-20.9	-30.9	Flush-Mount	PVC	Wire Wrap SS	0.02/4.0	SS	3.0
RW-205D	8.75	8.82	8.18	77	64.0 - 74.0	64	74	4.0	-55.3	-65.3	Flush-Mount	PVC	Wire Wrap SS	0.02/4.0	SS	3.0
RW-206S	8.6	9.02	8.26	28	15.0 - 25.0	15	25	4.0	-6.4	-16.4	Flush-Mount	PVC	Wire Wrap SS	0.02/4.0	SS	3.0
RW-206IA	8.6	9.05	8.15	48	35.0 - 45.0	35	45	4.0	-26.4	-36.4	Flush-Mount	PVC	Wire Wrap SS	0.02/4.0	SS	3.0
RW-206IB	8.55	9.13	7.63	58	45.0 - 55.0	45	55	4.0	-36.5	-46.5	Flush-Mount	PVC	Wire Wrap SS	0.02/4.0	SS	3.0
RW-207S	8.5	8.8	8.15	23	10.0 - 20.0	10	20	4.0	-1.5	-11.5	Flush-Mount	PVC	Wire Wrap SS	0.02/4.0	SS	3.0
RW-207I	8.5	8.77	8.23	33	20.0 - 30.0	20	30	4.0	-11.5	-21.5	Flush-Mount	PVC	Wire Wrap SS	0.02/4.0	SS	3.0
RW-208S	8.27	8.53	7.81	23	10.0 - 20.0	10	20	4.0	-1.7	-11.7	Flush-Mount	PVC	Wire Wrap SS	0.02/4.0	SS	3.0
RW-208I	8.27	8.52	7.23	42	29.0 - 39.0	29	39	4.0	-20.7	-30.7	Flush-Mount	PVC	Wire Wrap SS	0.02/4.0	SS	3.0
RW-209S	8	8.48	7.63	30	15.0 - 25.0	15	25	6.0	-7.0	-17.0	Flush-Mount	PVC	Wire Wrap SS	0.02/4.0	SS	5.0
RW-209I	8	8.28	7.69	40	25.0 - 35.0	25	35	6.0	-17.0	-27.0	Flush-Mount	PVC	Wire Wrap SS	0.02/4.0	SS	5.0
RW-210S	7.6	7.85	7.3	28	15.0 - 25.0	15	25	4.0	-7.4	-17.4	Flush-Mount	PVC	Wire Wrap SS	0.02/4.0	SS	3.0
RW-210I	7.6	7.93	7.32	38	25.0 - 35.0	25	35	4.0	-17.4	-27.4	Flush-Mount	PVC	Wire Wrap SS	0.02/4.0	SS	3.0
RW-211S	8.5	8.74	7.15	29	6.0 - 26.0	6	26	4.0	2.5	-17.5	Flush-Mount	PVC	Wire Wrap SS	0.02/4.0	SS	3.0
RW-211I	8.5	8.76	7.23	43	30.0 - 40.0	30	40	4.0	-21.5	-31.5	Flush-Mount	PVC	Wire Wrap SS	0.02/4.0	SS	3.0
NRW-01S ²	14.18	15.28	14.86	19	9.0 - 19.0	9	19	4.0	5.2	-4.8	Flush-Mount	SS	SS	0.02/4.0	--	--
NRW-02I ²	14.27	--	--	49	34.0 - 44.0	34	44	4.0	-19.7	-29.7	Stick Up	SS	SS	0.02/4.0	SS	5.0
NRW-03D ²	14.28	--	--	84	69.0 - 79.0	69	79	4.0	-54.7	-64.7	Stick Up	SS	SS	0.02/4.0	SS	5.0

Notes:

1 - Derived from the nearest surface elevation from final as-built survey

2 - Containment pad surface

NM - Not measured

bgs - below ground surface

DNAPL - Dense Non-Aqueous Phase Liquid

SS - stainless steel

RW-200S = Shallow recovery wells

RW-200I = Intermediate recovery wells

RW-205D = Deep recovery wells

Table 3
DNAPL Thickness During 2016 Gauging Events
National Grid Former Clifton MGP Site
Staten Island, New York

