Chapter 14: Contaminated Materials

A. INTRODUCTION AND METHODOLOGY

OVERVIEW

This chapter describes the potential for soil and groundwater contamination to exist in the project alignment. It summarizes the results of the project's contaminated materials assessments, including the initial soil sampling performed since completion of the SDEIS. It then examines the potential for effects from preexisting subsurface contamination along the Second Avenue Subway alignment and proposed train storage and maintenance areas during the project's construction and operation.

The chapter first describes the project alignment's characteristics and the potential contaminants that are of concern—that is, those contaminants that could already exist in soil and groundwater beneath the alignment, storage yards, and other nearby areas and could be encountered during project construction.

Next, the chapter details the methodology for how contaminated materials studies were conducted for the project. These studies include the Preliminary Environmental Site Assessment (PESA), which was conducted to initially investigate site conditions and to identify locales that warrant further analysis, and the subsequent sampling program that further characterized underlying soil and groundwater conditions.

Next, the chapter presents a discussion of existing conditions, including the results of the PESA and the soil sampling that was conducted at 11 locales along the Second Avenue Subway alignment as part of an ongoing program of subsurface site investigations. This is followed by a description of future conditions whether or not the Second Avenue Subway is built.

Finally, the chapter presents a discussion of the potential impacts from contaminated materials during the Second Avenue Subway's construction and operation, as well as the specific measures that would be employed to protect workers' safety, public health, and the environment.

SECOND AVENUE SUBWAY ENVIRONMENTAL SETTING

The approximately 8.5-mile Second Avenue Subway alignment, extending from 125th Street to Hanover Square, consists of a mix of bedrock in the central area and soil to the north and in the south. Between approximately 92nd and 4th Streets, as well as the area south of Fletcher Street, the subsurface of the project alignment generally consists of bedrock at varying depths below a shallow layer of glacial till and some overlying fill of unknown origin. North of approximately 92nd Street and south of approximately 4th Street, the subsurface generally consists of soils and fill materials of unknown origin. Groundwater is typically found at approximately 10 to 60 feet below grade along the project alignment, and most of the project alignment is partially or completely below the water table.

Most of the alignment is centered beneath existing roads (i.e., the extended Second Avenue corridor). Adjacent properties include predominantly residential and commercial uses. However, some of the neighborhoods served by the proposed project were once industrial and those past land uses as well as current uses may have contaminated the soil, bedrock, and/or groundwater beneath the alignment. In addition, much of New York City, including Manhattan, has been covered with fill material in the past, and fill material often contains contaminants.

In addition to the project alignment, several sites outside Manhattan are being considered for use by the project as subway train storage or maintenance areas. These sites are all existing rail yards. Normal operations at rail yards—particularly maintenance and other operations in the past, when there were fewer environmental regulations—may have, over time, led to soil and/or groundwater contamination from these operations.

Other factors along the project alignment and in the other areas mentioned above influence the assessment of on-site contaminated materials. For example, contamination typically migrates to an adjacent property via groundwater or through soil gas. Proximity to the project route is an important factor in determining potential for impact—the closer a given contaminated site is to a construction activity, the greater the potential that the site of concern might result in contamination reasonably close to the project route. Sites located hydraulically upgradient of the project route with respect to groundwater flow have a greater potential to affect the project site, because contaminants may travel toward the project site in the groundwater. Conversely, those sites located downgradient of the project route with respect to groundwater flow are less likely to have affected the project site. While the groundwater along the project route generally flows toward the East River, local variations are possible. Similarly, movement of soil gases through subsurfaces is difficult to predict because of both natural geological conditions and manmade structures such as utility lines.

Many contaminants that enter the ground bind to soil particles, and therefore are not likely to move far from the source site where they originated. Others can dissolve in or travel with groundwater that passes beneath the source, thereby traveling to, or finding a pathway to, other properties or receptors nearby. Generally, Manhattan bedrock does not have extensive fractures and fissures, but contaminated water can travel through bedrock pathways or in the overlying soil/fill material to other locations.

Because the project could result in changes to short- and long-term groundwater flow patterns, especially if dewatering is required during construction and/or operation, the assessment conducted for the Second Avenue Subway conservatively assumed that any adjacent site might result in contamination along the alignment.

In addition, results of ongoing geotechnical investigations have indicated that the groundwater levels along much of the proposed alignment are tidally influenced. Therefore, construction of the project's tunnels (and specifically its cut-and-cover sections) would have to account for the effects of tidal flow and prevent build-up of water pressure on both sides of the tunnel box structures. Several areas in the southern portion of the alignment were found to cross former streambeds and bulkheads from former shorelines, and on 125th Street, the alignment would pass through a thick peat layer at the site of a former lakebed.

POTENTIAL CONTAMINANTS OF CONCERN

Soil, soil gas, and groundwater can become contaminated as a result of past or current activities on the alignment or on adjacent properties. Many past and current industrial activities use, store,

or generate contaminated materials that can be spilled, dumped, or buried nearby. Other activities common in residential neighborhoods—such as gas stations, auto repair shops, dry cleaners, and paint stores—can also result in contamination due to improper management of raw product and/or waste materials.

Subsurface soil, soil gas, and groundwater contamination can remain undetected for many years, undetected and posing no threat to nearby workers, residents, passersby, or other receptors. Excavation, earthmoving, dewatering, and other construction activities can, however, expose the contaminants, providing a pathway of exposure and introducing potential risk to construction workers and others nearby if such contaminants are not properly managed. In this way, construction of the Second Avenue Subway might encounter contaminated soil, soil gas, and/or groundwater.

Based on the types of contaminants that have been found in New York City—particularly in Manhattan, and including those associated with former or current rail yards—some of the potential contaminants of concern for the project alignment are described below. The list provides a summary description and potential sources of the categories of contaminants and is not a comprehensive list of all contaminants that may be encountered:

- *Volatile organic compounds (VOCs)*. These include aromatic compounds—such as benzene, toluene, ethylbenzene, xylene (BTEX), and methyl tertiary butyl ether (MTBE), which are found in petroleum products (especially gasoline)—and chlorinated compounds, such as tetrachloroethene (also known as perchloroethylene or "perc"), and tricholoroethene, which are common ingredients in solvents, degreasers, and cleansers. VOCs represent the greatest potential for contamination issues since, in addition to soil and groundwater contamination, they can generate organic vapors. Former or current dry cleaners, particularly plants where large-scale processing occurs, and gasoline stations are the most likely sources for substantial VOC contamination in Manhattan. Former manufactured gas plant operations, auto repair, and large gasoline spills can also lead to similar concerns, as can maintenance or fuel facilities at rail yards (although there are now established procedures for the proper storage, handling, use, and disposal of these materials).

