APPENDIX F

FINAL QUALITATIVE HUMAN EXPOSURE ASSESSMENT
AND
FISH AND WILDLIFE RESOURCES IMPACT ANALYSIS
JULY 2002, REVISED JANUARY 2003

Qualitative Human Exposure Assessment and Fish and Wildlife Resources Impact Analysis

Bay Shore/Brightwaters Former Manufactured Gas Plant Site

Prepared for: KeySpan Corporation
One MetroTech Center
Brooklyn, New York 11201-3850

Prepared by: VHB /Vanasse Hangen Brustlin, Inc.
Environmental Risk Management
54 Tuttle Place
Middletown, Connecticut 06457

July 2002, Revised January 2003

Table of Contents

List of Tables

Qualitative Human Exposure Assessment

Fish and Wildlife Resources Impact Analysis

List of Attachments

1.0 Introduction

This Qualitative Human Exposure Assessment (QHEA) and Fish and Wildlife Resources Impact Analysis (FWRIA) is part of the Remedial Investigation conducted under an Order on Consent (Index No. D1-0002-98-11) between KeySpan Corporation (KeySpan) and the New York State Department of Environmental Conservation (NYSDEC) concerning the former manufactured gas plant (MGP) site located in Bay Shore and the Incorporated Village of Brightwaters, Suffolk County, New York. An evaluation of potential human exposure pathways and risk of impact to the environment is part of the scope-of-work presented in the final Bay Shore/Brightwaters Former MGP Site Investigation Work Plan, dated August 1999 (D&B, 1999). This assessment incorporates data collected during the initial and supplemental field investigation programs conducted at the site. It is an update of the assessment submitted to NYSDEC on July 29, 2002.

This assessment identifies potential human exposures associated with chemical constituents detected in soil, groundwater, indoor air, ambient air, sediment, and surface water at or near the site. A screening-level ecological assessment in the form of a FWRIA also is included.

This assessment considers potential exposure of humans and biota to chemicals at the site. The objectives of the assessment are:

- to identify chemicals of potential concern (COPCs) that are related to the former gas manufacturing activities conducted at the site;
- to identify potential pathways of exposure to people, plants, animals, and fish;
- to estimate and characterize the potential ecological risks associated with these exposures; and
- to indicate the need for mitigative measures to reduce potential exposures.

1.1 Site Location, Description and Setting

The Bay Shore/Brightwaters former MGP site is located in Bay Shore (Town of Islip) and the incorporated Village of Brightwaters, Suffolk County, New York. The site (excluding off-site areas) covers 10.3 acres and is bisected by Clinton Avenue. The Bay Shore property (including the Bay Shore Site) consists of 4.5 acres to the east of Clinton Avenue, and the Brightwaters property (including the Brightwaters Yard Site, the Brightwaters East Parcel, Bay Shore West Parcel, and Bay Shore West Storage Lot Parcel) consists of 5.8 acres to the west of Clinton Avenue. The site is bordered by the Long Island Railroad (LIRR) – Montauk Branch to the south, Fifth Avenue to the east, and Orinoco Drive to the north (Attachment 1-1A).

The Bay Shore property to the east of Clinton Avenue includes an active gas regulator station, an inactive LIPA (Long Island Power Authority) electric substation, and a small storage building, all of which are located in the northern part of this parcel. This parcel is referred to herein as the Bay Shore Site (Attachment 1-1A). The southern portion of this parcel is generally vacant and covered with grass and other low vegetation.

The property to the west of and fronting on Clinton Avenue is herein considered as two parcels: 1) the Bay Shore West Parcel; and 2) the Bay Shore West Storage Lot Parcel (Attachment 1-1A). The Bay Shore West Parcel was previously covered with relatively dense vegetation. The parcel was cleared in February 2002 and most of the parcel is now covered with dolomite/crushed stone. The West Parcel is being used by KeySpan for storage of equipment and materials in support of utility operations. The Bay Shore West Storage Lot Parcel is utilized for the storage of equipment and materials in support of KeySpan gas construction activities at the Brightwaters Yard Site. Property to the west of the Bay Shore West and Bay Shore West Storage Lot Parcels also is comprised of two parcels, referred to in this assessment as: 1) The Brightwaters East Parcel and 2) the Brightwaters Site proper (or the Brightwaters Yard Site). The Brightwaters Yard Site extends into the Village of Brightwaters, serves as an active KeySpan gas construction facility, and contains equipment storage areas and vehicle parking areas.