Location	Bay Street	Willow Avenue						Containment Cell		
Well ID	RW-2011	RW-205D	RW-206IB	RW-207I	RW-208I	RW-209S	RW-211I	NRW-01S	NRW-02I	NRW-03D
Date	feet	feet	feet	feet	feet	feet	feet	feet	feet	feet
1/11/2016	3.00	3.40	0.00	0.00	6.30	4.30	2.40	0.00	0.00	0.00
2/3/2016	2.97	0.80	1.20	1.90	10.00	4.10	1.10	0.00	0.00	0.00
2/18/2016	0.00	2.23	0.00	2.30	5.50	4.29	1.30	0.00	0.00	4.40
3/3/2016	3.05	1.60	1.40	2.10	6.20	4.30	1.00	0.00	0.00	0.00
3/18/2016	0.00	2.10	1.80	2.20	5.70	4.30	1.20	0.10	0.00	0.00
4/4/2016	4.01	2.42	1.20	3.00	7.50	4.90	0.70	--	--	--
4/26/2016	1.10	0.10	1.20	3.20	5.30	4.95	0.90	--	--	--
5/16/2016	2.70	2.70	2.60	1.30	4.00	7.00	2.00	0.00	0.00	7.00
6/2/2016	0.90	0.80	0.40	1.50	5.11	7.10	0.30	--	0.00	--
6/17/2016	3.10	1.20	0.90	1.50	10.78	7.50	1.00	0.00	0.00	0.00
Min Thickness (ft)	0.00	0.10	0.00	0.00	4.00	4.10	0.30	0.00	0.00	0.00
Max Thickness (ft)	4.01	3.40	2.60	3.20	10.78	7.50	2.40	0.10	0.00	7.00
Avg Thickness (ft)	2.08	1.74	1.07	1.90	6.64	5.27	1.19	0.01	0.00	1.63

Notes:

ft - feet

DNAPL - Dense Non-Aqueous Phase Liquid

-- - Not Measured

Only recovery wells with measurable DNAPL thickness are included in this table; all recovery wells are gauged on at least an annual basis, consistent with the Site Management Plan, and the last complete DNAPL recovery well network gauging event was completed on June 17, 2016.

**Table 4
Summary of DNAPL Removal
National Grid Former Clifton MGP Site
Staten Island, New York**

Location	Bay Street	Willow Avenue						Containment Cell			Event
Well ID	RW-2011	RW-205D	RW-206IB	RW-2071	RW-208I	RW-209S	RW-2111	NRW-01S	NRW-02I	NRW-03D	Volume
Date	Gallons	Gallons	Gallons	Gallons	Gallons	Gallons	Gallons	Gallons	Gallons	Gallons	Gallons
Total Recovered Prior To 2016	361	272	72	108	859	42	59	0	58	32	1,863
1/11/2016	10	15	--	--	24	--	10	--	--	--	59
2/3/2016	15	--	--	--	15	--	--	--	--	--	30
2/18/2016	--	10	--	--	15	--	--	--	--	--	25
3/3/2016	4	--	--	4	7	--	--	--	--	--	15
3/18/2016	--	--	--	--	12	--	--	--	--	--	12
4/4/2016	9	8	--	12	11	--	--	--	--	--	40
4/26/2016	--	--	--	9	12	--	--	--	--	--	21
5/17/2016	13	33	14	--	12	--	8	--	--	--	80
6/2/2016	--	--	--	--	15	--	--	--	--	--	15
6/17/2016	15	--	--	--	20	--	--	--	--	--	35
Total Recovered, 2016 Year to Date	66	66	14	25	143	0	18	0	0	0	331
Total Recovery To Date	428	338	86	133	1,001	42	77	0	58	32	2,194
Percent of Total	19%	15%	4%	6%	46%	2%	3%	0%	3%	1%	100%

Notes:

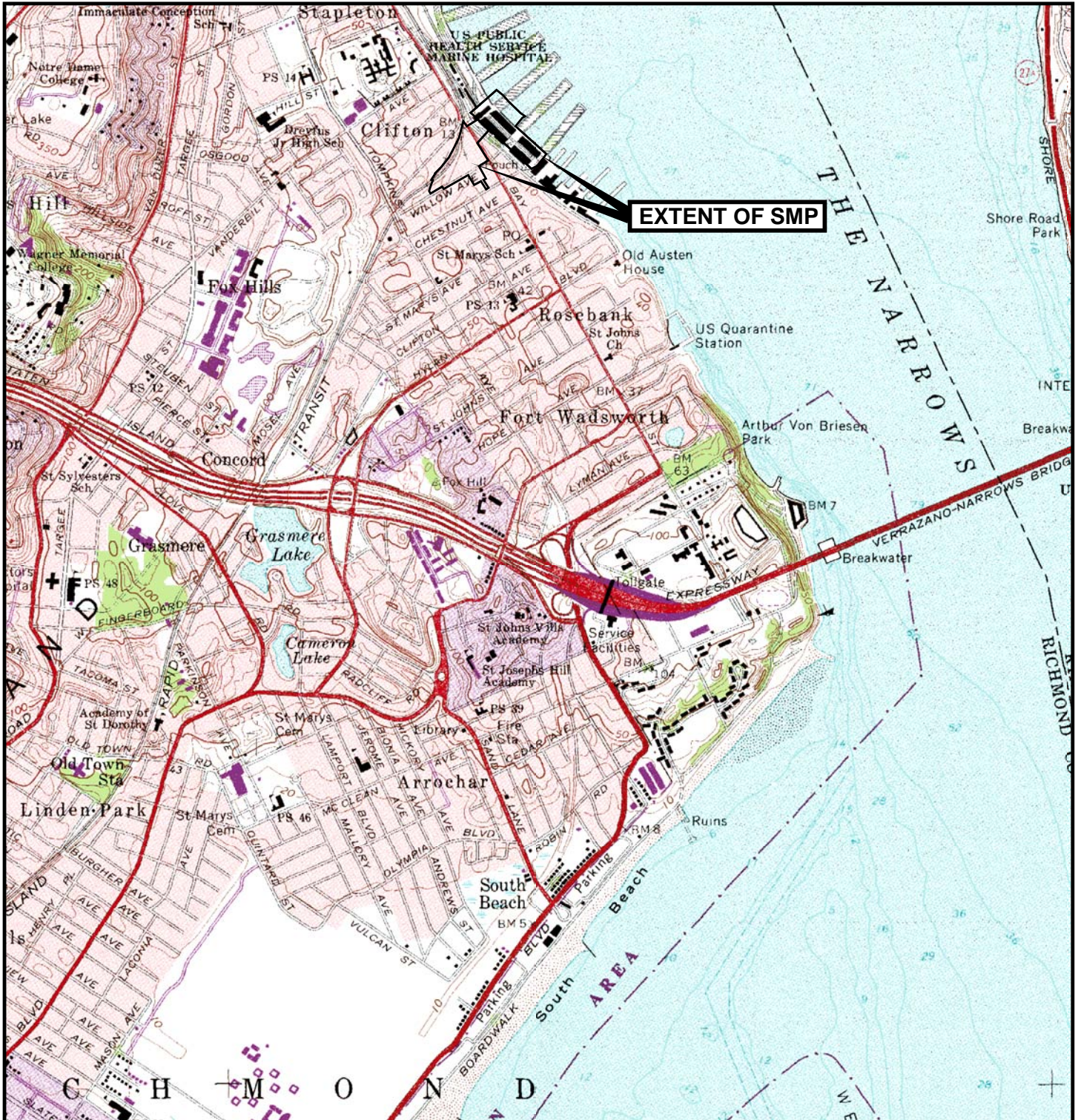
DNAPL - Dense Non-Aqueous Phase Liquid

-- DNAPL was not pumped as the DNAPL level was below the sump

Volumes recorded consist of DNAPL and water mixture

Figures

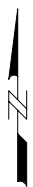
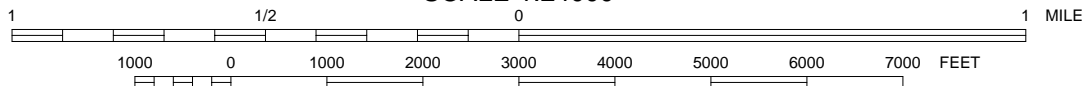
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UNITED STATES GEOLOGIC SURVEY
 THE NARROWS QUADRANGLE
 NEW YORK - NEW JERSEY
 7.5 MINUTE SERIES (TOPOGRAPHY)