- *Metals (including lead, arsenic, cadmium, chromium, and mercury)*. Metals are often used in smelters, foundries, and metal works and are found as components in paint, ink, petroleum products, and coal ash. These metals tend not to travel in soil, and so they would be of greatest concern at the site where they were generated. Metals are not expected to be of great concern under the roadway, but they could be an issue in the rail yards if substantial subsurface construction is required there. Metals are known to be present in fill material throughout the New York metropolitan area.

- *Semivolatile organic compounds (SVOCs)*. The most common SVOCs encountered are polycyclic aromatic hydrocarbons (PAHs), which are constituents of partially combusted coal or petroleum-derived products, such as coal and coal ash, and asphalt. These are common in New York City fill. Coal tar, associated with the historic manufacture of gas for lighting, or "town gas," is a relatively dense viscous liquid mixture composed predominantly of volatile and semi-volatile organic compounds that include PAHs and benzene, toluene, ethylbenzene, and xylene (BTEX).

- *Asbestos*. Steam pipes (and other utility lines) beneath some of the city's streets or in rail yards may be coated with asbestos or encased in "transite." There are well-defined regulatory programs to manage asbestos during construction work. Asbestos containing

materials (ACMs) could also be encountered in properties acquired for Second Avenue Subway activities.

- *Polychlorinated biphenyls (PCBs)*. Commonly used as a dielectric fluid in transformers and some underground high-voltage electric pipelines, PCBs are of special concern at rail yard and train maintenance locations and electric power transformer locations where leakage into soil under or surrounding the transformers may have occurred. PCBs and/or PCB-containing materials were once widely used in manufacturing and industrial applications (i.e., hydraulic lifts, subsurface and surface transformers, and plastic manufacturing, etc.). PCBs are potentially an issue at rail yards or along pipelines, but are less likely elsewhere. They tend to travel only short distances in soil, except in unusual circumstances (e.g., large spills of PCB-containing oils over many years).
- *Pesticides, herbicides, and rodenticides*. These are commonly used to control rodents and/or insects, and vegetation in rail yards, particularly between the tracks.
- *Fuel oil and gasoline storage tanks*. Numerous residences and businesses along the alignment currently have, or once had, both known and undocumented above-ground storage tanks (ASTs) or underground storage tanks (USTs) for fuels, including gasoline. Some of these tanks may have been removed, and others, although no longer in use, may remain buried in place. Fueling facilities are also associated with rail yards and power generation. Some of the tanks are known to have leaked, and others have possibly leaked with no evidence of a spill to date. Some of the spills have been cleaned up in accordance with state regulations, but others have not because they have not yet been discovered or because cleanup, which can take several years, is ongoing. However, both the regulatory process and technologies are in place to address the cleanup.
- *Soil gas*. The air within the soil's pore spaces can become contaminated with various types of gases, including VOCs (described above) and other naturally produced gases, such as methane, hydrogen sulfide, and carbon monoxide. These are all formed from the breakdown of organic material and can be natural (e.g., from old peat deposits) or manmade (e.g., from decaying garbage). Methane is not itself a toxic gas, but can form a potentially explosive mixture when present in the air at high enough levels. VOCs or other soil gases, such as hydrogen sulfide and methane, can present a concern, especially to workers in below-grade spaces, if they are present at high enough levels to be toxic or to create an oxygen-deficient atmosphere.

It should be recognized that the potential contaminated materials identified above are typical of those found in urban areas. Generally, additional analysis to determine whether mitigation is needed is appropriate only when contaminants exceed urban background or regulatory threshold levels. The primary concerns for this project related to potential contaminated materials are worker and community health and safety, and managing the products of excavation in an appropriate manner, including beneficial reuse. The preventative measures that would be employed to address these concerns are discussed later in the chapter.

METHODOLOGY

The contaminated materials assessment conducted for the Second Avenue Subway has had two main stages: 1) a Preliminary Environmental Site Assessment (PESA) and 2) further evaluation of selected locales through subsurface investigations.

First, a PESA was conducted to determine the likelihood and nature of possible contaminated materials at each area where construction activities could potentially disturb soil, soil gas, rock, or groundwater flow. The PESA examined each proposed station area and all proposed tunnel sections that would be built in soil rather than rock, as well as all potential shaft or off-street staging sites and potential storage or maintenance yard sites.

Next, the results of the PESA were evaluated to determine the likelihood for contamination at specific project areas so that these areas could be further tested and analyzed to ensure no effects from contamination would result.[1] Portions of the subway that would be bored through rock were not further assessed. Because these areas would be constructed at least 30 to 80 feet below grade, they are less likely to have been adversely affected by uses located above. However, it is possible that contaminated groundwater or even free-phase contamination (e.g., gasoline or solvents) could be encountered within fractures in the bedrock. Although groundwater samples from bedrock will be collected to determine the potential for such impacts, contamination can be highly localized and is sometimes not released until construction occurs.

Since completion of the SDEIS, subsurface site investigations along the corridor have begun at certain sites identified in the PESA as warranting further analysis. As part of this continuing initial environmental sampling program, a program of 11 borings was performed to collect soil and groundwater samples. This program included both field screening to determine potential contamination, as well as collection of soil and groundwater samples that were then sent to a laboratory for analysis.

For any sources or conditions warranting further analysis, such analysis will be undertaken either during continuing engineering or potentially during construction. (See "Existing Conditions" for the summary results for these borings and more detail in Appendix K.3.)

METHODOLOGY: PRELIMINARY ENVIRONMENTAL SITE ASSESSMENT

As described in the SDEIS, no subsurface testing was performed for the project alignment as part of the PESA, which was the first phase of a comprehensive contaminated materials assessment conducted for the Second Avenue Subway.

The American Society for Testing and Materials (ASTM) Standard E1527-00 sets out a standard practice for performing a "Phase I Environmental Site Assessment." This approach includes four components: records review, site reconnaissance (a visual site inspection of the adjacent buildings and properties from the right-of-way), interviews, and reporting. The ASTM standard is primarily designed to aid a prospective property purchaser's inquiry into the environmental conditions of the property before its acquisition. As this analysis was conducted for the entire approximately 8.5-mile-long, linear Second Avenue Subway project rather than acquisition of any particular property associated with the project, a modified "Phase I"—hereinafter referred to as a PESA analysis—was performed (as described in more detail below), which focused on those aspects of the ASTM Standard that are appropriate to the project at this time.

