PROPOSED REMEDIAL ACTION PLAN

K-Nassau Works MGP
Manufactured Gas Plant Program
Brooklyn, Kings County
Site No. 224019B
February 2020

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

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SECTION 1: SUMMARY AND PURPOSE OF THE PROPOSED PLAN

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

The New York State Manufactured Gas Plant Program (also known as the MGP Program) is an enforcement program, the mission of which is to identify and characterize suspected former MGP sites and to investigate and remediate those sites found to pose a significant threat to public health and environment.

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

SECTION 2: CITIZEN PARTICIPATION

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

Brooklyn Community Board 2
350 Jay St, Ste 8
Brooklyn, NY 11201
Phone: (718) 596--5410

Key project documents are also included on DEC Info Locator:

http://www.dec.ny.gov/pubs/109457.html

A public comment period has been set from: 02/28/2020 to 03/29/2020

A public meeting is scheduled for the following date: March 19, 2020 at 7:00 pm

Public meeting location: **Building 92 Brooklyn Navy Yard**
63 Flushing Avenue
Brooklyn, NY 11205

At the meeting, the findings of the remedial investigation (RI) and the feasibility study (FS) will be presented along with a summary of the proposed remedy. After the presentation, a question-and-answer period will be held, during which verbal or written comments may be submitted on the PRAP.

Written comments may also be sent through March 29, 2020 to:

Douglas MacNeal
NYS Department of Environmental Conservation
Division of Environmental Remediation
625 Broadway
Albany, NY 12233
douglas.macneal@dec.ny.gov

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

Receive Site Citizen Participation Information by Email

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

SECTION 3: SITE DESCRIPTION AND HISTORY

Location: The Nassau Gas Works site is 3.71-acres, located in an urban area in Brooklyn. It is located at the northwest corner of Kent Avenue and Washington Avenue. The original site footprint ran from Kent Avenue, south and west, under the current Wallabout Channel. The off-site area impacted by site-related contamination consists of a 9.29-acre area that extends beneath Wallabout Channel and the City of New York Department of Sanitation (DSNY) Railroad Siding Area and the Brooklyn Navy Yard Development Corporation (BNYDC) parcel to the south of the site.

Site Features: The site is a flat, paved area with no buildings or structures present.

Current Zoning and Land Use: The site is zoned M3-1 (manufacturing) and is currently vacant. The surrounding parcels are used for a combination of commercial and multi-unit residential.

Past Use of the Site: The site was originally a manufactured gas plant on the far eastern edge of the Brooklyn Navy Yard. The site was originally designated as Operable Unit 2 of the Brooklyn Navy Yard class 2 site (224019A). The most recent use of the site was by DSNY for salt storage purposes.

Site Geology and Hydrogeology: The site is underlain by a 5- to 10-foot layer of fill beneath which are intermingled layers of silt and sand down to approximately 100 feet below grade where a confining unit (the Gardiners Clay) or bedrock is encountered. Groundwater at the site is approximately 8 feet below grade and flows radially out from the north corner of the site to the southwest, south, and southeast towards the East River and Wallabout Channel.

A site location map is attached as Figure 1 with historical site features detailed on Figure 2.

SECTION 4: LAND USE AND PHYSICAL SETTING

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

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

SECTION 5: ENFORCEMENT STATUS

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

The former MGP Site is situated within the northeast portion of a 13-acre parcel owned by the

City of New York. The City of New York and NYSDEC entered into an Administrative Consent Order (ACO) (Index No: D2-0001-9403) in 1996 (1996 ACO) for the 13-acre parcel within the Brooklyn Navy Yard that included the Wallabout Channel Barge Basin, the former MGP Plant, and property utilized by the City that is designated by NYSDEC as a Class 2 Inactive Hazardous Waste Disposal Site (IHWDS No. 224019A). The 1996 ACO required the City to: develop and implement an Interim Remedial Measure program ("IRM program") and Supplementary Site Assessment ("SSA"); and develop and implement a remedial plan to address petroleum contamination in groundwater.

In 2006, the 1996 ACO was suspended and replaced with two separate ACOs (October 2006 ACOs), one for the City (Index No. W2-1089-06-06, Site Number 224019A, OU-1, 9.29 acres) and one for KeySpan (now National Grid) (Index No. W2-1090-06-06, Site No. 224019A, OU-2, 3.71 acres), to develop and implement a remedial program to address MGP-related contamination within OU-1 and OU-2, respectively.

In 2011, the two ACOs were further modified to create separate sites from the operable units, OU-1 henceforth being referred to as Site Number 224019A and OU-2 henceforth being referred to as Site Number 224019B ("the site").

SECTION 6: SITE CONTAMINATION

6.1: Summary of the Remedial Investigation

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

The following general activities are conducted during an RI:

- research of historical information;
- geophysical survey to determine the lateral extent of wastes;
- test pits, soil borings, and monitoring well installations;
- sampling of waste, surface and subsurface soils, groundwater, and soil vapor;
- sampling of surface water and sediment; and
- ecological and Human Health Exposure Assessments.

The analytical data collected on this site includes data for:

- groundwater;
- soil;
- surface water; and
- sediment.

6.1.1: Standards, Criteria, and Guidance (SCGs)

The remedy must conform to promulgated standards and criteria that are directly applicable or

that are relevant and appropriate. The selection of a remedy must also take into consideration guidance, as appropriate. Standards, Criteria and Guidance are hereafter called SCGs.

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

6.1.2: RI Results

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

- coal tar;
- benzene, toluene, ethylbenzene and xylenes (BTEX);
- cyanide; and
- polycyclic aromatic hydrocarbons (PAHs), including acenaphthene, benzo(a)anthracene, benzo(a)pyrene, chrysene, naphthalene and phenanthrene.

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

- groundwater; and/or
- soil.

6.2: Interim Remedial Measures

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

There were no IRMs performed at this site during the RI.

6.3: Summary of Environmental Assessment

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

The Fish and Wildlife Resources Impact Analysis (FWRIA), which is included in the RI report, presents a detailed discussion of the existing and potential impacts from the site to fish and wildlife receptors.

Nature and Extent of Contamination: Both on- and off-site soil and groundwater were analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), metals, polychlorinated biphenyls (PCBs) and pesticides. Based upon investigations conducted to date, the primary contaminant of concern is coal tar and its associated compounds including, but not limited to, benzene, toluene, ethylbenzenes, and xylenes (BTEX), polycyclic aromatic hydrocarbons (PAHs), including acenaphthene, benzo(a)anthracene, benzo(a)pyrene, chrysene, naphthalene, phenanthrene and cyanide. The MGP coal tar has been found at depths exceeding 80 feet below grade and has migrated under the adjacent Wallabout Channel Barge Basin and the eastern end of the Brooklyn Navy Yard. Coal tar impacts beneath Wallabout Channel were observed at depths greater than 20 feet below the mudline of the channel.

Soil - The soil contamination is found in the same areas as the coal tar contamination, both on- and off-site, and includes VOCs (BTEX) and SVOCs (naphthene, acenaphthene, chrysene, benzo(a)anthracene, benzo(a)pyrene and phenanthrene). Detected maximum concentrations of BTEX compounds range from 100 to 500 parts per million (ppm) with the highest concentration being xylene found at 500 ppm compared to the protection of groundwater standard which is 1.6 ppm. Benzene is the most detected BTEX compound with a maximum concentration of 100 ppm compared to the protection of groundwater SCO, which is 0.06 ppm. Detected maximum concentrations of SVOCs range from 230 to 6,800 ppm. The SVOC most prevalent across the site is benzo(a)pyrene with a maximum concentration of 230 ppm compared to the commercial SCO of 1 ppm. The SVOC with the highest concentration is naphthalene with a maximum concentration of 6,800 ppm compared to the protection of Groundwater SCO of 12.

Groundwater - The groundwater is contaminated with VOCs (BTEX), SVOCs (naphthalene and acenaphthene) and cyanide. Benzene concentrations were detected at a maximum of 1,500 parts per billion (ppb) compared to the 1 ppb ambient water quality standard. The standard for ethylbenzene is 5 ppb and concentrations ranged as high as 1,800 ppb. Naphthalene has a standard of 10 ppb and was detected as high as 7,600 ppb. Cyanide has been detected as high as 2,340 ppb, exceeding its 200ppb standard. The shallow groundwater contamination extends to Wallabout Channel. However, the deep groundwater contamination extends almost another 500 feet southwest of the site limit, with toluene found at 37 ppb, compared to a standard of 5 ppb.