THE NARROWS, NY. - NJ.
 1966
 PHOTOREVISED 1981

SCALE 1:24000

















NATIONAL GRID
 FORMER CLIFTON MANUFACTURED GAS PLANT
 INTERIM MONITORING REPORT

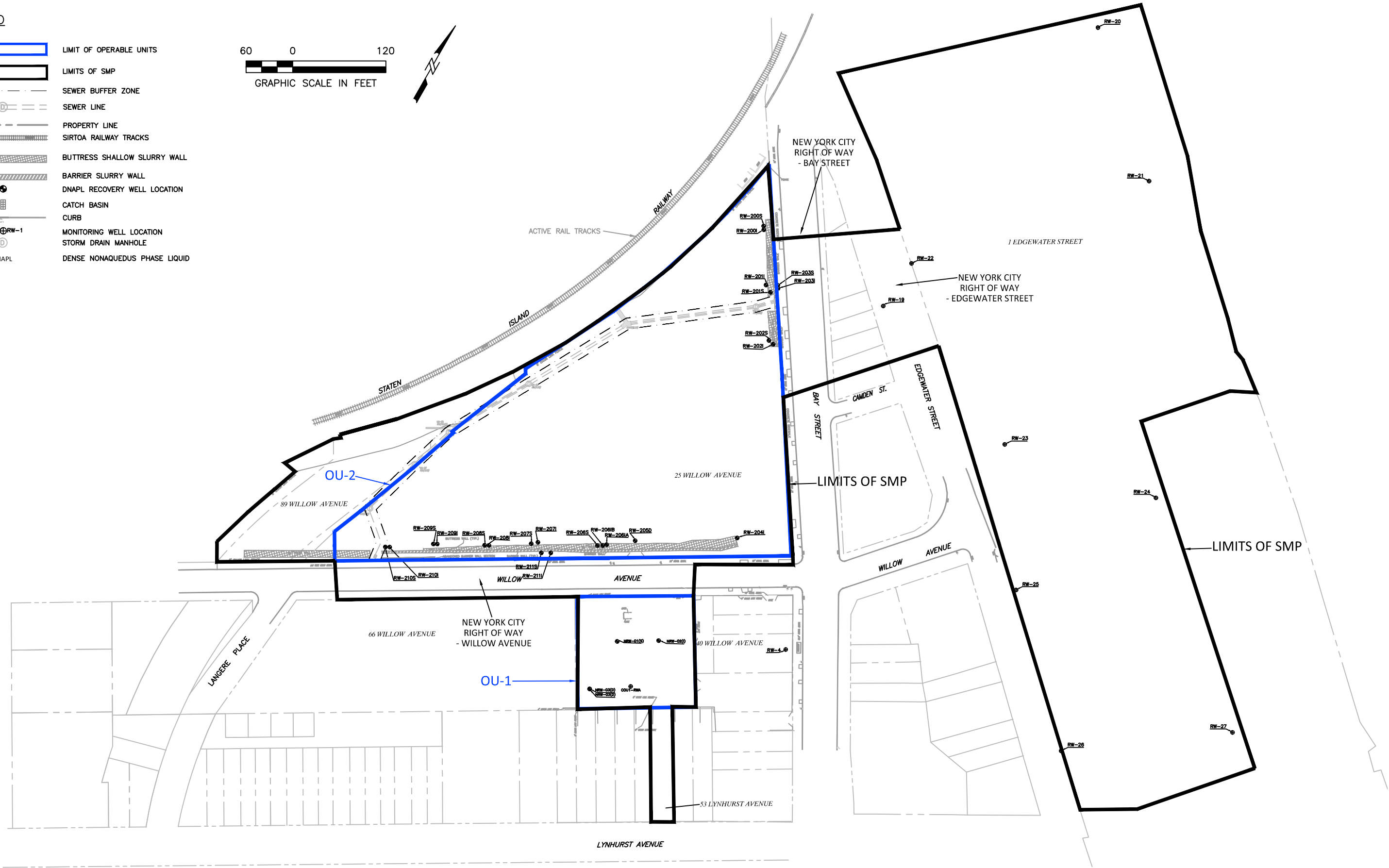
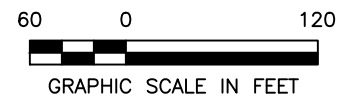
SITE LOCATION MAP