For the purposes of the qualitative human exposure assessment, the site in its entirety consists of the following components/parcels:

- The Bay Shore Site and Bay Shore West Parcel referred to as Operable Unit 1 (OU-1). From a remedial perspective, this OU also includes an off-site area south of the Bay Shore site, extending to Union Boulevard. For the purposes of the qualitative human exposure assessment, this off-site area is considered as part of OU-2;

- The Brightwaters Yard Site and Bay Shore West Storage Lot Parcel (OU-3);

- The Brightwaters East Parcel (OU-3);

- The groundwater plumes emanating from the Bay Shore Site (OU-2) and the Brightwaters Site (OU-3);

- Watchogue Creek/Crum's Brook (OU-4); and

- Other off-site areas (*i.e.*, O-Co-Nee Pond (OU-3), Lawrence Lake, and Lawrence Creek (OU-2)).

Detailed descriptions of the site setting are found in the following sections of the Remedial Investigation Report (April 2002):

- Site History – Section 1.4.1;

- Land Use and Demographics – Section 1.5.1;
- Climate – Section 1.5.2;
- Topography – Section 1.5.3; and
- Site Hydrogeological Characteristics – Section 3.0.

2.0 Qualitative Human Exposure Assessment

2.1 Nature and Extent of Chemical Constituents

BTEX (benzene, toluene, ethylbenzene and xylenes) were the principal volatile organic compounds (VOCs) detected in samples at the site and are the common VOCs associated with coal tar. Semivolatile organic compounds (SVOCs) also were detected at the site. Polycyclic aromatic hydrocarbons (PAHs) are the common subset of SVOCs found in coal tar. Section 4.0 of the Remedial Investigation Report provides a detailed description of the nature and extent of chemical constituents found at on-site parcels and relevant off-site locations.

2.2 Selection of Chemicals of Potential Concern

Several classes of chemicals were detected in the soil, groundwater, indoor air, ambient air, sediment, and surface water at the Bay Shore/Brightwaters site. COPCs for the Bay Shore/Brightwaters site were selected following the practice established by EPA in the Risk Assessment Guidance for Superfund, Volume I, Part A (EPA, 1989). Selection criteria were as follows:

- Site-wide frequency of detection was considered. Chemicals with a frequency of detection of less than 5% in a data set of 20 or more samples were excluded from the assessment. Also, consideration was given as to whether the detected chemical is related to historic and current uses of the site;

- Chemicals not detected at least once above the limit of detection were automatically excluded from the assessment, regardless of the size of the data set.

A summary list of COPCs by medium is presented in Table 2-1. Relevant and appropriate values (*i.e.*, Standards, Criteria, and Guidance Values (SCGs)) for these COPCs are provided in Appendix C of the Final Remedial Investigation Report.

This human exposure assessment provides qualitative descriptions of potential exposure to site-related COPCs for human populations who may reasonably be expected to contact site media under present or future conditions. This qualitative human exposure assessment is comprised of two primary components:

- Description of exposure setting and identification of potentially exposed populations; and

- Identification of exposure pathways.

These components are discussed in greater detail in the following paragraphs.

2.3 Exposure Setting and Identification of Potentially Exposed Populations

Under current and future site use conditions, the potentially exposed populations (*i.e.*, potential receptors) are those that might come into contact with site COPCs. Tables 2-2A through 2-2K present exposure pathway matrices that depict the various exposure routes for current and future on-site and off-site human populations for each of the parcels at the site.

In order to make remedial management decisions in the context of current or proposed land uses, it is necessary to combine certain parcels. To this end, the following combinations are used:

- The Bay Shore Site and the Bay Shore West Parcel are considered as one area (OU-1) for the purposes of assessing potential exposure. This is because current land use and the potential future land use (*i.e.*, commercial property) for both parcels are the same. This has the implication that both will be managed in the same fashion from a remedial standpoint. As stated previously, the Bay Shore West Parcel was recently cleared of vegetation (in February 2002) and is being used by KeySpan in support of utility operations. Additionally, from a remedial standpoint, OU-1 also encompasses an area south of the Bay Shore site extending to Union Boulevard; however, for purposes of the qualitative human exposure assessment, this off-site area is considered part of the Bay Shore groundwater plume area, OU-2.