Soil Vapor - No soil vapor samples were collected because the site is currently a vacant lot.

Sediment - There is no evidence of sediment impacts to the Wallabout Channel Barge Basin or the adjacent basins of the Brooklyn Navy Yard. While sediment sampling did indicate SVOCs contaminants in the shallow sediment, these levels were well below those that would indicate an impact from MGP tar with the highest concentration being 2.48 ppm for flouranthene. The levels of these SVOCs are similar to other sediment samples from other urban waterways and reflect contamination from non-point sources. MGP tar impacts beneath the Wallabout Channel Barge Basin begin approximately 20 feet below the sediment surface.

Special Resources Impacted/Threatened: A Fish and Wildlife Resources Impact Analysis was performed, and it was determined that no special resources were being threatened or impacted by site related contamination.

6.4: Summary of Human Exposure Pathways

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

The site is completely fenced, which restricts public access, and is covered by asphalt and concrete. Therefore, people will not come into contact with contaminated soil or groundwater unless they dig below the surface. People are not drinking the contaminated groundwater because the area is served by a public water supply that is not affected by this contamination. Volatile organic compounds in soil vapor (air spaces within the soil) may move into buildings and affect the indoor air quality. This process, which is similar to the movement of radon gas from the subsurface into the indoor air of buildings, is referred to as soil vapor intrusion. Because the site is vacant, the inhalation of site related contaminants due to soil vapor intrusion does not represent a current concern. The potential for soil vapor intrusion will be evaluated for any buildings developed on-site. Sampling indicates soil vapor intrusion is not a concern for off-site buildings.

6.5: Summary of the Remediation Objectives

The objectives for the remedial program have been established through the remedy selection process stated in 6 NYCRR Part 375. The goal for the remedial program is to restore the site to pre-disposal conditions to the extent feasible. At a minimum, the remedy shall eliminate or mitigate all significant threats to public health and the environment presented by the contamination identified at the site through the proper application of scientific and engineering principles.

The remedial action objectives for this site are:

Groundwater

RAOs for Public Health Protection

- Prevent ingestion of groundwater with contaminant levels exceeding drinking water standards.
- Prevent contact with, or inhalation of volatiles, from contaminated groundwater.

RAOs for Environmental Protection

- Remove the source of ground or surface water contamination.
- Restore the groundwater aquifer to pre-disposal/pre-release conditions, to the extent practicable.

Soil

RAOs for Public Health Protection

- Prevent ingestion/direct contact with contaminated soil.
- Prevent inhalation of or exposure from contaminants volatilizing from contaminants in soil.

RAOs for Environmental Protection

- Prevent migration of contaminants that would result in groundwater, surface water or sediment contamination.

Soil Vapor

RAOs for Public Health Protection

- Mitigate impacts to public health resulting from existing, or the potential for, soil vapor intrusion into buildings at a site.

SECTION 7: SUMMARY OF THE PROPOSED REMEDY

To be selected, the remedy must be protective of human health and the environment, be cost-effective, comply with other statutory requirements, and utilize permanent solutions, alternative technologies or resource recovery technologies to the maximum extent practicable. The remedy must also attain the remedial action objectives identified for the site, which are presented in Section 6.5. Potential remedial alternatives for the Site were identified, screened and evaluated in the FS report.

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

The basis for the Department's proposed remedy is set forth at Exhibit D.

The proposed remedy is referred to as the Cover System, Institutional Control and Coal Tar Recovery remedy. Refer to Figure 5 in the Exhibits for a depiction of the proposed remedy.

The estimated present worth cost to implement the remedy is $2,500,000. The cost to construct the remedy is estimated to be $1,800,000 and the estimated average annual cost is $120,000.

The elements of the proposed remedy are as follows:

1. Remedial Design

A remedial design program will be implemented to provide the details necessary for the construction, operation, optimization, maintenance, and monitoring of the remedial program. Green remediation principles and techniques will be implemented to the extent feasible in the design, implementation, and site management of the remedy as per DER-31. The major green remediation components are as follows:

- considering the environmental impacts of treatment technologies and remedy stewardship over the long term;
- reducing direct and indirect greenhouse gases and other emissions;
- increasing energy efficiency and minimizing use of non-renewable energy;

- conserving and efficiently managing resources and materials;
- reducing waste, increasing recycling and increasing reuse of materials which would otherwise be considered a waste;
- maximizing habitat value and creating habitat when possible;
- fostering green and healthy communities and working landscapes which balance ecological, economic and social goals;
- integrating the remedy with the end use where possible and encouraging green and sustainable re-development; and
- additionally, to incorporate green remediation principles and techniques to the extent feasible in the future development at this site, any future on-site buildings will include, at a minimum, a 20-mil vapor barrier/waterproofing membrane on the foundation to improve energy efficiency as an element of construction.

2. Cover System:

A site cover currently exists in the form of former concrete foundations and asphalt pavement. This site cover shall be maintained to allow for commercial use of the site. Any site redevelopment will maintain the existing site cover. The site cover may include paved surface parking areas, sidewalks or soil where the upper one foot of exposed surface soil meets the applicable SCOs for commercial use. Any fill material brought to the site will meet the requirements for the identified site use as set forth in 6NYCRR part 375-6.7(d).

3. Coal Tar Recovery:

Installation and operation of coal tar recovery wells above the Gardiners Clay and above less permeable units, across zones of dense non-aqueous phase liquid (DNAPL) saturated lenses, and at locations coordinated with reasonably anticipated future site use, to remove potentially mobile coal tar from the subsurface. The exact number, depth, type and spacing of the recovery wells will be determined during the design phase of the remedy. Coal tar will be collected periodically from each well; however, if wells are determined by the Department to accumulate large quantities of coal tar over extended time periods, they can be converted to automated collection.

4. Institutional Control:

Imposition of an institutional control in the form of an environmental easement for the controlled property which will:

- require the remedial party or site owner to complete and submit to the Department a periodic certification of institutional and engineering controls in accordance with Part 375-1.8 (h)(3);
  - allow the use and development of the controlled property for commercial use as defined by Part 375-1.8(g), which will also permit industrial use, although land use is subject to local zoning laws;
  - restrict the use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by the NYSDOH or NYCDOH; and
  - require compliance with the Department approved Site Management Plan.

5. Site Management Plan:

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

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

Institutional Controls: The Environmental Easement discussed in paragraph 4 above.

Engineering Controls: The cover and coal tar recovery systems discussed in paragraphs 2 and 3 above.

This plan includes, but may not be limited to:

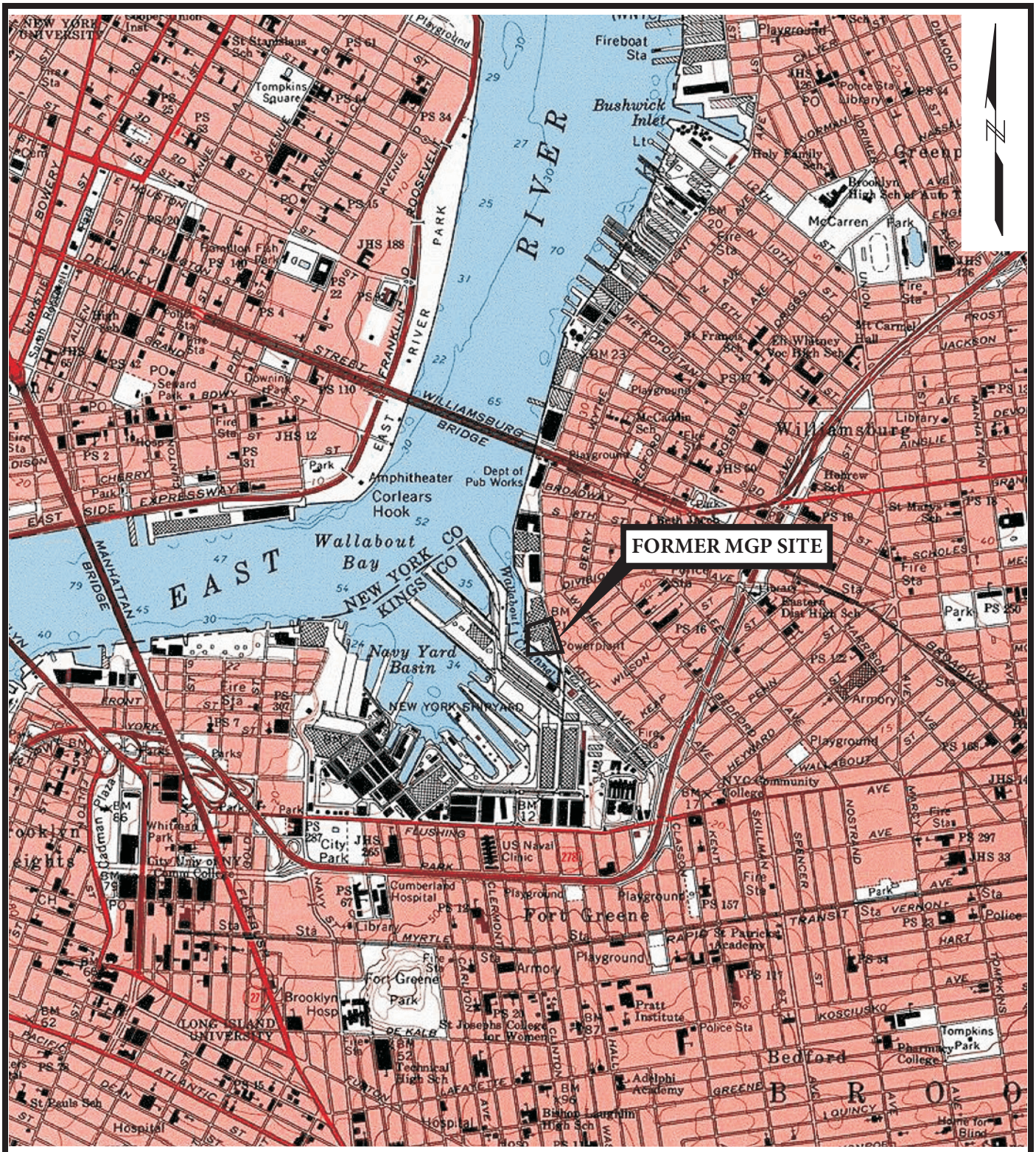
- an Excavation Plan which details the provisions for management of future excavations in areas of remaining contamination;
- descriptions of the provisions of the environmental easement including any land use, and groundwater use restrictions;
- a provision for evaluation of the potential for soil vapor intrusion for any buildings developed on the site, including provision for implementing actions recommended to address exposures related to soil vapor intrusion, and a provision to expand soil vapor intrusion evaluation off-site if on-site soil vapor is shown to be grossly impacted;
- a provision that should a building foundation or building slab be removed in the future, a cover system consistent with that described in Paragraph 1 above will be placed in any areas where the upper one foot of exposed surface soil exceeds the applicable SCOs;
- provisions for the management and inspection of the identified engineering controls;
- maintaining site access controls and Department notification; and
- the steps necessary for the periodic reviews and certification of the institutional and/or engineering controls.

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

- monitoring of groundwater for contaminants of concern to assess the performance and effectiveness of the remedy;
- monitoring of coal tar collection wells for performance and effectiveness;
- monitoring for vapor intrusion for any new buildings developed on the site, as may be required by the Institutional and Engineering Control Plan discussed above; and
- a schedule of monitoring and frequency of submittals to the Department.
- .

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

- procedures for operating and maintaining the remedy;
- compliance monitoring of treatment systems to ensure proper O&M as well as providing the data for any necessary permit or permit equivalent reporting;
- maintaining site access controls and Department notification; and
- providing the Department access to the site and O&M records.

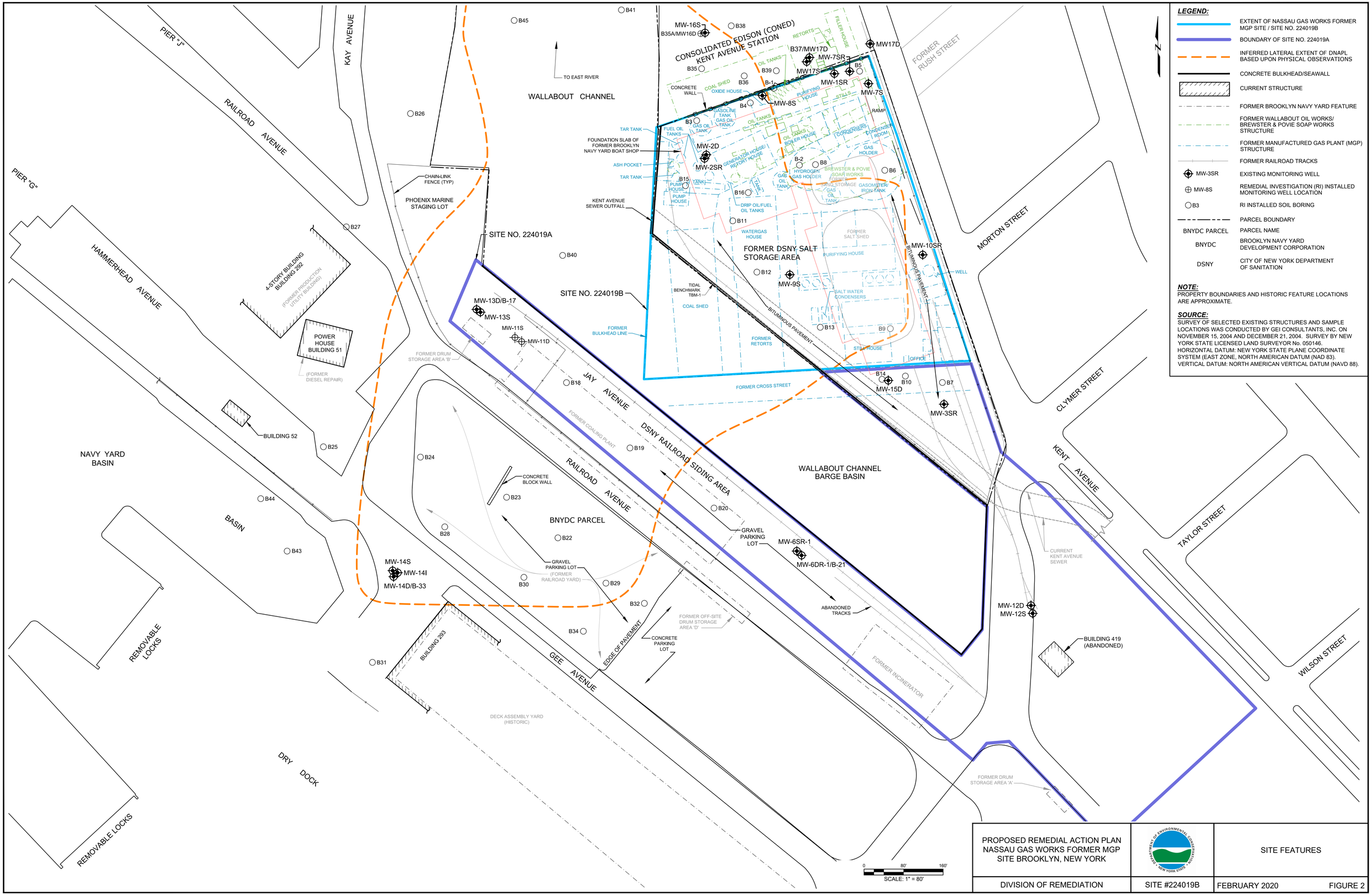


0 2000 4000

SCALE, FEET

SOURCE: Map created with TOPO! ® ©2001 National Geographic (www.nationalgeographic.com/topo)

PROPOSED REMEDIAL ACTION PLAN **NASSAU GAS WORKS FORMER MGP SITE** **BROOKLYN, NEW YORK**		**SITE LOCATION**
DIVISION OF REMEDIATION	**SITE #224019B**	**FEBRUARY 2020** **FIGURE 1**