DATE: 07/25/14 | DRWN: RCW | JOB NO.: 60137363-540

FIGURE 1

LEGEND














-  LIMIT OF OPERABLE UNITS
-  LIMITS OF SMP
-  SEWER BUFFER ZONE
-  SEWER LINE
-  PROPERTY LINE
-  SIRTOA RAILWAY TRACKS
-  BUTTRESS SHALLOW SLURRY WALL
-  BARRIER SLURRY WALL
-  DNAPL RECOVERY WELL LOCATION
-  CATCH BASIN
-  CURB
-  MONITORING WELL LOCATION
-  STORM DRAIN MANHOLE
-  DENSE NONAQUEOUS PHASE LIQUID

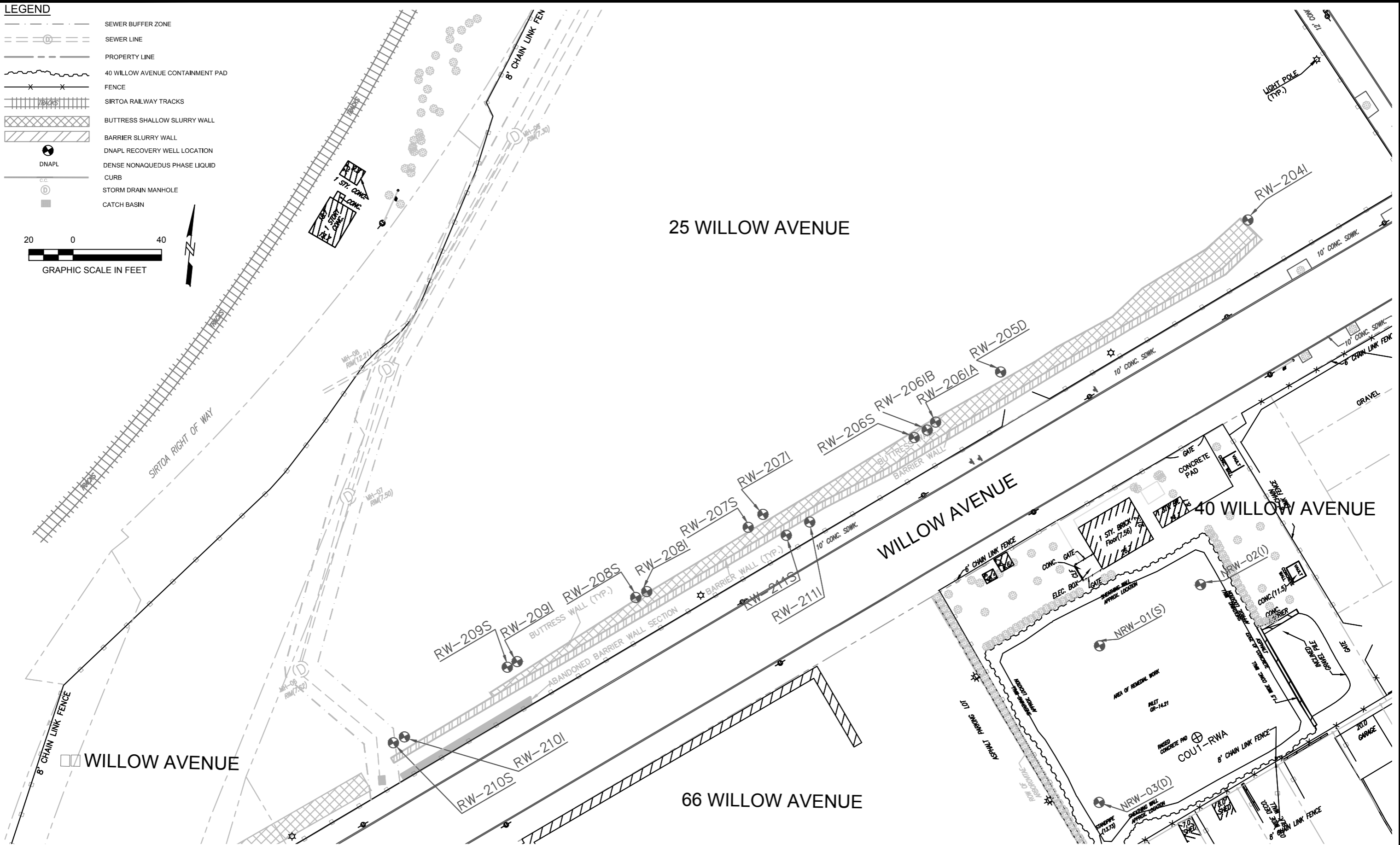
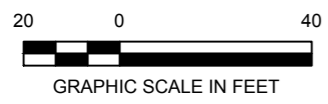