- Similarly, the Brightwaters Yard Site and the Bay Shore West Storage Lot Parcel are considered as one area for the purposes of the assessment (OU-3).

- The Brightwaters East Parcel is considered as one area for the purposes of the assessment (OU-3). This is because of concerns associated with soil conditions in the vicinity of four former underground storage tanks (USTs), which were evaluated as a part of the Brightwaters Yard Underground Storage Tank Removal/Closure Interim Remedial Measure/Investigation (see Figure 2-4 of the Remedial Investigation Report).

- Watchogue Creek/Crum's Brook (OU-4) is considered as one area for the purposes of the assessment. This is due to a former plant drainage line that historically discharged to this creek. The freshwater portion of Watchogue Creek/Crum's Brook currently is not classified by the NYSDEC as to suitable use; however, Class C standards apply to this portion of the Creek because the Creek discharges to a Class SC tidal water body. Class C waters are suitable for fish survival and/or reproduction and other aquatic life and for secondary contact recreation, but not primary contact recreation. The tidal portion of Watchogue Creek is classified as SC which indicates that the waters are suitable for fishing, fish propagation, and survival, and the water quality shall be suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes.

- The Bay Shore and Brightwaters groundwater plumes (OU-2 and OU-3, respectively) are considered separately with respect to potential off-site (*e.g.*, residential indoor air) exposures. This is due to the spatial separation of the plumes and because, due to logistical constraints, it is anticipated that future remedial actions to mitigate groundwater impacts will be conducted separately for each plume.

- The assessment of potential off-site exposures includes Lawrence Lake, Lawrence Creek, and O-Co-Nee Pond. The NYSDEC has classified two of these surface water bodies. The classification of Lawrence Lake is Class C, which is a freshwater classification indicating that this water body is suitable for fish survival and/or reproduction and other aquatic life and for secondary contact recreation but not for primary contact recreation. Lawrence Creek is a tidal salt-water body classified SC which indicates that the water is suitable for fishing, fish propagation, and fish survival. Additionally, the water quality shall be suitable for primary and secondary contact recreation; however, other factors may limit the use for these purposes. O-Co-Nee Pond currently is not classified; however, Class C standards apply because the Pond discharges to Lawrence Lake, which is a Class C surface water body.

2.3.1 Current Scenarios

Current human populations considered in this exposure assessment include the following (categorized according to the six parcel combinations described above):

- Potentially exposed human populations at the Bay Shore Site and Bay Shore West Parcel (OU-1) include: on-site trespassers, possibly exposed via contact with surface soil; adult on-site KeySpan workers, possibly exposed via contact with surface soil and inhalation of vapors in indoor air; and adult nearby off-site utility workers possibly exposed via contact with surface and subsurface soil and groundwater.

    - On-site trespassers were included in the exposure assessment because the possibility exists that these individuals could gain access to portions of the Bay Shore/Brightwaters site via inactive portions of the site.

    - Current on-site KeySpan workers are those individuals currently engaged in the activities required for the function and maintenance of those portions of the site devoted to company operations.

  - Chemical exposures for nearby, off-site utility workers could be expected because of the presence of subsurface sewer, telephone, gas, water and rail road facilities in the areas immediately adjacent to the site (Table 2-2A).

- Potentially exposed human populations at the Brightwaters Yard Site and Bay Shore West Storage Lot Parcel (OU-3) include: on-site trespassers, via contact with surface soil and adult on-site KeySpan workers, via contact with surface soil and inhalation of vapors in indoor air (Table 2-2B).

- Potentially exposed human populations at the Brightwaters East Parcel (OU-3) include: on-site trespassers via contact with surface soil and adult on-site KeySpan workers via contact with surface soil and inhalation of vapors in indoor air (Table 2-2C).