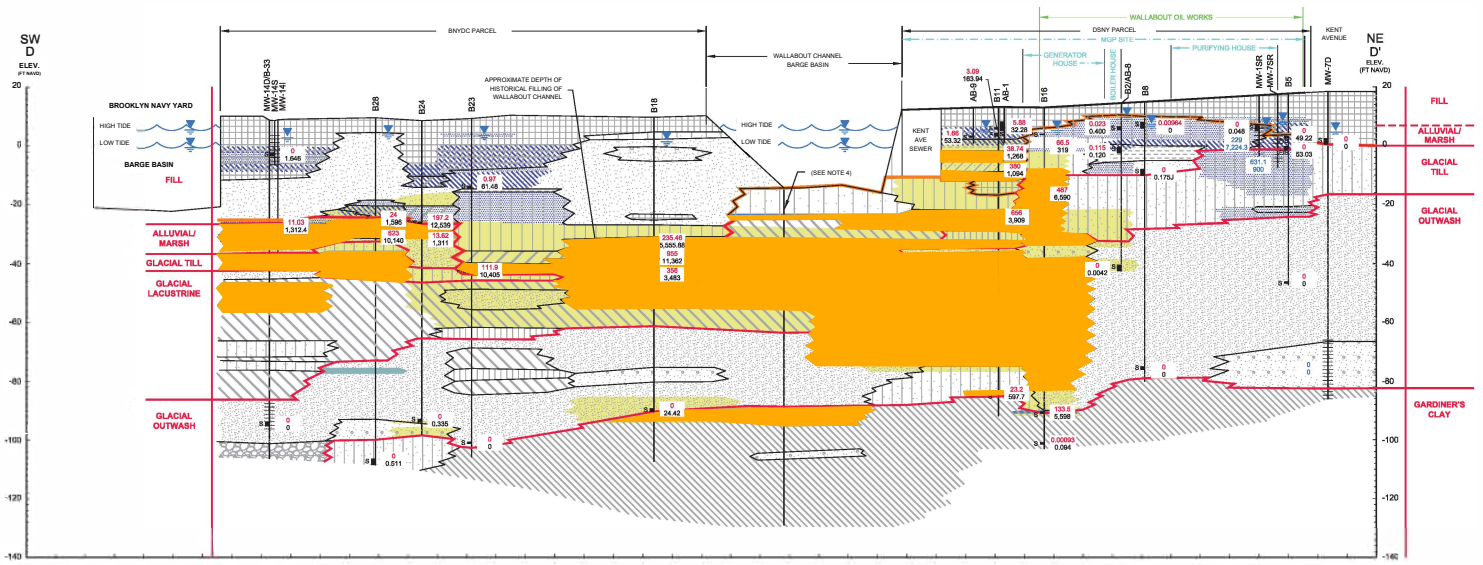
LEGEND:

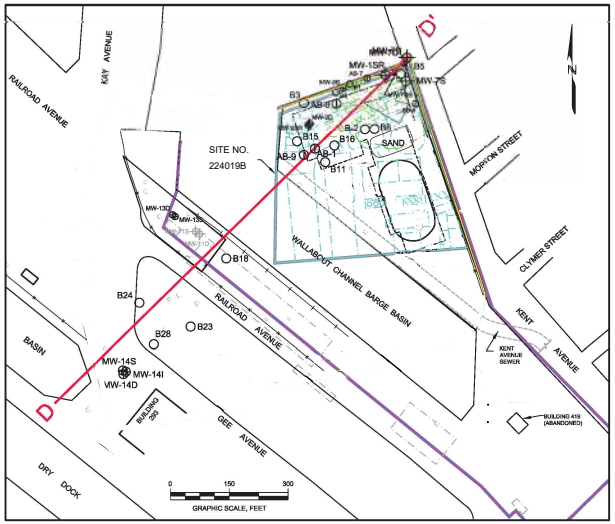
- EXTENT OF NASSAU GAS WORKS FORMER MGP SITE / SITE NO. 224019B
- BOUNDARY OF SITE NO. 224019A
- INFERRED LATERAL EXTENT OF DNAPL BASED UPON PHYSICAL OBSERVATIONS
- CONCRETE BULKHEAD/SEAWALL
- CURRENT STRUCTURE
- FORMER BROOKLYN NAVY YARD FEATURE
- FORMER WALLABOUT OIL WORKS/ BREWSTER & POVIE SOAP WORKS STRUCTURE
- FORMER MANUFACTURED GAS PLANT (MGP) STRUCTURE
- FORMER RAILROAD TRACKS
- MW-3SR — EXISTING MONITORING WELL
- MW-8S — REMEDIAL INVESTIGATION (RI) INSTALLED MONITORING WELL LOCATION
- B3 — RI INSTALLED SOIL BORING
- PARCEL BOUNDARY
- BNYDC PARCEL — PARCEL NAME
- BNYDC — BROOKLYN NAVY YARD DEVELOPMENT CORPORATION
- DSNY — CITY OF NEW YORK DEPARTMENT OF SANITATION

NOTE:
PROPERTY BOUNDARIES AND HISTORIC FEATURE LOCATIONS ARE APPROXIMATE.

SOURCE:
SURVEY OF SELECTED EXISTING STRUCTURES AND SAMPLE LOCATIONS WAS CONDUCTED BY GEI CONSULTANTS, INC. ON NOVEMBER 15, 2004 AND DECEMBER 21, 2004. SURVEY BY NEW YORK STATE LICENSED LAND SURVEYOR No. 050146. HORIZONTAL DATUM: NEW YORK STATE PLANE COORDINATE SYSTEM (EAST ZONE, NORTH AMERICAN DATUM (NAD 83). VERTICAL DATUM: NORTH AMERICAN VERTICAL DATUM (NAVD 88).

PROPOSED REMEDIAL ACTION PLAN NASSAU GAS WORKS FORMER MGP SITE BROOKLYN, NEW YORK	NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION	SITE FEATURES
DIVISION OF REMEDIATION	SITE #224019B	FEBRUARY 2020 FIGURE 2





CROSS SECTION LOCATION MAP

NOTE:
PROPERTY BOUNDARIES AND HISTORIC FEATURE LOCATIONS ARE APPROXIMATE

LEGEND

ALLUVIAL DEPOSITS
- GRAVELLY-SAND
- SAND (SHALLOW)