<p>NATIONAL GRID FORMER CLIFTON MANUFACTURED GAS PLANT INTERIM STATUS REPORT</p>		<p>SITE LAYOUT</p>	
DATE: 01/23/2015	DRWN: RCW	JOB NO.: 60137363-540	FIGURE 2

File: \\ny01\proj\01\Environmental\National_Grid\Clifton\60137363\GIS\Layouts\2015-01-23.dwg Layout: 1-2 Interim Status Report - Site Layout - 6/20/15 10:45 AM

LEGEND

-  SEWER BUFFER ZONE
-  SEWER LINE
-  PROPERTY LINE
-  40 WILLOW AVENUE CONTAINMENT PAD
-  FENCE
-  SIRTOA RAILWAY TRACKS
-  BUTTRESS SHALLOW SLURRY WALL
-  BARRIER SLURRY WALL
-  DNAPL RECOVERY WELL LOCATION
-  DENSE NONAQUEOUS PHASE LIQUID
-  CURB
-  STORM DRAIN MANHOLE
-  CATCH BASIN



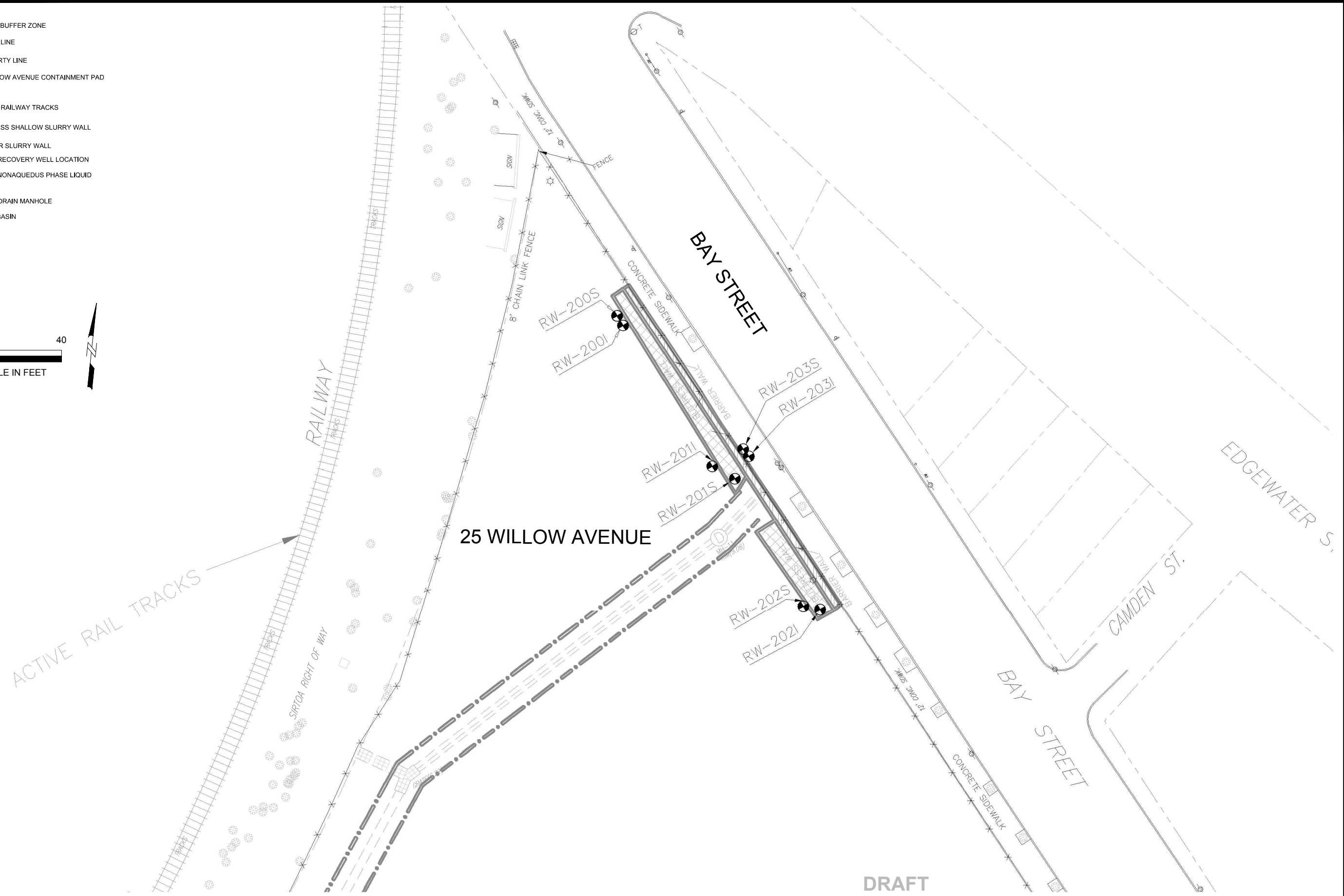
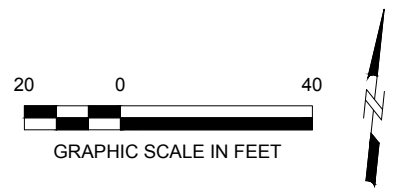
NATIONAL GRID FORMER MGP SITE
 CLIFTON, RICHMOND COUNTY, NEW YORK
 60137363-600