- Potential exposures along Watchogue Creek/Crum's Brook (OU-4) include the following populations: adult and (0- to 6-year-old) child off-site residents living along the creek in Area "B" and trespassers in Area "C" of this creek (Tables 2-2E and 2-2F). Potential exposure media for the off-site residents and trespassers includes surface soil, surface water and sediment. As part of an interim remedial measure (IRM), this portion of Watchogue Creek/Crum's Brook has undergone restoration efforts, including the removal of shallow sediments and channel realignment (see section 4.7 of the Remedial Investigation Report).

- Current off-site residents living downgradient (generally due south) of the site may be exposed to chemicals volatilizing out of the groundwater plumes passing underneath residential structures, as well as sediment and surface water exposures in Lawrence Lake, Lawrence Creek (OU-2), and O-Co-Nee Pond (OU-3). These populations include:

  - Bay Shore and Brightwaters groundwater plume areas: adult and (0- to 6-year-old) child off-site residents; and

  - Surface water areas, including Lawrence Lake, Lawrence Creek, and O-Co-Nee Pond: adult and (0- to 6-year-old) child off-site residents.

Additionally, the consumption of fish and crabs from O-Co-Nee Pond, Lawrence Lake, and Lawrence Creek is possible. Potential off-site residential exposures to chemicals due to basement flooding and gardening also are possible. Flooding events could lead not only to the introduction of water in the basement but also to soil residues, and thus possible exposure to chemicals in both media. Basement soil residues most likely would originate from the soil in closest proximity to the building foundation. This soil is typically clean fill and chemical exposures derived therefrom would likely be insignificant.

A private well and basement survey has been performed in the vicinity of the site. This survey was designed and conducted in part to identify residents living within the limits of the Bay Shore and Brightwaters groundwater plumes, as defined in the Remedial

Investigation Report, who may be using groundwater for domestic use. Relevant potential exposure pathways for such use of groundwater include ingestion, dermal contact, inhalation of volatiles while showering (if a private well is used as the source for the bathing water), and for irrigation purposes. The basement survey was conducted to identify those structures with basements, whether those basements have earthen floors, and whether moisture or odors have been observed in the basement. Details concerning the results of the survey are provided in Section 2.5 below.

Exposure to chemicals in soil from gardening presents only a minimal opportunity for exposure due to low concentrations of chemicals in potential off-site transport mechanisms (*i.e.*, site-derived dust). Tables 2-2A through 2-2K summarize the current receptor populations and their associated exposure pathways.

2.3.2 Future Scenarios

Future human populations include on-site and off-site construction workers and on-site adult commercial workers, adult and child visitors, and on-site adult and child residents. Exposure for the construction worker is possible because virtually any site re-development would involve some kind of construction activity. Potential on-site exposure media for the construction worker include surface soil, subsurface soil, and groundwater. Off-site construction worker exposure to portions of Watchogue Creek/Crum's Brook (OU-4; Areas "A" and "B") also may be possible. Potential exposure media for off-site construction workers include surface soil, subsurface soil, and groundwater.

In addition, because certain parcels of the site are suited for commercial/light industrial redevelopment (*i.e.*, Bay Shore Site (OU-1), Bay Shore West Parcel (OU-1), Brightwaters Yard Site (OU-3) and Bay Shore West Storage Lot Parcel (OU-3)), exposures for adult commercial workers and adult and child visitors to future commercial properties are possible, absent appropriate remedial measures. Commercial worker and site visitor exposures are limited to indoor air because this is the exposure route most likely to occur and present the greatest potential risk. It is expected that future land use of the on-site property may be deed restricted to prevent residential development; however, because deed restrictions are not yet in place, a future on-site residential scenario is included in this assessment. Potential on-site exposure media for these future on-site residents includes surface and subsurface soil, groundwater, and indoor and ambient air.

2.4 Identification of Exposure Pathways

Tables 2-2A through 2-2K provide qualitative descriptions of the complete exposure pathways for potential current and future on-site and off-site human populations:

Under current site use conditions at the Bay Shore Site (OU-1), Bay Shore West Parcel (OU-1), the Brightwaters Yard Site (OU-3), Brightwaters East Parcel (OU-3), and the Bay Shore West Storage Lot Parcel (OU-3), the on-site trespasser population may potentially receive exposure to surface soil via the ingestion (oral), dermal, and inhalation routes. On-site

KeySpan workers may spend time both outdoors and indoors and, consequently, may potentially be exposed to chemicals in surface soil (via ingestion, dermal contact, and inhalation during outdoor activities) and also to COPCs in indoor air (via inhalation during indoor activities). Additionally, under current site use conditions at the Bay Shore Site and the Bay Shore West Parcel, adult nearby off-site utility workers may potentially receive exposure to surface and subsurface soil via the ingestion, dermal, and inhalation routes.