MARSH DEPOSITS
- SILT (SHALLOW)
- SILT-SAND
- SILT-CLAY
- CLAY (SHALLOW)
- SANDY-CLAY
- GRAVELLY-SILT
- PEAT

GLACIAL TILL DEPOSITS
- SILT (DEEP)
- SILT-SAND
- SAND, SILT, CLAY

GLACIAL LACUSTRINE DEPOSITS
- CLAY (DEEP)
- SILT-CLAY

GLACIAL OUTWASH DEPOSITS
- SAND (DEEP)
- GRAVELLY-SAND
- COBBLE ZONE

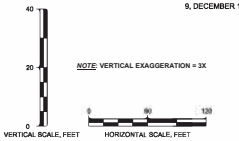
- FILL

PRE-GLACIAL DEPOSITS
- GARDINERS CLAY

PHYSICAL OBSERVATIONS
- VISUAL IMPACTS
- ODORS

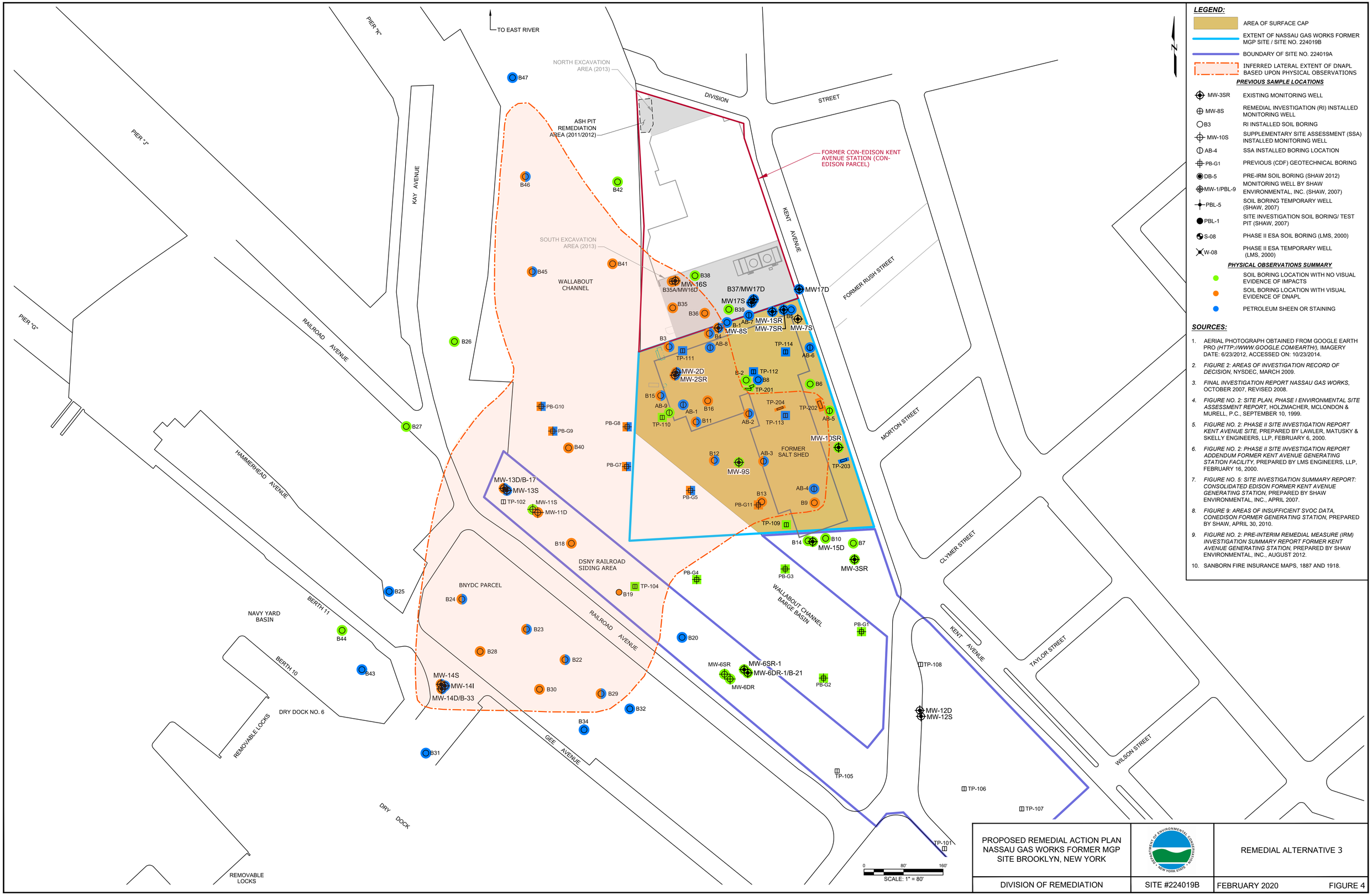
- CONTACT
- CONTACTIS APPROXIMATED
- OBSERVEDAPPARENT GROUNDWATERTABLEBASED UPON BORING INFORMATION
- MW-14D/B-33 — SOIL BORING/ MONITORING WELL IDENTIFICATION
- BORING
- ANALYTICAL SOIL SAMPLE INTERVAL — S — 15.97 BTEX mg/kg; 472.2 PAH mg/kg
- ANALYTICAL GROUNDWATER SAMPLE INTERVAL — F — FORENSIC SOIL SAMPLE INTERVAL
- BTEX ug/L 15.97; PAH ug/L 472.2 — WELL SCREEN INTERVAL

NOTES:
1. LABORATORYANALYTICAL RESULTINFORMATIONSHOWN ON THISFIGURE WERE OBTAINED FROM REMEDIAL INVESTIGATIONS COMPILED BY GEI CONSULTANTS, INC. FROMOCTOBERTO DECEMBER 2004 ANDSUPPLEMENTARY SITE ASSESSMENTINVESTIGATION COMPLETED BYHDR ENGINEERING IN 1997.
2. BTEX STANDS FOR BENZENE, TOLUENE, ETHYLBENZENE AND TOTAL XYLENES.
3. PAH STANDS FOR POLYCYCLIC AROMATIC HYDROCARBONS.
4. GEOLOGIC INFORMATION WAS OBTAINED FROM BORING 64 NAVY YARD EXTENSION, SHEET 4, BORING LOGS PART 3 OF 9, DECEMBER 1943.



NOTE: VERTICAL EXAGGERATION = 3X

PROPOSED REMEDIAL ACTION PLAN NASSAU GAS WORKS FORMER MGP SITE BROOKLYN, NEW YORK		CROSS SECTION
DIVISION OF REMEDIATION	SITE #224019B	FEBRUARY 2020 FIGURE 3



LEGEND:

- AREA OF SURFACE CAP
- EXTENT OF NASSAU GAS WORKS FORMER MGP SITE / SITE NO. 224019B
- BOUNDARY OF SITE NO. 224019A
- INFERRED LATERAL EXTENT OF DNAPL BASED UPON PHYSICAL OBSERVATIONS

PREVIOUS SAMPLE LOCATIONS

- MW-3SR — EXISTING MONITORING WELL
- MW-8S — REMEDIAL INVESTIGATION (RI) INSTALLED MONITORING WELL
- B3 — RI INSTALLED SOIL BORING
- MW-10S — SUPPLEMENTARY SITE ASSESSMENT (SSA) INSTALLED MONITORING WELL
- AB-4 — SSA INSTALLED BORING LOCATION
- PB-G1 — PREVIOUS (CDF) GEOTECHNICAL BORING
- DB-5 — PRE-IRM SOIL BORING (SHAW 2012)
- MW-1/PBL-9 — MONITORING WELL BY SHAW ENVIRONMENTAL, INC. (SHAW, 2007)
- PBL-5 — SOIL BORING TEMPORARY WELL (SHAW, 2007)
- PBL-1 — SITE INVESTIGATION SOIL BORING/ TEST PIT (SHAW, 2007)
- S-08 — PHASE II ESA SOIL BORING (LMS, 2000)
- W-08 — PHASE II ESA TEMPORARY WELL (LMS, 2000)

PHYSICAL OBSERVATIONS SUMMARY

- SOIL BORING LOCATION WITH NO VISUAL EVIDENCE OF IMPACTS
- SOIL BORING LOCATION WITH VISUAL EVIDENCE OF DNAPL
- PETROLEUM SHEEN OR STAINING

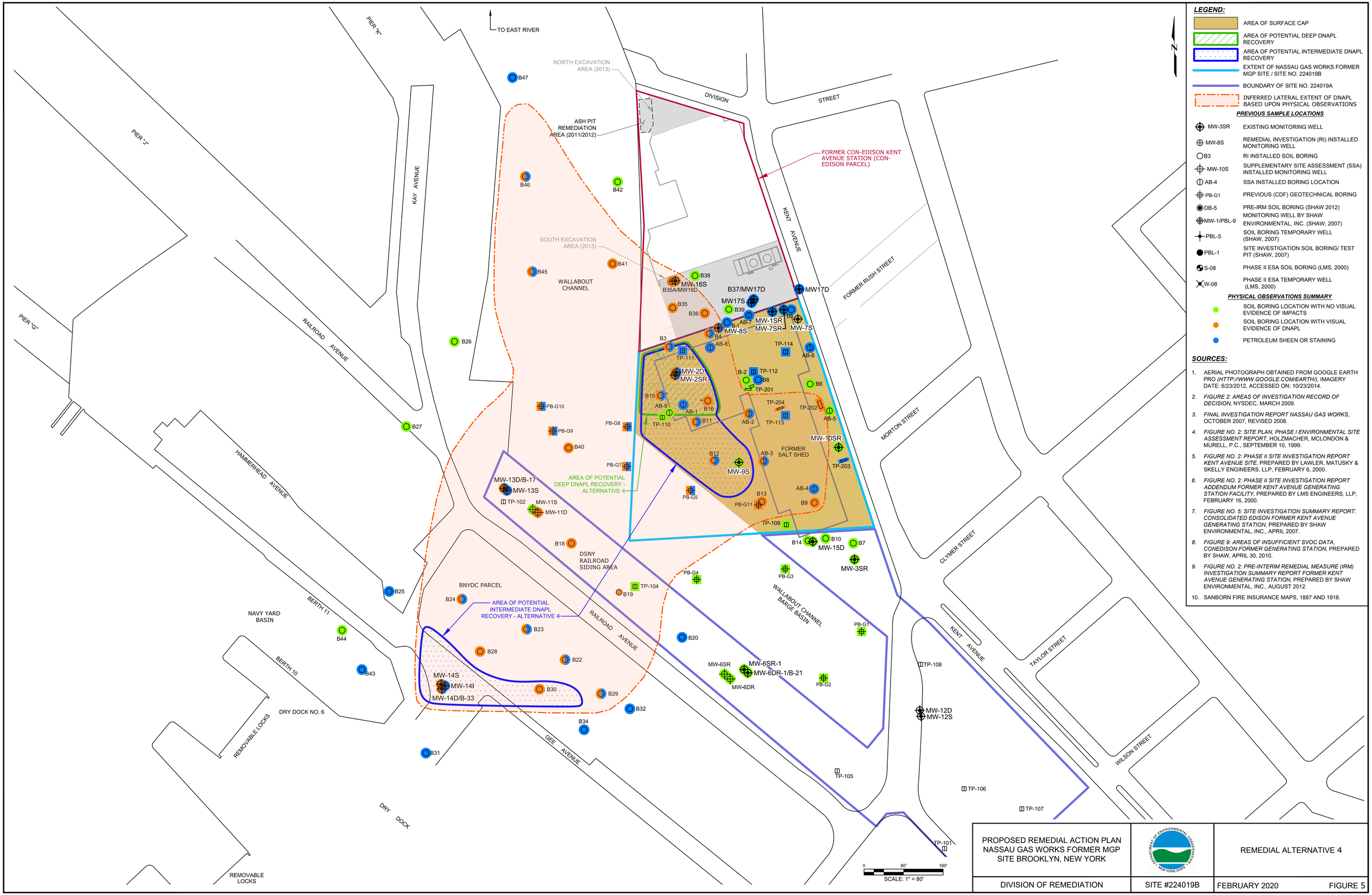
SOURCES:

1. AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH PRO *(HTTP://WWW.GOOGLE.COM/EARTH/)*, IMAGERY DATE: 6/23/2012, ACCESSED ON: 10/23/2014.
2. *FIGURE 2: AREAS OF INVESTIGATION RECORD OF DECISION,* NYSDEC, MARCH 2009.
3. *FINAL INVESTIGATION REPORT NASSAU GAS WORKS*, OCTOBER 2007, REVISED 2008.
4. *FIGURE NO. 2: SITE PLAN, PHASE I ENVIRONMENTAL SITE ASSESSMENT REPORT*, HOLZMACHER, MCLONDON & MURELL, P.C., SEPTEMBER 10, 1999.
5. *FIGURE NO. 2: PHASE II SITE INVESTIGATION REPORT KENT AVENUE SITE,* PREPARED BY LAWLER, MATUSKY & SKELLY ENGINEERS, LLP, FEBRUARY 6, 2000.
6. *FIGURE NO. 2: PHASE II SITE INVESTIGATION REPORT ADDENDUM FORMER KENT AVENUE GENERATING STATION FACILITY,* PREPARED BY LMS ENGINEERS, LLP, FEBRUARY 16, 2000.
7. *FIGURE NO. 5: SITE INVESTIGATION SUMMARY REPORT: CONSOLIDATED EDISON FORMER KENT AVENUE GENERATING STATION,* PREPARED BY SHAW ENVIRONMENTAL, INC., APRIL 2007.
8. *FIGURE 9: AREAS OF INSUFFICIENT SVOC DATA, CONEDISON FORMER GENERATING STATION,* PREPARED BY SHAW, APRIL 30, 2010.
9. *FIGURE NO. 2: PRE-INTERIM REMEDIAL MEASURE (IRM) INVESTIGATION SUMMARY REPORT FORMER KENT AVENUE GENERATING STATION,* PREPARED BY SHAW ENVIRONMENTAL, INC., AUGUST 2012.
10. SANBORN FIRE INSURANCE MAPS, 1887 AND 1918.

PROPOSED REMEDIAL ACTION PLAN
NASSAU GAS WORKS FORMER MGP SITE
BROOKLYN, NEW YORK

REMEDIAL ALTERNATIVE 3

DIVISION OF REMEDIATION | SITE #224019B | FEBRUARY 2020 | FIGURE 4



LEGEND:

- AREA OF SURFACE CAP
- AREA OF POTENTIAL DEEP DNAPL RECOVERY
- AREA OF POTENTIAL INTERMEDIATE DNAPL RECOVERY
- EXTENT OF NASSAU GAS WORKS FORMER MGP SITE / SITE NO. 224019B
- BOUNDARY OF SITE NO. 224019A
- INFERRED LATERAL EXTENT OF DNAPL BASED UPON PHYSICAL OBSERVATIONS

PREVIOUS SAMPLE LOCATIONS

- MW-3SR — EXISTING MONITORING WELL
- MW-8S — REMEDIAL INVESTIGATION (RI) INSTALLED MONITORING WELL
- B3 — RI INSTALLED SOIL BORING
- MW-10S — SUPPLEMENTARY SITE ASSESSMENT (SSA) INSTALLED MONITORING WELL
- AB-4 — SSA INSTALLED BORING LOCATION
- PB-G1 — PREVIOUS (CDF) GEOTECHNICAL BORING
- DB-5 — PRE-IRM SOIL BORING (SHAW 2012)
- MW-1/PBL-9 — MONITORING WELL BY SHAW ENVIRONMENTAL, INC. (SHAW, 2007)
- PBL-5 — SOIL BORING TEMPORARY WELL (SHAW, 2007)
- PBL-1 — SITE INVESTIGATION SOIL BORING/ TEST PIT (SHAW, 2007)
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PHYSICAL OBSERVATIONS SUMMARY

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PROPOSED REMEDIAL ACTION PLAN
NASSAU GAS WORKS FORMER MGP SITE
BROOKLYN, NEW YORK

REMEDIAL ALTERNATIVE 4

DIVISION OF REMEDIATION | SITE #224019B | FEBRUARY 2020 | FIGURE 5

Exhibit A

Nature and Extent of Contamination

This section describes the findings of the Remedial Investigation (RI) for all environmental media that were evaluated. As described in Section 6.1, samples were collected from various environmental media to characterize the nature and extent of contamination.

For each environmental media for which contamination was identified, a table summarizes the findings of the investigation. The tables present the range of contamination found at the site in the media and compares the data with the applicable SCGs for the site. The contaminants are arranged into three categories; volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and inorganics (cyanide). For comparison purposes, the Standards, Criteria and Guidance values (SCGs) are provided for each medium that allows for unrestricted use. For soil, the Restricted Commercial Use SCGs identified in Section 4 and Section 6.1.1 are also presented.

Waste/Source Areas

As described in the RI report, waste/source materials were identified at the site and are impacting groundwater and soil. Wastes are defined in 6 NYCRR Part 375-1.2 and include solid, industrial and/or hazardous wastes. Source areas are defined in 6 NYCRR Part 375-1.2. Source areas are areas of concern at a site where substantial quantities of contaminants are found which can migrate and release significant levels of contaminants to another environmental medium. Wastes and source areas were identified and include areas immediately adjacent to historic gas production and tar handling features on the former City of New York Department of Sanitation (DSNY) Salt Storage Area, the DSNY Railroad Siding Area and Brooklyn Navy Yard Development Corporation (BNYDC) Parcel, and particularly beneath the footprint of Wallabout Channel. Refer to Figure 2 for a Site Features map indicating these areas. These features led to coal tar impacts at the site, including: elevated concentrations of VOCs, particularly benzene, toluene, ethyl benzene, and xylene (commonly and collectively referred to as BTEX); SVOCs, particularly polycyclic aromatic hydrocarbons (PAHs); and metals (cyanide). Coal tar impacts beneath Wallabout Channel were observed at depths greater than 20 feet below the mudline of the channel. In addition, extensive fill material (such as glass, nails, brick, trash, and concrete fragments and petroleum impacted soils) exists on-site and is encountered as deep as 53 feet within the footprint of Wallabout Channel. The former tar handling and gas production structures likely represent the point at which the majority of the tar releases occurred during the manufactured gas plant (MGP) operation. Migration of coal tar in the environment is influenced primarily by the site geology and lithology. From these locations, tar likely migrated downward through permeable soil deposits (fill and alluvial/marsh deposits, glacial till, and outwash sands) until it encountered less permeable soil strata (glacial till and silt-clay lenses). The less permeable soil strata then caused a portion of the tar volume to migrate laterally along the top of less permeable layers. This migration of tar has resulted in bands of tar-saturated soils and zones of residual tar saturation (blebs, lenses, etc.) which coincide with the distribution of BTEX and PAH in soils, and that act as a continuing source of groundwater contamination. As the groundwater flows through the tar contaminated soil strata, it will continue to desorb VOCs and SVOCs, creating an ongoing source of groundwater impacts.

Selection of a remedy to address the waste/source areas identified during the RI will be addressed in the proposed remedies.

Groundwater

Groundwater samples were collected from the former DSNY Salt Storage Area on-site, as well as the DSNY Railroad Siding Area and BNYDC parcel off-site. Groundwater samples collected in the vicinity of former tar handling and storage structures located within the former DSNY Salt Storage Area contained BTEX constituents and PAHs in excess of the SCGs, which decreased by orders of magnitude away from the tar handling structures. Total cyanide was detected in groundwater beneath and down gradient of the tar purifying facilities and tar-impacted soils in excess of its standard. Total PAHs, BTEX compounds and cyanide were not detected above SCG values in groundwater samples collected from the DSNY Railroad Siding Area and the BNYDC parcel. Table 1 below summarizes the groundwater data of representative MGP compounds.