Records relating to past and current site uses, spills, and other relevant information were reviewed for properties along the alignment. However, because of the scope of the proposed

[1] At Pier 6, where dredging may be required to allow barge operations, more detailed testing of sediment will be required to characterize the nature and extent of possible contamination (see Chapter 15, "Natural Resources," for information related to contaminated sediments in the East River at the Pier 6 site).

subway—8.5 miles of tunnels through a highly developed, predominantly residential and commercial corridor—the ASTM-recommended 1-mile survey was judged not appropriate. Instead, a narrower study area was judged appropriate, typically including all properties adjacent to the current roadway beneath which the subway would travel. A site reconnaissance was performed along the entire alignment, but interior inspections of buildings for all properties adjacent to the alignment were not judged appropriate and consequently were not conducted, nor were current owners or occupants of the buildings interviewed. In addition, the form of report specified by ASTM was modified to consist of this chapter and its supporting tables, figures, and appendices.

The PESA employed a historical map review, regulatory database and records research, and a visual inspection either on the potential alignment/site or from the adjacent right-of-way. The review of historical land maps sought to determine the past uses on and adjacent to the subway alignment, each potential shaft and staging site, the various train storage options, and each maintenance yard. The research involved reviewing Sanborn real estate atlases and fire insurance maps dating from the present back to the late 1800s or early 1900s for such uses as gasoline stations, electric substations, gasworks, chemical works, and other uses that would be more likely to have acted as sources of contamination of underlying soil, soil gas, and groundwater.

In addition, federal and state database and regulatory records were reviewed—including listings of petroleum spills, petroleum storage facilities, and generators of hazardous materials—to determine the regulatory status of sites and the adjacent properties. Finally, a visual inspection of the alignment and potential shaft sites and staging areas was performed to determine potential sources of contamination, including vent pipes and fill caps indicating the potential presence of petroleum tanks, current manufacturing/industrial use, gasoline stations, electrical transformer vaults, dry cleaners, and areas of dumping.

METHODOLOGY: EVALUATION OF SITES THAT WARRANT FURTHER ANALYSIS

The information collected during the PESA process was organized, and the numerous sites identified as having potential contaminants were divided into two groups, depending on the likelihood of potential contamination, based on the professional judgment of geologists, engineers, and environmental health and safety professionals:

The first group includes sites that do not reasonably appear likely to have contaminated the soil, soil gas, or groundwater at the alignment, and therefore do not warrant additional analysis. These include electrical vaults with no known spills, recorded spills that have been "closed" by the New York State Department of Environmental Conservation (NYSDEC), spills confined to manholes, spills on the surface streets, medical or dental offices, electric substations, known small-quantity hazardous waste generators, metal works, paints and oils shops, smaller underground tank facilities, active spills within enclosed structures, and miscellaneous manufacturers. (More information about these sites, as well as those that do warrant analysis, discussed below, is provided in Appendix K.1, "Evaluation of Sites that Warrant Further Analysis." Sites that were found not to warrant additional analysis are those listed as Categories A and B).

The second group includes sites that reasonably appear to have the potential to have resulted in contamination that could have affected the alignment, and should undergo additional analysis. These sites include known "active" status spills, known large-quantity hazardous waste generators, bulk storage facilities, above-ground tanks, auto wreckers, dry cleaners with a plant

on the premises, gas stations, underground gasoline storage tanks, and locations with known contaminated soil and groundwater (see also Appendix K.1, "Evaluation of Sites that Warrant Further Analysis," Category C). Dry cleaning establishments were considered to warrant further analysis, because the halogenated solvents used in the cleaning process have a high potential to travel into soils and groundwater and to thus affect an area extending well beyond the premises. Without proper management, these chemicals can potentially migrate in vapor form and have a potential to enter excavations or even finished stations.

The potential for a given site to have contaminated the project site was estimated based on its proximity to the alignment, the size of facility or spill, the nature of the hazardous material associated with it, the potential for releases of a material into the environment, and the length of time a facility existed at that location. Where a combination of facilities or activities were located together, that combination was judged collectively to consider its potential to have affected the alignment.

Once the sites were categorized, the locations were then summarized in tables provided in Appendix K.1 and then mapped using Geographic Information System (GIS) software to show general trends or groupings of sites. The maps are included in Appendix K.1 and were used to analyze the spatial pattern of sites identified in the PESA in relation to the project alignment. Yard sites, staging areas, and shaft sites were also evaluated through the process described above.

For sites that warrant further analysis, as described later in this chapter, the procedure for further investigations would include, but would not be limited to: determining whether construction activities would disturb the area around the identified site, conducting additional research to determine if there are existing data on site conditions (e.g., subsurface investigations conducted by the property owner or confirmation that no dry cleaning was conducted on the premises), and whether remediation had already occurred (such as spill closure reports). Together, this additional analysis would guide determination of whether subsurface testing should be done.

METHODOLOGY: INITIAL BORINGS PROGRAM UNDERTAKEN SINCE THE SDEIS

Environmental sampling data is necessary for two reasons: first, it guides health and safety procedures and measures necessary to protect both workers and the community, and second, it indicates whether special handling or disposal of spoils or excavated material is likely to be required.

Since completion of the SDEIS, NYCT has initiated an environmental sampling program from 125th Street (East Harlem) to Pine Street (Lower Manhattan) to investigate potential soil and groundwater contamination at the 143 locales identified during the PESA process. Analytical results are available for soil and groundwater samples collected from 10 of these 11 locales initially identified for soil sampling. (At the sampling locale near 65th Street, no sample was collected, as bedrock was encountered at a shallower depth than anticipated and therefore, the targeted depth could not be reached.)

Prior to initiating the sampling program at the 11 locales, detailed protocols were developed for performing the work. These protocols included a Health and Safety Plan ("HASP") to ensure that workers performing the work—as well as the public—would not be adversely affected during the sampling process, an Emergency Action Plan (EAP) and a Hazardous Materials Intrusive Investigation Work Plan (HMII). Another important aspect of the protocols mandated reporting any signs of petroleum or VOCs that were encountered to the New York State

Department of Environmental Conservation (NYSDEC) in accordance with the New York Navigation law.

As shown in the Table 14-1, these 11 locales are distributed throughout the investigation area. Working with the project's engineers, NYCT identified a number of factors—including types, locations, and geographic concentrations of sources; potential pathways; proximity to sensitive receptors; groundwater conditions, geology (rock vs. soil); construction type; and likelihood of contamination—before determining to begin the soil sampling program at these locations. These borings allow for the collection of information needed to perform a Hazard Risk Assessment as required by the U.S. Occupational Health and Safety Administration (OSHA). See "Existing Conditions," below, for the results of the initial boring program.