Under current off-site use conditions, off-site residents living near Watchogue Creek/Crum's Brook (OU-4) may potentially contact surface soil via ingestion, dermal contact, and inhalation during everyday activities such as playing, gardening, etc. For these individuals, exposure is restricted to the region bounded to the north by the LIRR right-of-way and to the south by Union Boulevard (designated in Attachment 1-1B as Watchogue Creek/Crum's Brook Area "B"). Exposure to off-site sediment and surface water via ingestion and dermal contact in Lawrence Lake, Lawrence Creek and O-Co-Nee Pond also is possible for these off-site residents. The consumption of fish from these three surface water bodies also may occur. The potential for human exposure to site-related COPCs through the consumption of fish and crabs in Lawrence Lake, Lawrence Creek, and O-Co-Nee Pond is likely minimal because:

- BTEX and PAH compounds generally were not detected or were detected at relatively low concentrations in the surface water; and

- The chemicals present in the surface water, porewater, and sediment samples do not tend to bioconcentrate or bioaccumulate.

While elevated concentrations of some constituents were observed in a few sediment and porewater samples, these samples represent a limited area of insufficient size to result in a significant impact. Moreover, these chemicals are readily diluted in surface water (as supported by available data), readily biodegraded in the environment, and do not bioaccumulate in fish or crabs; therefore, it is highly unlikely that fish or crabs are adversely impacted. Consequently, human consumption of fish and crabs is not an exposure pathway of concern.

In addition, persons residing near the Bay Shore and Brightwaters groundwater plumes (OU-2 and OU-3, respectively) may be exposed to chemicals originating from groundwater via inhalation of vapors in indoor air. Indoor air sampling has been performed at several properties in the vicinity of the site. Results of the sampling indicate that:

- Naphthalene, the compound most generally associated with MGP impacts, was not detected in any of the samples;

- The majority of volatile organic compounds for which analysis was performed were not detected;

- The majority of the detected compounds were detected at concentrations within the range of background levels as reported by the New York State Department of Health (NYSDOH); and

- Those compounds detected above NYSDOH background levels are generally those not typically associated with MGP impacts.

NYSDOH background levels do not exist for some of the detected compounds. Detected concentrations of these compounds are orders of magnitude below occupational standards. Consequently, available indoor air data suggest that the inhalation of vapors derived from site-related chemicals is not an exposure pathway of concern.

Trespassers to Watchogue Creek/Crum's Brook may possibly contact chemicals in surface soil, sediment, and surface water via ingestion and dermal contact in the region of the creek south of Union Boulevard (designated in Attachment 1-1B as Watchogue Creek/Crum's Brook Area "C"). As stated previously, an IRM was initiated in this area and is currently in progress (see section 4.7 of the Remedial Investigation Report).

Under future site use conditions at the Bay Shore Site, Bay Shore West Parcel, Brightwaters Yard Site, the Bay Shore West Storage Lot Parcel, and the Brightwaters East Parcel, on-site construction workers may receive exposure to surface and subsurface soil via the ingestion, dermal, and inhalation routes, and to groundwater via the dermal and inhalation routes as a consequence of their work (*i.e.*, trenching, excavation, installing deep piles, etc.). Because the Bay Shore Site, Bay Shore West Parcel, Brightwaters Yard Site, and Bay Shore West Storage Lot Parcel are suited for commercial/light industrial redevelopment, exposure for commercial workers and adult and child visitors at future commercial properties are possible. Commercial worker and site visitor exposures are limited to indoor air because this is the exposure route most likely to occur and present the greatest potential risk.

Future on-site adult and child residents may receive exposure to surface and subsurface soil via the ingestion, dermal, and inhalation routes; to groundwater via ingestion, dermal contact and inhalation of vapors while showering (if a private well is used for domestic purposes); and to indoor air via inhalation.