Table 1 - Groundwater

Detected Constituents	Concentration Range Detected (ppb)[a]	SCG[b] (ppb)	Frequency Exceeding SCG
VOCs			
Benzene	ND - 1,500	1	8/19
Toluene	ND - 400	5	7/19
Ethylbenzene	ND - 1,800	5	6/19
Xylenes, total	ND - 1,600	5	6/19
SVOCs			
Acenaphthene	ND - 110	20	2/19
Naphthalene	ND - 7,600	10	6/19
Inorganics			
Cyanide	ND - 2,340	200	2/19

a - ppb: parts per billion, which is equivalent to micrograms per liter, µg/L, in water.
bbb - SCG: Standard Criteria or Guidance - Ambient Water Quality Standards and Guidance Values (TOGs 1.1.1), 6 NYCRR Part 703, Surface water and Groundwater Quality Standards, and Part 5 of the New York State Sanitary Code (10 NYCRR Part 5).

The primary groundwater contaminants are BTEX compounds, as well as naphthalene, associated with operation of the former manufactured gas plant. The primary groundwater contamination is associated with the former gas production and tar handling and storage features.

Based on the findings of the RI, the presence of coal tar has resulted in the contamination of groundwater. The site contaminants that are considered to be the primary contaminants of concern which will drive the remediation of groundwater to be addressed by the remedy selection process are:

- benzene;
- ethylbenzene;
- toluene;
- xylenes, total;
- acenaphthene;
- naphthalene; and
- cyanide.

Soil

Subsurface soil samples were collected at the site during the RI. Subsurface soil samples were collected from depths of 1 - 115 feet below grade to assess soil contamination impacts to groundwater. The results indicate that soils at the site exceed the Unrestricted Use soil cleanup objectives (SCOs) for VOCs and SVOCs. Extensive coal tar-impacted soils were encountered beneath the former gas production and tar handling/storage areas and, to a lesser extent, beneath the former hydrogen gas holder and gasometer structures and adjacent to the former gas oil tank. Coal tar impacts include VOCs, particularly BTEX compounds, and SVOCs, particularly PAHs. These tar-impacted soils were encountered as far north as the site boundary, as far south as the Wallabout Channel, and as far east as the south end of the site boundary. Refer to Figure 5 for a representation of the lateral extent of observed impacts. Tar saturated soils were primarily encountered within sand layers located approximately between 28 and 53 feet below ground surface (bgs) and from 75 feet bgs to the top of the Gardiners Clay on-site within the land surface area and in fill above a fine-grained glacial silt clay beneath Wallabout Channel and off-site within the DSNY Railroad Siding Area and BNYDC Parcel. Isolated tar-impacted soils were encountered in coarse glacial outwash sand and in fine sand layers within the Gardiners Clay on the eastern boundary of the BNYDC parcel. Table 2 below summarizes the soil data of representative MGP compounds.

Table #2 - Soil

Detected Constituents	Concentration Range Detected (ppm)[a]	Unrestricted SCG[b] (ppm)	Frequency Exceeding Unrestricted SCG	Restricted Use SCG[c] (ppm)	Frequency Exceeding Restricted SCG
VOCs					
Benzene	ND - 100	0.06	35/124	0.06	35/124
Ethylbenzene	ND - 430	1	40/124	1	40/124
Toluene	ND - 270	0.7	21/124	0.7	21/124
Xylenes, total	ND - 500	0.26	41/124	1.6	40/124
SVOCs					
Acenaphthene	ND – 1,300	20	28/124	98	18/124

Detected Constituents	Concentration Range Detected (ppm)[a]	Unrestricted SCG[b] (ppm)	Frequency Exceeding Unrestricted SCG	Restricted Use SCG[c] (ppm)	Frequency Exceeding Restricted SCG
Benzo(a)anthracene	ND - 340	1	48/124	5.6	42/124
Benzo(a)pyrene	ND - 230	1	46/124	1	46/124
Chrysene	ND - 340	1	47/124	56	19/124
Naphthalene	ND - 6,800	12	40/124	12	40/124
Phenanthrene	ND - 2,300	100	36/124	500	20/124

a - ppm: parts per million, which is equivalent to milligrams per kilogram, mg/kg, in soil;
b - SCG: Part 375-6.8(a), Unrestricted Soil Cleanup Objectives; and
c - SCG: Part 375-6.8(b), Restricted Use Soil Cleanup Objectives for the Protection of Public Health for Commercial Use/Protection of Groundwater (for those compounds also detected in groundwater).

The primary soil contaminants are BTEX compounds and SVOCs, namely PAHs, associated with operation of the former manufactured gas plant. The primary soil contamination is associated with the former MGP structures including gas production and tar handling and storage features.

While separate phase petroleum and lead contaminated soils were encountered, these impacts are un-related to the MGP and are generally affiliated with the extensive filling of the Navy Yard Area and with prior industrial and defense agency uses of the Navy Yard. Forensic analysis of PAHs in soil samples confirmed that the impacts were not consistent with former MGP operations. In addition, the elevated concentrations of mercury within shallow fill material is related to the fill material itself and is not associated with the former MGP. Furthermore, any polychlorinated biphenyl (PCB) impacts are unrelated to the former MGP. The presence of PCBs are comingled with elevated metal concentrations and petroleum-impacted soils, further supporting that the petroleum impacts encountered are un-related to the former MGP operation and are likely related to historic fill material used in the development of the Navy Yard and Navy Yard operations. Therefore, the petroleum-related, PCB and metal compounds found in soil are not considered MGP-related contaminants of concern. These contaminants were addressed during remedial activities performed in association with the BNYDC property, Site 224019A.

Based on the findings of the RI, the presence of coal tar has resulted in the contamination of soil. The site contaminants identified in soil which are considered to be the primary contaminants of concern, to be addressed by the remedy selection process are:

- benzene;
- ethylbenzene;
- toluene;
- xylenes, total;
- acenaphthene;
- benzo(a)anthracene;
- benzo(a)pyrene;

- chrysene;
- naphthalene; and
- phenanthrene.

Surface Water and Sediments

Surface water quality of the Wallabout Channel Barge Basin was assessed in Fall 2000. Surface water results indicated acute SCG exceedances for a number of metals, however, no MGP-related compounds were reported above SCGs. Surface water has not been more recently assessed due to the tidal exchange and combined sewer overflow (CSO) effluent inputs into the Wallabout Channel and Wallabout Channel Barge Basin, which continue to occur.

Surficial sediments were analyzed along with the surface water quality in Fall 2000. These sediments contained compounds above SCGs relating to CSO discharges, industrial discharges, and recent deposition in a stagnant water body and currently represent urban background sediment concentrations. Surficial sediments post-date the operation of the MGP, the last maintenance dredging of the Channel was performed by the United States Navy in 1957 and 1961, and are un-related to releases from the MGP.

Subsurface sediments were investigated during Summer 2014. These sediments consisted of black to gray organic silt with varying amounts of sand, organic material (sticks, wood fibers, roots, shells, leaves, etc.) and urban fill material (e.g. hair-like material, coal fragments, metal fragments, plastic pieces, etc.) which ranged in thickness from 20 to more than 30 feet. These deposits are a result of harbor sedimentation, industrial discharges or sediment loading from on-going CSO discharges since the last maintenance dredging (post-MGP operations, 1961). Site related coal tar impacts beneath the Wallabout Channel Barge Basin were observed at depths greater than 20 feet below the mudline of the channel.

Exhibit B

Description of Remedial Alternatives

The following alternatives were considered based on the remedial action objectives (see Section 6.5) to address the contaminated media identified at the site as described in Exhibit A.

Alternative 1: No Action

The No Action Alternative is evaluated as a procedural requirement and as a basis for comparison. This alternative leaves the site in its present condition and does not provide any additional protection to public health and the environment.

Alternative 2: Restoration to Pre-Disposal or Unrestricted Conditions

This alternative achieves all of the SCGs discussed in Section 6.1.1 and Exhibit A and soil meets the unrestricted soil cleanup objectives listed in Part 375-6.8 (a). This alternative includes excavation and off-site disposal of soils from impacted pockets and lenses up to more than 100 feet below ground surface in an area encompassing approximately 12.5 acres. Performance of this work requires shoring and dewatering efforts, demolition of two off-site buildings and excavation and off-site disposal of approximately 160,000 cubic yards of soil.

Capital Cost:.....$260,000,000

Alternative 3: Cover System and Institutional Controls

This alternative includes a cover system, including a surface soil cover and impervious caps effective for controlling exposure to impacted surface and shallow subsurface soils, and an institutional control to prevent exposures for potential receptors.