B. EXISTING CONDITIONS

The results of the PESA appear in Appendices K.1 and K.2. The results of the sampling program conducted at the 11 locales are summarized below and laboratory data are presented in more detail in Appendix K-3.

RESULTS OF PRELIMINARY ENVIRONMENTAL SITE ASSESSMENT

Within the study area, the PESA identified 724 sites with the potential for contamination. Of those sites, 143 were determined to warrant further analysis.[1] Most of the sites identified in the PESA conducted for the project alignment are typical of urban areas, with most of the contaminants that they might produce being commonly found in urban settings. These sites were predominantly gas stations and dry cleaners, but also included present and/or former fuel facilities, bus and rail facilities, power generating stations, chemical facilities, large-quantity hazardous waste generators, petroleum bulk storage facilities, and three former manufactured gas plants in the vicinity of 111th and 99th Streets and near Pearl Street/Park Row.[2] A more detailed description of the sites identified as having the potential for contamination is provided in Appendix K.2.

Former manufactured gas plants are of special concern as they frequently are among the most contaminated sites. The three locations cited above are known to the NYSDEC and are the subject of an August 2002 Consent Order, under which Con Edison, the sites' responsible party, has committed to a Voluntary Cleanup Agreement (VCA) program. Under this program, Con Edison will determine the extent of contamination, if any, at each of the properties and implement a comprehensive investigation and cleanup of each site.

For the Second Avenue Subway project, the potential storage tracks, maintenance yards, and surrounding areas also have potential contamination and warrant further analysis. The potential

[1] (The number of sites increased by 25 from the 118 discussed in the SDEIS for the following reasons: 20 sites were added for areas in rock where surface excavation would likely be required, and a further 5 were added because the study area has been expanded to extend farther to the west on 125th Street).

[2] The specific locations of these sites are as follows: the former East 111th Street Works is bounded by 112th to 110th Streets from Second Avenue to First Avenue; the East 99th Street Works is bounded by 99th to 98th Streets from Second Avenue to the East River; and the 286 Water Street Site is bounded by Water and Catherine Streets.

for contamination exists from the industrial activities that already occur or have occurred in the past on each of the yard sites.[1]

In addition, certain background concentrations can be expected from both natural and anthropogenic sources. Generally, additional analysis to determine the need for mitigation is appropriate only when contaminants exceed urban background levels or established regulatory thresholds.

RESULTS OF INITIAL BORINGS PROGRAM UNDERTAKEN SINCE THE SDEIS

As mentioned above, since completion of the SDEIS, NYCT collected and analyzed soil samples from 10 of the 143 locales initially identified in the PESA process for further analysis, and groundwater samples at 5 of these locales. At all eleven locales, field screening of soils was also performed.[2] Table 14-1 identifies the locations of the initial 11 sampling locales. It also identifies the potential contaminant source identified in the PESA for each locale, as well as the soil, groundwater, and field screening results of the boring program. Figures showing the locations of these borings are provided in Appendix K.3, along with detailed results for the soil and groundwater samples. At certain locales, samples were successfully collected from multiple depths.

An overview of the sampling results is provided below in Table 14-1 and generally confirm the results of the PESA, with 4 of the 11 sampling locales (Park Avenue between 126th and 125th Streets; 97th and Second Avenue; 4th Street and Second Avenue; and St. James Place between Madison and Pearl Streets) yielding results that indicate elevated contaminant concentrations at subsurface levels. The results are not indicative of conditions at street level because there is currently no potential for exposure to these contaminants because they are beneath pavement.

At these four locales, the results indicate that further study is required to determine appropriate measures to minimize exposure to workers and the community and/or to identify special measures to handle and dispose of materials during construction. An overview of the types of measures that would be implemented is provided below under Section D for each type of contaminant.

It should be noted that even contaminants not detected during the initial sampling (e.g., PCBs) cannot be dismissed as absent from the alignment and may be encountered during subsequent investigations. The specific measures that would be used during construction to minimize exposure to workers and the public and for special handling/disposal would depend upon a number of site-specific factors, including the geometry of the work area/excavation; nature of the contaminated medium; type, distribution, and concentration of the contaminant(s), and the potential exposure pathways (e.g., inhalation, ingestion, direct contact). An overview of the types of measures that would be implemented is provided below in Section D, "Preventative Measures to Avoid Impacts." While these borings have confirmed the presence of contaminants in several locations, further investigation is still required to determine the pervasiveness of the contaminants of concern at those locations.

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[1] With the elimination of the Coney Island Yard expansion site from further consideration as a potential yard area, one particularly contaminated site would no longer be affected by the project.

[2] As noted above under the section entitled "Methodology, Initial Borings Program Undertaken Since the SDEIS," no soil samples were collected at the 11th site at 65th Street because of the presence of bedrock.

Table 14-1
Results of Initial Sampling Program

Location	Potential Contaminant Source	Soil Analysis Results	Groundwater Analysis Results	Field Screening Observations
Park Ave between 126th and 125th Sts	Former Gas Station	No contaminants with elevated levels	No contaminants with elevated levels	Petroleum odors, VOCs
Lexington Ave between 126th and 125th Sts	Dry Cleaner; Petroleum Storage Tanks	No contaminants with elevated levels	No groundwater sample collected	No findings of concern
97th St and Second Ave	Manufactured Gas Plant; Petroleum Storage Tanks	Total VOC levels of 102 ppm, total SVOC levels at 1,304 ppm, and lead at 964 ppm	Total VOCs of 1.2 ppm	Coal tar odors, VOCs
91st St and Second Ave	Dry Cleaner	No contaminants with elevated levels	No groundwater sample collected	No findings of concern
65th St and Second Ave	Dry Cleaner	No soil samples collected	No groundwater sample collected	No findings of concern
57th St between Second and Third Ave	Dry Cleaner	No contaminants with elevated levels	No groundwater sample collected	No findings of concern
54th St and Second Ave	Dry Cleaner; Petroleum Storage Tanks	No contaminants with elevated levels	No groundwater sample collected	No findings of concern
11th St and Second Ave	Dry Cleaner; Petroleum Storage Tanks	No contaminants with elevated levels	No groundwater sample collected	No findings of concern
4th St and Second Ave	Dry Cleaner; Petroleum Storage Tanks	No contaminants with elevated levels	No contaminants with elevated levels	Odors, VOCs
St. James Pl between Madison and Pearl Sts	Manufactured Gas Plant, Dry Cleaner, Petroleum Storage Tanks	No contaminants with elevated levels	No contaminants with elevated levels	Hydrogen cyanide, hydrogen sulfide, carbon monoxide, and methane
Water St between Fulton and John St	Printers; Petroleum Storage Tanks	No contaminants with elevated levels	No contaminants with elevated levels	No findings of concern

Note: This table is new for the FEIS.