Potential future off-site human exposure populations include construction workers in Watchogue Creek Areas "A" and "B" who may potentially receive exposure to surface and subsurface soil via the ingestion, dermal, and inhalation routes, and to groundwater via the dermal and inhalation routes.

Tables 2-3A through 2-3E provide context, in qualitative terms, of the potential for the exposures discussed above to actually occur. For example, the potential for on-site trespasser exposure to site-related chemicals in surface soil at the Bay Shore site and Bay Shore West Parcel is considered minimal because access to the site is restricted by a gated fence. For those current exposure scenarios that are deemed more likely to occur, that is those which are considered moderate or moderate to high (*e.g.*, construction workers and

KeySpan employees), these workers already are trained to take proper precautions to reduce the potential for exposure.

The remedial investigation and qualitative human exposure assessment have indicated that there are pathways through which people on the site and in the community may possibly be exposed to potentially hazardous materials related to former MGP activities; however, no imminent hazards were identified. The potential for this exposure should be evaluated for possible reduction through remedial actions. Therefore, KeySpan has initiated, with NYSDEC approval and under NYSDEC supervision, some interim remedial measures (IRMs), and will develop long-term remedial actions in the next phase of this program, the development of a Remedial Action Plan. These IRMs and subsequent remedial actions will address properties that are currently or potentially impacted by the site (including the site itself) to ensure future valuable use of these properties.

2.5 Well and Basement Survey

A private well and basement survey of properties in the vicinity of the site was conducted during the second, third, and fourth quarters of 2002. Specifically, properties within, between and in the immediate vicinity of the two groundwater plumes, as defined in the Remedial Investigation, were the subject of the survey. The survey consisted of an initial mailing of 289 questionnaires. Of the 289 questionnaires, 89 were address or property duplicates. Of the 200 remaining questionnaires from the initial mailing, 72 (or 36%) were returned to KeySpan. For the 128 questionnaires for which responses were not received, follow-up communications were initiated. This follow-up consisted of a maximum of three phone calls per property. During this process, an additional 58 questionnaires were completed. This increased the total response rate to 65% and decreased the number of properties requiring additional follow-up to 70. In consultation with NYSDEC, it was agreed that a 100% response rate for the questionnaires was not necessary but that attempts should be made to achieve as high a response rate as possible for properties within the plume paths. As a result of this decision, 44 properties were eliminated from further follow-up because they were not located near the plume and four attempts to contact the property owner, including the initial questionnaire mailing, had been made. Twenty-six properties were identified that are located within the plume but for which survey responses had not been received.

For the 26 properties for which responses had not been received, a Community Development Representative from KeySpan went door-to-door in an attempt to obtain responses. If no one was home, a letter and another copy of the questionnaire were left at the residence. As a result of this effort, 15 questionnaires were completed. Attempts to locate one property owner have thus far been unsuccessful, which leaves 10 questionnaires for which no response has been received. The number of completed questionnaires is 145 for a response rate of 73% (as of December 16, 2002). Results of the survey are summarized as follows:

Basement Survey

- Basements/crawl spaces are located at ninety-one (91) of the properties;
    - ➢ Sixty (60) of these report water in the basement, with the majority of these (52, or approximately 87%) reporting water in the basement following a rain event;
        - Thirty-nine (39) report an odor in the basement when the basement is wet, twenty-five (25) of which may be categorized as a damp, musty "wet earth" odor;
        - Eight (8) respondents indicate an odor of potential concern, *i.e.,* an odor that is characterized as "gasoline", "oil", or "driveway sealer" when the basement is wet;
        - Of the eight (8) respondents who indicated an odor of potential concern, one property has a crawl space; five (5) properties utilize the basement for storage, laundry, and/or a workshop; and one (1), for which an "oil" odor was reported, utilizes the basement as an office and storage space. This property also has a furnace and hot water heater located in the basement. One survey respondent, for which the basement is used as living space, reported a "gasoline" odor. This odor is due to a neighbor's gasoline tank.