**DNAPL RECOVERY WELL LOCATIONS
 ALONG WILLOW STREET**

DATE: 01/23/2015 DRWN: SNP

FIGURE 3

LEGEND	
	SEWER BUFFER ZONE
	SEWER LINE
	PROPERTY LINE
	40 WILLOW AVENUE CONTAINMENT PAD
	FENCE
	SIRTOA RAILWAY TRACKS
	BUTTRESS SHALLOW SLURRY WALL
	BARRIER SLURRY WALL
	DNAPL RECOVERY WELL LOCATION
	DNAPL
	DENSE NONAQUEOUS PHASE LIQUID CURB
	STORM DRAIN MANHOLE
	CATCH BASIN




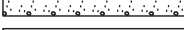
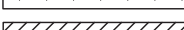
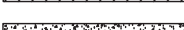
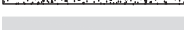

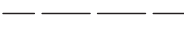













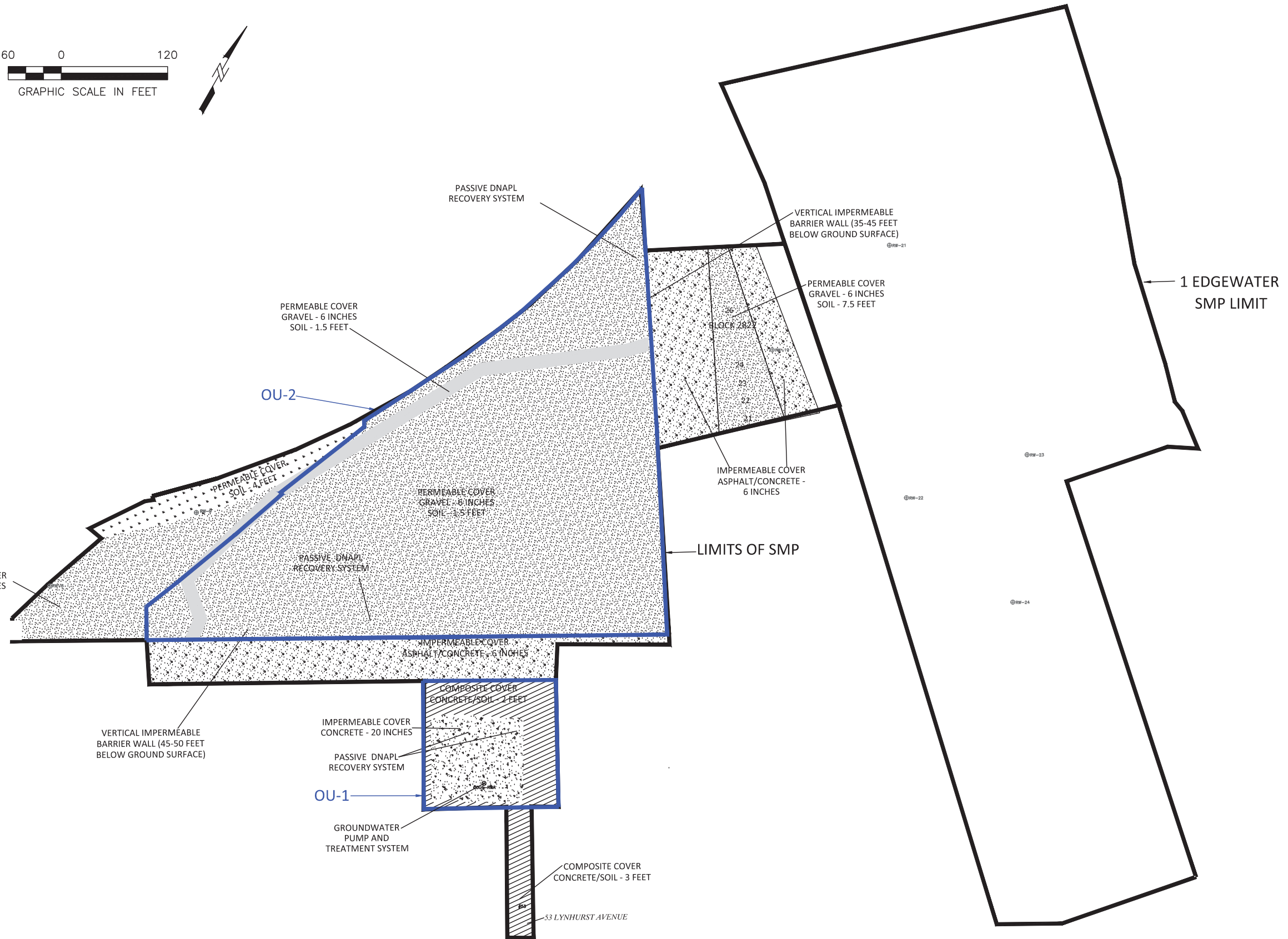
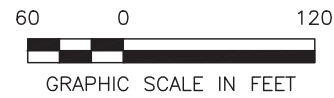
DRAFT