The discussion below provides information first on the results of the soil and groundwater laboratory analyses, and then on the field screening data. Where appropriate, reports have been filed with NYSDEC regarding spills and other potential concerns throughout this testing process.

SOIL ANALYSIS RESULTS

At 97th Street and Second Avenue, levels of VOCs, SVOCs, and metals—particularly lead—consistent with the former manufactured gas plant were encountered. As noted above, this is one of the sites that Con Edison has committed to investigate and clean as part of their Voluntary Cleanup Agreement with NYSDEC.

At the other locales, although some metals were outside typical non-urban background ranges, no significantly elevated levels were encountered. Additionally, solvents typically associated

with dry-cleaning establishments (e.g., tetrachloroethene, or perc) were found at low levels at certain locations—namely Lexington Avenue between 126th and 125th Streets, 11th Street and Second Avenue; and St. James Place. At all three locations, these were below the most stringent guidelines used to assess soil contamination. However, more testing will be performed at these and other locations prior to any excavation.

GROUNDWATER RESULTS

Groundwater monitoring wells were installed at seven of the 11 locales (Park Avenue between 126th and 125th Sts, 97th Street and Second Avenue, 4th St and Second Avenue, St. James Place between Madison and Pearl Streets, and Water Street between Fulton and John Street). At two of these locales (57th Street between Second and Third Avenues and 11th Street and Second Avenue), no water sample could be collected as the wells were dry.

At the five locales where a sample of groundwater was collected, various volatile organic compounds (including BTEX and perc), semivolatile organic compounds and metals were detected, but at all locales except 97th Street the levels were sufficiently low that treatment would not be required prior to discharge to the sewer system. At 97th Street, the levels of VOCs indicated that treatment for VOCs might be required before groundwater could be discharged to the sewer system. However, more testing of groundwater will be performed prior to any excavation and dewatering.

FIELD SCREENING RESULTS

Various field screening methods are routinely performed as part of subsurface investigations both to provide for worker safety and give preliminary indicators of contamination to assist in developing safety and management procedures. The methods include performing visual observation, noting any unusual odors, and using field instruments to screen soil samples collected from the ground.

Because of the nature of equipment and measurement protocols used in the field, the data are considered semi-quantitative—i.e., they are indicative of the presence of contaminants, but the numerical readings are less precise than those analyzed at a laboratory. Nevertheless, field measurements are important because they provide early warnings for workers at excavation sites that a potential hazard may be present.

At four of the 11 locales, field screening of the subsurface soils indicated the potential for contamination, as follows:

- At Park Avenue between 126th and 125th Streets, petroleum odors and VOCs readings were observed. These observations are consistent with the former gas station in the vicinity. More work is needed to determine the extent of contamination, and management measures would be required to ensure worker safety and specify measures for proper disposal of any contaminated soils.
- At 97th Street and Second Avenue, coal tar odors and VOCs were noted. These data are again consistent with the former manufactured gas facility described above.
- At 4th Street and Second Avenue, odors and VOCs were again noted. These observations are likely attributable to the nearby dry cleaning establishment and/or various petroleum storage tanks.

- Finally, at St. James Place between Madison and Pearl Streets, field data indicated several contaminants which are likely related to the former manufactured gas plant. As at 97th Street, this site is part of Con Edison's Voluntary Cleanup Agreement with NYSDEC.

At the other seven locales where initial borings have been conducted, no elevated levels of contamination that would necessitate special handling during excavation were identified.

CONCLUSION

For all of the sites described above, and throughout the alignment, more study is necessary to determine the existence and levels of any contaminants. As part of this process, more borings will be required at these and other locations prior to commencement of construction activities. Many of the measures identified below in Section D would be conducted throughout the alignment in any case (for example, air monitoring during excavation activities).

As noted below, additional investigation is ongoing and will continue through ongoing engineering and into construction. For each class of contaminant, these investigations will focus on answering the following questions: first, are contaminants present; second, what special procedures are required for legal disposal of these materials; and third, what measures are required to handle contaminated materials safely to minimize potential exposure to workers and the public.

A description of how the various types of contaminants identified at these or other sites where contaminants are identified would be addressed is provided under section D below.

C. FUTURE CONDITIONS COMMON TO ALL ALTERNATIVES

In the future, remediation of sites already known to regulatory agencies (e.g., listed sites and active spills) will continue, though potentially at a slower pace than if construction were required in the vicinity for the Second Avenue Subway. Remediation of some other sites that might be discovered during design or construction phases of the Second Avenue Subway project would likely not occur unless the sites were discovered by some other means. The extent of remediation conducted on some sites might be less without the proposed project, as soil removal underneath roadways is not usually required as a part of site cleanups. However, without the proposed project there would be no exposure to such soils.

D. CONSTRUCTION IMPACTS OF THE PROJECT ALTERNATIVES

NO BUILD ALTERNATIVE

There are no excavation or construction activities associated with the No Build Alternative, and therefore this alternative would have no contaminated materials impacts. Under the No Build Alternative, contaminated sites would only be cleaned up if identified in some other way or as required under some regulatory program.

SECOND AVENUE SUBWAY

The PESA analysis, which conservatively assumed that all study areas would be fully excavated using cut-and-cover methods, identified a preliminary list of locations that warrant further analysis, should the project ultimately require excavation at or near these sites. Construction of the new subway would involve a variety of earthmoving and excavating activities, and

construction activities in these areas could encounter contaminated soil, soil gas, or groundwater. One of the first steps that will occur in the subsequent analysis phase during ongoing engineering will be further definition of locations where project excavation would occur, so that areas of potential concern can be analyzed in more detail in those locations.

This section describes the potential impacts from contaminated materials that could result during construction of the Second Avenue Subway. It also discusses preventative measures that would be taken to avoid significant impacts. With respect to construction phasing, in all cases, if a locale is contaminated, the only time at which impacts could occur there is during construction of the phase in which that locale is affected. Because there are contaminated or potentially contaminated locales along the entire project alignment, it is assumed that the impacts described below could occur during each of the four construction phases.