KeySpan has offered to follow-up with the homeowners who indicated the presence of an odor of potential concern. Due to the lack of precipitation in recent months, the basements at the properties were dry until recently. KeySpan has told property owners to contact the company if they experience the odor again, at which point KeySpan will schedule a property visit to determine whether further testing is warranted. Thus far, indoor air sampling has been performed at three of these properties.

Well Survey

- Seventeen (17) respondents reported the presence of a groundwater well on their property;
    - ➢ KeySpan attempted to schedule visits for each of these properties. As a result, visits were conducted at eleven (11) properties.
    - ➢ The presence of a well could not be confirmed at two (2) of the eleven (11) properties due to access issues;
    - ➢ At five (5) properties, it was confirmed that a well is not present;
    - ➢ The presence of a well was confirmed at four (4) properties:

- One of these wells is in active use for irrigation purposes;
- Three wells were confirmed to be inactive (*i.e.*, not in use) for a period of several years.
- KeySpan attempted to sample all four wells. Two wells could not be sampled due to access issues, (*i.e.*, piping set-up). Sampling of the other two wells, one active irrigation well and one inactive well, was performed. With the exception of methyl tert-butyl ether, a common gasoline additive, no VOCs or SVOCs were detected in the sample collected from the active irrigation well. Several VOCs and SVOCs, including naphthalene, were detected in the inactive well. This well is not currently used as a source of water for any purpose, and the pump is currently inoperable.

➢ One respondent indicated the presence of an old well that reportedly is not functional.

➢ One respondent who indicated the possible presence of a well, later stated that the property does not have a well;

➢ Four respondents who indicated the presence of a well on their property did not respond to phone calls concerning a property visit nor did they respond to door-to-door knocking. Consequently, the presence of a well at these properties could not be confirmed.

In summary, results of the indoor air sampling and the well and basement survey have identified a very small number of properties at which the potential for indoor air exposure exists. The owners of these properties have been contacted. Additionally, 144 of the 145 survey respondents indicated that they do not use groundwater wells for domestic purposes (*i.e.*, irrigation of gardens, cooking, bathing); consequently, exposure to potentially site-related constituents that may be present in groundwater does not occur for these individuals (*i.e.*, domestic use of groundwater is an incomplete exposure pathway). One well is used for irrigation purposes and it is located to the south of the Brightwaters site.

3.0 Fish and Wildlife Resources Impact Analysis

Following the Appendix 1C Decision Key in the NYSDEC's Fish and Wildlife Resources Impact Analysis guidance, a FWRIA was deemed required (see Table 3-1). Therefore, the following analysis identifies actual or potential risks to plants, fish, and wildlife residing on and near the Bay Shore/Brightwaters site from chemicals potentially migrating from the former MGP. The analysis focuses on risks associated with site-related chemicals detected in soil, surface water, sediment, and groundwater. This analysis contains:

- site descriptions and a characterization of plant and animal resources and their value to humans;
- the identification of regulatory standards and criteria for fish and wildlife;
- evaluations of potential exposure pathways to fish and wildlife from site-related chemicals of potential ecological concern (COPECs), to regulatory criteria or derived toxicological benchmarks for the protection of fish and wildlife; and
- conclusions regarding the potential of exposure and possible risks to fish and wildlife on or near the site.

3.1 Fish and Wildlife Resources

3.1.1 Terrestrial Resources

The U.S. Fish and Wildlife Service and the NYSDEC Natural Heritage Program were contacted regarding species of concern, significant habitats, and fishery resources within two miles of the site. In addition, a field reconnaissance survey of the site and surrounding 0.5-mile radius was conducted on September 27, 1999 and again on January 28, 2000. The objectives of the survey were to:

- map and describe plant communities and aquatic resources on and adjacent to the site;
- observe wildlife species;
- identify significant ecological resources; and
- observe evidence of stress to plants and animals, if any, from site-related chemicals.

Three distinct terrestrial plant cover types were identified during the field reconnaissance within a 0.5-mile radius from the site. The boundaries between these cover types are depicted in Attachment 1-1D. Plant species identified by cover type within the site are presented in Table 3-2. Field surveys were conducted within the 0.5-mile study area except at water bodies potentially impacted by the groundwater plume. Ecological resources were also identified from agency contacts, the U.S. Geological Survey topographic maps, and state and federal wetland maps. Each plant cover type is described below as to the plant species composition, vegetation structure, and land use. Whenever possible, these areas were classified according to the New York State Natural Heritage Program's Ecological Communities of New York State (Reschke, 1990).