Cover System

A site cover currently exists in areas not occupied by buildings and will be maintained to allow for commercial/industrial use of the site. Any site redevelopment will maintain the existing site cover. The site cover may include paved surface parking areas, sidewalks or soil where the upper one foot of exposed surface soil meets the applicable SCOs for commercial/industrial use.

Institutional Controls

An environmental easement would be placed on the site property to ensure commercial use of the site and restrict groundwater use. A Site Management Plan (SMP) would be developed to provide for the long-term monitoring, maintenance, operation, inspection and reporting of the components of the site remedy. The SMP would include a provision for evaluation of the potential for soil vapor intrusion for any occupied buildings to be erected on-site as well as an Excavation Plan to detail provisions for management of future excavations in areas of remaining contamination.

Present Worth:.....*$106,000*
Capital Cost:.....*$430,000*
Annual Costs:.....*$700,000*

Alternative 4: Cover System, Institutional Control and Coal Tar Recovery

This alternative includes a cover system, including a surface soil cover and impervious caps effective for controlling exposure to impacted surface and shallow subsurface soils, an institutional control, to prevent exposures for potential receptors, and coal tar recovery, to reduce the amount of source material in the subsurface by removing mass.

Cover System

A site cover currently exists in areas not occupied by building foundations and will be maintained to allow for commercial/industrial use of the site, as described above under Alternative 3.

Institutional Control

An institutional control in the form of an environmental easement, including a SMP, for the controlled property will be imposed, as described above under Alternative 3.

Coal Tar Recovery

Installation and operation of coal tar recovery wells within permeable lenses located above less permeable lenses in the subsurface to remove potentially mobile coal tar from the subsurface. The exact location, number, depth, type and spacing of the recovery wells will be determined during the design phase of the remedy but will commence in the area of monitoring wells exhibiting historical collection of free product. Coal tar will be collected periodically from each well; however, if wells are determined by the Department to accumulate large quantities of coal tar over extended time periods, they can be converted to automated collection. The depths and locations will be determined during the design phase and are anticipated to include both on- and off-site areas.

Present Worth:.....*$526,000*
Capital Cost:.....*$1,510,000*
Annual Costs:.....*$2,500,000*

Exhibit C

Remedial Alternative Costs

Remedial Alternative	Capital Cost ($)	Annual Costs ($)	Total Present Worth ($)
1. No Action	0	0	0
2. Restoration to Pre-Disposal or Unrestricted Conditions	260,000,000	0	260,000,000
3. Cover System and Institutional Control	106,000	430,000	700,000
4. Cover System, Institutional Control and Coal Tar Recovery	526,000	1,510,000	2,500,000

Exhibit D

SUMMARY OF THE PROPOSED REMEDY

The Department is proposing Alternative 4, Cover System, Institutional Control and Coal Tar Recovery as the remedy for this site. Alternative 4 achieves the remediation goals for the site by controlling exposure to impacted surface and shallow subsurface soils, preventing exposures for potential receptors, and reducing the amount of source material in the subsurface by removing coal tar. The elements of this remedy are described in Section 7. The proposed remedy is depicted on Figure 5.

Basis for Selection

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

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

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

Alternative 1 (No Action) does not provide any protection to public health and the environment and will not be evaluated further. Alternative 2 offers protection of human health and the environment as it entails the restoration of the site to pre-disposal or unrestricted conditions by excavating all impacted materials; however, this has the potential to increase risk to public health and the environment in the short-term due to potential exposure to previously inaccessible, impacted soils, and impacts to the community to undertake such a large/deep excavation project, with a high number of truck trips and potential for motor vehicle accidents/spillage, etc. Alternatives 3 (Cover System and Institutional Control) and 4 (Cover System, Institutional Control and Coal Tar Recovery) satisfy this criterion by preventing direct exposure to impacted soils, restricting site use, and improving subsurface conditions by removal of the coal tar, which will help protect future subsurface construction workers. The environmental easement and site management plan imposed by Alternatives 3 and 4 restricts the use of groundwater at the site to prevent exposure. They also contain provisions for evaluation of the potential for soil vapor intrusion for any building developed on the site which further protects public health and restricts site use to commercial. Alternative 4 also includes coal tar recovery which provides additional environmental protection by removing mobile coal tar from the subsurface and preventing further migration.

2. Compliance with New York State Standards, Criteria, and Guidance Values. Compliance with SCGs addresses whether a remedy will meet environmental laws, regulations, and other standards and criteria. In addition, this criterion includes the consideration of guidance which the Department has determined to be applicable on a case-specific basis.

Alternative 2 complies with SCGs through the excavation and off-site disposal of all impacted soils. Alternatives 3 and 4 comply with SCGs to the extent practicable with the imposition of an institutional control that restricts the use of groundwater and a cover system that meets regulatory standards in surface soils for commercial or industrial use. Alternatives 3 and 4 both contain a provision for evaluation of the potential for soil vapor intrusion for any building developed on the site to ensure indoor air quality will meet SCGs. In addition, Alternative 4 addresses recoverable coal tar which furthers assists in restoration of groundwater quality to the extent practicable.

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

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

Alternative 2 is effective in the long-term as it entails the excavation and off-site disposal of all impacted soils. A cover system can be effective long-term at preventing direct exposure to soil impacts provided long-term maintenance and monitoring programs are specified in an institutional control and associated SMP. The institutional control is effective in the long-term, through the implementation of site-use restrictions and the SMP which includes an Excavation Plan and an evaluation for potential soil vapor intrusion for any future buildings developed on-site. Both Alternatives 3 and 4 include a cover system and institutional control. Alternative 4 also includes coal tar recovery which can potentially be effective in the permanent removal of some coal tar from the subsurface, although residual coal tar will remain.

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

Alternative 2’s effectiveness at permanently reducing the volume of wastes at the site entails the excavation and off-site disposal of all impacted soils. Alternative 3controls potential exposures with a cover system and an institutional control, but does not reduce the toxicity, mobility or volume of remaining contaminants. Alternative 4 provides the benefits of Alternative 3 with the added benefit of coal tar recovery which provides for the reduction of mobility and volume of contamination. Both Alternatives 3 and 4 include an evaluation for potential soil vapor intrusion for any future buildings developed on-site and both comply with SCGs as described in Criteria 2.

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

The excavation of impacted materials to depths of 100 feet or more under Alternative 2 would cause severe short-term adverse impacts to workers and the community, and potentially to public health, by increasing the potential for exposure. The transport of very large volumes of excavated

soil and backfill would cause significant traffic disruptions and create a huge carbon footprint. The cover system and institutional control of Alternatives 3 and 4 will be effective in the short-term with no short-term impacts. However, the added coal tar recovery of Alternative 4 will slightly increase potential for worker exposure to coal tar that can be readily managed with standard protocols. All three of these alternatives are protective of public health with regard to soil vapor through either excavation of all impacted soils or the institutional control of Alternatives 3 and 4 which contains a provision for evaluation of the potential for soil vapor intrusion for any building developed on the site.

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

Alternative 2 (Restoration to Pre-Disposal or Unrestricted Conditions) is not implementable considering the large-scale effort removing soils to greater than 100 feet below ground surface across an area of more than 12 acres. Both the cover system and institutional control of Alternatives 3 and 4 are implementable. A cover system currently exists at the site and the proposed future site structures and surface features are compatible with the requirements of a cover system. Negotiations and access agreements with the property owner are required for implementation of a land use restriction and application of the SMP. There are potentially greater administrative implementation issues for the coal tar recovery of Alternative 4 associated with the current site development plans, the location of the recovery wells and site access for coal tar recovery and monitoring; however, Alternative 4 is readily implementable technically.

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

The present worth costs of Alternatives 3 and 4 are similar to each other in that they both require a cover system and institutional control. Alternative 4 has added cost associated with the implementation of coal tar recovery; however, the additional cost is small in relation to the added environmental benefit of removing mobile coal tar.

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

The cover system and institutional control of Alternatives 3 and 4 are consistent with the current and proposed commercial land use both on-site and on adjacent properties. T added coal tar recovery of Alternative 4 will require that the location of the recovery wells and the duration of recovery efforts be coordinated with proposed site development. Both alternatives include in the institutional control a provision for the evaluation of the potential for soil vapor intrusion for any building developed on the site.

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

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

Alternative 4 is being proposed because, as described above, it satisfies the threshold criteria and provides the best balance of the balancing criterion.