TYPES OF POTENTIAL IMPACTS

The presence of hazardous materials threatens human health or the environment only when exposure to those materials can occur. Even then, the mere presence of or exposure to such materials does not necessarily constitute a risk to human health. Rather, a health risk requires a complete exposure pathway to the contaminants and a sufficient dose to produce adverse health effects. For these reasons, detailed specifications will be incorporated into the project's Construction Environmental Protection Program (CEPP) to govern construction in known or potentially contaminated areas. As described previously in this FEIS, the CEPP will be the document in which all project commitments and requirements related to construction will be incorporated. NYCT will incorporate relevant portions of the CEPP into all construction contracts, and contractors will be obligated to follow these provisions. For contaminated materials, the types of commitments that will be included in the CEPP and contractual obligations are described below.

For the Second Avenue Subway project, the greatest potential for exposure to any contaminants of concern would be during construction, when construction activities would disturb the soil. This would include contaminated soil, soil gas, and groundwater.

For contaminants such as metals (except mercury), PCBs, and SVOCs found in soil or groundwater, volatilization is not anticipated to occur during subway construction. Therefore, the greatest potential for exposure to these contaminants is via direct contact with the contaminated soil or groundwater, or via inhalation of contaminated dust. Consequently, the focus of the management program that will be defined in the CEPP is to reduce the potential for direct contact with or inhalation of the contaminants. (Dust control measures are described below under "Preventative Measures to Avoid Impacts.")

For contaminants such as VOCs (including gasoline and perchloroethylene), mercury, and soil gases such as methane or cyanide, in addition to the exposure pathways above, inhalation of vapors and movement of vapors through the subsurface pathways and the air are also of concern. Therefore, these types of contaminants require more specialized measures to ensure safety. Fumes, flammable gases, or oxygen-deficient atmospheres are also potential pathways for exposure that would be managed carefully during construction. Nuisance odors may also have to be managed.

Contaminated groundwater, which could be encountered during dewatering, is another potential pathway to exposure, particularly for construction workers inside that excavation. Consequently,

as noted below, preventative measures would also be taken with respect to handling of groundwater.

Within the large station areas and within other portions of the project where work would be conducted in soil, the evaluation identified locations that appear to have some potential to contain contaminated soil, soil gas, and groundwater. If contamination is present, and if the project would involve earthmoving activities there, additional measures would be undertaken to avoid impacts. In the areas where construction in hard rock would occur, the project might encounter contaminated groundwater and related gases seeping through the rock fractures, but the overall potential to encounter contamination in rock is lower than in soil.

PREVENTATIVE MEASURES TO MINIMIZE IMPACTS

Different types of contaminants and media (i.e., whether the contaminants are found in soil, soil gas, rock, or groundwater) require different management approaches. For example, VOCs are of concern because they can move through the soil and into the air, thereby affecting a wider geographic area. Therefore, measures to manage VOCs typically include ventilation with treatment as necessary and transporting contaminated materials in containers and/or covered trucks. Most other soil contaminants are only transmitted when attached to dust. For this reason, all work with the potential to generate dust (e.g., excavation) is done in accordance with OSHA requirements to protect workers (who have the greatest potential for exposure because of their close proximity to the work areas), and with National Ambient Air Quality Standards (NAAQS) to protect the public.

For the Second Avenue Subway, preventative measures would be undertaken to protect the safety of the public, community residents, and construction workers, as well as subway workers and the larger environment for areas where the Second Avenue Subway has the potential to encounter areas identified through the preliminary investigation. As described in this section, these include further investigations to better determine the nature and extent of contamination in areas where the project might encounter it, requirements that contractors perform additional borings before excavation for review and approval by NYCT, and prescribed construction measures to manage contaminated materials during construction. All of these measures will be set out in the project's CEPP, both to meet all applicable legal requirements and to minimize potential impacts. Work would be coordinated with NYSDEC as appropriate and in accordance with applicable requirements. "Measures During Construction," below, summarizes, by class of contaminant, the typical procedures that would be employed.

The Second Avenue Subway's CEPP will contain health and safety requirements specifically addressing the regulations and guidelines that must be met and followed to protect the safety of the public, community residents and construction workers, as well as subway workers and the environment. Contaminated soils, rock, or groundwater must be handled and disposed of properly to comply with federal, state, and local environmental laws.

Further Investigations

The preliminary investigation conservatively assumed that large areas of the right-of-way above the project's tunnel alignment might be excavated. However, many portions of the alignment would not require excavation from the street surface. For stations in rock, excavation would likely be limited to a smaller area than at stations in soil. As ongoing engineering work advances, it will better define the specific areas where excavation would be needed, and additional investigation will be undertaken to determine the potential for contamination at these

sites. This investigation will include additional documentary research as well as possible physical testing of soil, soil gas, and groundwater in the field, as described below.

Many of the sites identified in the preliminary investigation may already have been reported to NYSDEC and have had some level of investigative work. Some may even have been cleaned up with oversight from NYSDEC. For those sites proximate to excavation areas, more detailed research of NYSDEC's records will be undertaken to narrow the areas of concern.

Once the areas requiring excavation for project construction are better defined, additional subsurface investigations will be conducted. For each area of concern, a sampling protocol will be prepared. This protocol will indicate sampling locations based both on their potential to have caused contamination and on the site's location relative to proposed construction activities and the basis for the need for sampling. The sampling plan, to be included in the protocol, will set forth sampling locations based on the proposed construction activities and subway design, as well as geology (e.g., depth of construction and location of groundwater). The protocol will also detail the proposed monitoring well locations and sampling plan, including monitoring well depths and design, laboratory analysis parameters, and the management of investigation derived wastes, including drill cuttings, drilling fluids, decontamination fluids, and monitoring well purge fluids. The report of fieldwork will include soil boring and monitoring well installation logs and soil gas readings.

The protocol will also include a "Quality Assurance Project Plan" that will detail the quality assurance and quality control (QA/QC) program. This program will be based on the NYSDEC's QA/QC, as well as on U.S. Environmental Protection Agency (EPA) requirements. This plan will describe laboratory methods, field quality control sampling, sample custody procedures, and field decontamination procedures. The protocol will also contain site-specific Health and Safety Program (HASP) plans, described in more detail below.

After completion of the subsurface investigation, a detailed report will be prepared that summarizes the findings of field activities and compares the analytical results with the appropriate federal, state, and city standards and guidelines. Due to space constraints at staging areas and the limited areas available for stockpiling soils, subsurface investigations would be completed prior to excavation so that mitigation measures can be determined in advance of excavation. In some cases, these measures may be implemented prior to excavation. For example, contaminated soils in some areas may be treated prior to excavation to avoid potential exposure at the time of construction.