NATIONAL GRID FORMER MGP SITE CLIFTON, RICHMOND COUNTY, NEW YORK 60137363-600		DNAPL RECOVERY WELL LOCATIONS ALONG BAY STREET
DATE: 01/23/2015	DRWN: SNP	FIGURE 4



LEGEND

	LIMIT OF OPERABLE UNIT (OU)
	LIMITS OF SITE MANAGEMENT PLAN (SMP)
	PERMEABLE COVER, GRAVEL/SOIL
	IMPERMEABLE COVER, ASPHALT/CONCRETE
	PERMEABLE COVER, SOIL
	COMPOSITE COVER, CONCRETE/SOIL
	IMPERMEABLE COVER, CONCRETE
	SEWER BUFFER ZONE
	PROPERTY LINE
	FENCE
	SIRTOA RAILWAY TRACKS
	BUTTRESS SHALLOW SLURRY WALL
	BARRIER SLURRY WALL
	DNAPL RECOVERY WELL LOCATION
	DNAPL RECOVERY WELL TO BE REMOVED
	CATCH BASIN
	CURB
	MONITORING WELL LOCATION
	DNAPL
	GROUNDWATER PUMP AND TREATMENT SYSTEM



ENGINEERING CONTROL

CITY OF NEW RIGHT OF WAY AREAS:

1. 6-INCH ASPHALT/CONCRETE COVER.
2. DNAPL RECOVERY SYSTEM.

BLOCK 2822 LOTS 20-24 AND 25 PROPERTIES:

1. 8-FEET GRAVEL/SOIL COVER.

40 WILLOW AVENUE PROPERTY

1. 20-INCH CONCRETE COVER.
2. 2-FEET CONCRETE/SOIL COVER.
3. DNAPL RECOVERY SYSTEM.
4. GROUNDWATER PUMP AND TREATMENT SYSTEM.
5. 125-FEET CONTAINMENT CELL.

53 LYNHURST AVENUE PROPERTY:

1. 3-FEET CONCRETE/SOIL COVER.

25 WILLOW AVENUE PROPERTY:

1. 2-FEET GRAVEL/SOIL COVER.
2. 30-50-FEET VERTICAL BARRIER WALL.
3. DNAPL RECOVERY SYSTEM.

89 WILLOW AVENUE PROPERTY:

1. 2-FEET GRAVEL/SOIL COVER.
1. 4-FEET SOIL COVER.



NATIONAL GRID FORMER CLIFTON MANUFACTURED GAS PLANT SITE MANAGEMENT PLAN		ENGINEERING CONTROL LOCATIONS
DATE: 01/31/2014	DRWN: XW	JOB NO.: 60137363-540
		FIGURE 5