Measures to Manage Contaminated Materials During Construction

Once contamination is known or suspected to exist in areas where excavation would be required, appropriate measures would be established and documented in a CEPP, and then followed to safely manage these areas and to avoid nuisance odors during construction. The CEPP would include health and safety procedures to minimize exposure to workers and the public, including monitoring both dust and VOCs at both the work zone and in the community. Ongoing work zone monitoring for soil gases, such as methane, would also be performed during all excavations to ensure the safety of those in the work zone and surrounding area. Finally, the CEPP would also include procedures for stockpiling, testing, loading, transporting, and properly disposing of the material.

Many of the contaminated materials management procedures described in this section apply to all classes of contaminants. However, in some cases, different measures would be required, as detailed below.

Excavation, Disposal, and Other Mitigation Measures. For all contaminants, if contaminated soil or rock requires excavation procedures would be developed to properly separate contaminated material from non-contaminated material and ensure proper management of the solid waste and contaminated spoils. Excavated contaminated and uncontaminated spoils would be disposed of in accordance with applicable local, state, and federal guidelines and regulations under a Spoils Management Plan contained in the CEPP, and would generally be handled through a program of excavation and off-site disposal. This could take place either before or during the subway excavation itself and would potentially require the following a rigorous soils testing program to determine the nature and degree of contamination within the soil, appropriate off-site disposal (at an authorized off-site landfill or recycling facility) or on-site reuse in accordance with a NYSDEC Beneficial Use Determinations (BUDs), and appropriate health and safety precautions. Among the pertinent regulatory requirements are those found in 6 NYCRR Parts 360 through 376, which identifies hazardous waste and other waste management requirements. Any waste disposal that would occur out of New York State would be regulated by similar federal and individual state requirements.

Alternatively, in certain situations and depending on the type and extent of contamination, it may be feasible to implement measures other than excavation and disposal to manage the contamination. These measures can include soil vapor extraction for VOCs; adding lime to soil to minimize the generation of hydrogen cyanide gas; soil vapor barriers for VOCs or soil gases; and capping for metals, SVOCs, and PCBs.

As noted earlier, many of the sites identified along the project alignment as warranting further analysis were former gasoline stations or dry cleaners (which are considered likely to have some VOC contamination). Procedures for cleanups of gas stations or fuel oil spills are generally similar to, but usually less complex and time-consuming than, those for dry cleaning facilities. Petroleum-related contaminants tend not to travel as far as the solvents associated with dry cleaning, and, due to the relatively larger number of petroleum spills, procedures and protocols for investigation and cleanup tend to be more standardized.

Health and Safety Plans (HASP). As part of the CEPP, HASP plans would be developed for the various construction activities associated with the project. Since the exposure pathways and other safety concerns associated with different construction methods vary, several plans are expected to be required. Each plan would address both the known contamination issues and contingency items. HASP plans would be developed in accordance with OSHA regulations and guidelines.

The site-specific HASP plans would be the primary measure used to safeguard construction workers and nearby residents during construction work. This document would describe in detail the health and safety guidelines, procedures, and work practices that must be adhered to and the work to be performed and special details such as confined spaces. The hazards would be evaluated by determining the contaminants of concern and their chemical and physical characteristics and health hazards considered within the potential exposure associated with the work to be performed. Air, soil, and water sampling and monitoring that would take place during the work would be consistent with all applicable regulations and guidelines. An emergency response plan would also be included in the event that monitoring data indicates a potential major hazard, and protocols for reporting spills or other concerns to relevant governmental agencies would be defined. Appropriate ventilation and, if necessary, treatment of ventilated air would be conducted in accordance with applicable city, state, and federal regulations. These measures would only be likely to be required at sites where VOCs and/or soil gas are a concern.

The plan would define the appropriate designated personnel to ensure that all requirements of the HASP plans are implemented and the training and qualifications required for on-site personnel. This training would enable personnel to recognize and understand the potential hazards to health and safety, provide them with the knowledge and skills necessary to perform the work with minimal risk to health and safety, and ensure that they can safely avoid or escape from emergencies. It would also define site work zones and the air monitoring necessary to identify potential exposure of the field personnel or the public to potential environmental hazards in the soil, soil gas, vapors, sewer gas, or groundwater. This monitoring would be defined for the appropriate environment. During subsurface work (especially within confined spaces), air monitoring would be conducted for (but not limited to) oxygen, carbon monoxide, methane, VOCs, respirable dust, hydrogen cyanide, and hydrogen sulfide, as appropriate. All TBMs used to excavate tunnels would be equipped with gas detection equipment to warn workers in the event that gas is encountered in the tunnels. A community air monitoring program would be designed to monitor for respirable dust, gases, and vapors that have the potential to leave the work area. The plan would discuss specifically the dust and vapor control measures and emergency procedures that are to be followed.

As per the HASP plans, work within confined and permit confined spaces (as defined by OSHA) would be conducted in accordance with OSHA 29 CFR 1910.146 (j). A medical surveillance program would be developed as necessary in accordance with OSHA regulation 29 CFR 1910.120 (f). Finally, the plan would define appropriate personal protective equipment (PPE), such as respirators to be used by workers in various excavation activities based on 29 CFR 1910.120, *Hazardous Waste Operations and Emergency Response, Appendix B, "General Description and Discussion of the Levels of Protection and Protective Gear.*"

Given the scale of the project and the variability in conditions over relatively limited areas, it is likely that unexpected contaminated soils would be encountered during construction. The HASP plans would set out appropriate procedures for handling such situations. These procedures would include requirements to notify appropriate regulatory agencies as well as procedures to quickly and safely address the issue so as to avoid construction delays. The HASP plans would also include routine monitoring of both air and soil/rock (in place and/or as spoils) to identify both the potential for unacceptable exposures and unforeseen contamination and the need for testing, special handling, or disposal of materials. It is also possible that volatile gases may be encountered during the excavation, even with management of hazardous materials. Temporary measures to prevent such a situation from becoming a hazard might include the use of ventilation systems within the excavation and the use of appropriate personal protective equipment. These potential hazards would be addressed in the HASP plans.

Dewatering. Construction of the subway would require removal of groundwater from the excavation area. It is likely that some of the groundwater requiring removal might be contaminated. If this groundwater exceeds the sewer use limitations set by the New York City Department of Environmental Protection (NYCDEP), the water would need to be treated by readily available technologies (such as oil-water separators for petroleum-related VOCs and SVOCs; activated carbon for VOCs; or filtration with sand or membranes for these and other contaminants). The decision about which of these procedures to use would depend on the types and levels of contamination detected at the time of excavation, and the quantity and rate of water requiring treatment. After treatment, the water would be retested before being discharged to sewer systems or an area water body via a State Pollutant Discharge Elimination System (SPDES) permit. An appropriate testing program where groundwater is known or suspected to

be contaminated would be developed as part of the project's CEPP. (For more information on groundwater, see Chapter 15, "Natural Resources.")

It is possible that the boring activities associated with tunnel construction in bedrock would change local groundwater flow patterns, both by providing a sump and conduit through the bedrock, and also by potentially creating, opening, or enlarging existing fractures and weaknesses within the bedrock in the vicinity of the boring. If this occurs, it is possible that contaminated groundwater (most likely from VOCs) or pure products (such as gasoline and solvents such as perc) may flow toward the tunnel, even from areas not investigated above. Monitoring for volatile gases would be done on an ongoing basis during rock excavation; if necessary, measures would be taken to collect the contaminated liquids and contain the intrusion. These measures would be undertaken carefully to minimize risks both from the liquids themselves and any vapors that they could generate. This situation would be set out in the HASP plans.

Work at Yards. All of the potential storage tracks and maintenance yard sites evaluated in this FEIS have the potential for contaminated soils and groundwater, except those located entirely in rock (e.g., those located on 125th Street west of the new 125th Street Station, between approximately 21st and 9th Streets on both sides of the alignment, and south of the Hanover Square Station). Additional subsurface investigations would be conducted where soil disturbance would occur and remedial measures, as described above, would be implemented in accordance with the CEPP.

E. PERMANENT IMPACTS OF THE PROJECT ALTERNATIVES

NO BUILD ALTERNATIVE

With the No Build Alternative, no Second Avenue Subway would be created, and no hazardous materials impacts would occur. Most contaminants in the soil or groundwater at the project site would remain in place, although some limited cleanups might occur at selected locations, if required by regulation for other projects.

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Once construction activities are completed, any remaining non-volatile subsurface contaminated materials would be "capped" by paved areas and potential pathways of exposure would be eliminated. Materials that qualify as hazardous or industrial waste would be removed from the site and disposed of in approved landfills or reused under a beneficial use determination whenever possible.

The proposed construction includes concrete tunnel liners with voids between the liner and the rock/soil sealed by injecting cement grout under pressure. This is designed to create an effective barrier against the seepage of water and most vapors into the tunnel. To minimize the possibility that vapors and contaminated groundwater could infiltrate the tunnel and station cavern, vapor and water barriers or other similar measures would be installed in areas where it is determined that such a threat exists and where feasible and required.

It is also possible that contaminated groundwater might migrate into the sumps (low points used to collect water and pump it to the sewer system). A testing protocol would be developed and approved by NYCDEP as part of the permit/approval and CEPP process for the construction of the project. Groundwater would also be sampled. If any groundwater exceeds NYCDEP's sewer

use limitations, it would need to be treated by readily available technologies and retested before being disposed to sewer systems. This would not result in any significant impact to workers, passengers, or wastewater treatment plants. Any contamination discovered once the subway is operational would be handled by NYCT in consultation with NYSDEC.

Operations both of the subway and the yards would include the use of a variety of chemicals, including fuels, lubricants, and other oils. All applicable tank certificates would be obtained and all regulatory requirements would be met. There are numerous applicable city, state, and federal regulations that cover the storage, handling, proper use, and disposal of these chemicals. Written procedures would be created and followed both to ensure the safety of workers and the public and to ensure all applicable regulations are followed. At some sensitive locations, additional procedures would be developed (in conjunction with stormwater management plans) to ensure that contaminated materials do not affect these sensitive areas.

F. MITIGATION MEASURES

Because of the potential that contaminated materials could be encountered both in known contaminated areas of the project (as described above) and in other unexpected areas, site-specific HASP plans would be developed under NYCT's oversight through its contractors for each phase of the construction. The HASP plans would reduce the potential for worker or public contact with contamination found in the soil, soil gas, or groundwater. It would be mandatory for contractors and subcontractors engaged in any on-site construction activities to follow the provisions of their HASP plans and their specifications to protect the safety of the public, community residents, construction workers, the environment, and subway personnel from existing soil, soil gas, or groundwater contamination encountered. In addition, all on-site personnel would be required to follow all applicable local, state, and OSHA construction codes and regulations. During construction, unusual conditions—such as odors or soil discoloration—that may indicate unexpected contamination would be identified and investigated. Any contaminated materials encountered during construction would be handled, stored, transported, and disposed of in accordance with all applicable federal, state, and local regulations, the project CEPP, and the site-specific HASP plans.

A primary result of this project is the excavation and off-site disposal of contaminated materials. This is more costly than the disposal of non-contaminated soil or rock, but is generally a rapid and relatively straightforward process. In some specific instances, other techniques, such as soil vapor extraction or sparging, may be applied to small areas of contamination that cannot be otherwise managed to eliminate unacceptable potential volatile or other contaminant migration into the excavation and/or finished subway system.

G. SUMMARY OF SIGNIFICANT ADVERSE IMPACTS AND MITIGATION MEASURES

- Contaminated materials in soil, soil gas, and groundwater are anticipated to be uncovered, either in locations where research indicated a potential problem or in other unexpected locations during construction. A list of the locations identified as having the potential for contamination is provided in Appendix K.2. Those sites are distributed in all four construction phases, and include properties formerly used for industrial activities, as well as current or previous uses common in residential and commercial neighborhoods along the alignment, such as gas stations, auto repair shops, dry cleaners, and paint stores.

- Investigations, including subsurface site investigations, are ongoing and will continue throughout the ongoing engineering phase and during later design and construction phases to better determine the nature and extent of contamination in areas where the project might encounter it. A sampling protocol, including a "Quality Assurance Project Plan," will be prepared and followed in areas requiring physical testing.
- Dust control and soil gas control measures would be employed throughout the project area.
- Preventative measures would be taken with respect to the handling of groundwater. Any groundwater exceeding the sewer use limitations set by NYCDEP would need to be treated and retested before its discharge to sewer systems or area water body via a SPDES permit.
- Health and safety procedures would be employed to minimize exposure to workers and the public. Procedures for handling, stockpiling, testing, loading, transporting, and disposing of contaminated material in accordance with all applicable laws and regulations would also be followed.
- Site-specific HASP plans for each construction phase would describe in detail the health and safety guidelines, procedures, and work practices that must be adhered to and the work to be performed and special details, such as confined spaces.
- All workers would be required to follow all applicable local, state, and OSHA construction codes and regulations.
- A hazardous materials management plan will be developed for testing, handling, transporting, and disposing of contaminated materials encountered during the proposed excavations, consistent with applicable regulations. This plan will be included in the project's CEPP.
- Should contaminants be found, appropriate measures will be taken to mitigate potential effects on the operating subway. This may include excavation of contaminated soils and disposal at an appropriate facility. ✷