3.1.1.1 Cover Type 1: Industrial/Commercial Area

Several areas near the Bay Shore/Brightwaters site are classified as industrial/ commercial. Most of these areas are covered with gravel, concrete, asphalt, a gravel and dirt mixture, or geotextile fabric and fill and gravel. With the exception of a few small patches of grass and weeds, these areas are essentially devoid of vegetation, due to constant disturbances from on-site equipment and paving. Therefore, there is little area for free growth of vegetation or development of wildlife habitats.

3.1.1.2 Cover Type 2: Residential Area

Cover type 2 is the dominant cover type within the half-mile radius. It consists of residential buildings surrounded by maintained lawns (*i.e.*, frequent mowing) and ornamental plantings. The lawns consist of grasses and weed species including English plantain (*Plantago lanceolata*) and dandelion (*Taraxacum officinale*). Ornamental shrubs and small trees are planted along the foundations of the homes. In addition, larger trees are planted in the yards. Ornamental trees and shrubs planted include arbor vitea (*Thuja occidentalis*), sugar maple (*Acer saccharum*), and crab apple (*Pyrus prunifolia*).

3.1.1.3 Cover Type 3: Successional Field

Two areas – the site itself and the undeveloped green space near Lawrence Lake – are classified as successional field. These areas are similar in species composition and structure and are therefore grouped as one cover type. This cover type is characterized as a weedy field dominated by grasses and forbs that occur on sites that have been cleared for development. Dominant plant species include gray goldenrod (*Solidago nemoralis*), small white aster (*Aster vimineus*), Queen Anne's lace (*Daucus carota*) and crab grass (*Digitaria sanguinalis*). In some areas, woody vegetation, such as staghorn sumac (*Rhus typhina*), tartarian honeysuckle (*Lonicera tatarica*) and black locust (*Robinia pseudo-acacia*) has begun to invade these fields. The park area is mowed frequently and will remain as a successional field.

3.1.2 Aquatic Resources

The Bay Shore/Brightwaters site lies within the Great South Bay drainage basin. The Great South Bay in the vicinity of Lawrence Creek is a Class SA water body, indicating that the water is suitable for human consumption of fish, fish propagation, and fish survival. Currently, this portion of the Great South Bay is uncertifiable for shellfish harvesting due to pathogens resulting from urban runoff (USFWS, 1997). Fish advisories also exist for portions of the Bay (USFWS, 1997).

Lawrence Creek is a tidal salt-water body classified as SC and is located within two miles of the site. The NYSDEC classifies salt-water bodies as SA, SB, SC, I, or SD. Title 6, Chapter 100, Part 700-705 of the New York State Code of Rules and Regulations (6NYCRR) defines the best usage of each water quality classification as follows.

- Class SA waters are suitable for shellfishing for market purposes, primary and secondary contact recreation and fishing. These waters shall be suitable for fish propagation and survival.
- Class SB waters are suitable for primary and secondary contact recreation and fishing. These waters shall be suitable for fish propagation and survival.
- Class SC waters are suitable for fishing. These waters shall be suitable for fish propagation and survival. The water quality shall be suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes.
- Class SD waters are suitable for fishing. These waters shall be suitable for fish survival. This classification may be given to those waters that, because of natural or man-made conditions, cannot meet the requirements for primary and secondary contact recreation and fish propagation.
- Class I waters are suitable for secondary contact recreation and fishing. These waters shall be suitable for fish propagation and survival.

Several freshwater water bodies (*i.e.*, Watchogue Creek/Crum's Brook, O-Co-Nee Pond, and Lawrence Lake [Class C]) were identified within two miles of the site. Class C standards apply to both the freshwater portion of Watchogue Creek and to O-Co-Nee Pond. These standards apply because of the classifications of their receiving water bodies: Watchogue Creek/Crum's Brook discharges to a Class SC tidal water while O-Co-Nee Pond discharges to Lawrence Lake. The NYSDEC classifies fresh water bodies as A, B, C, or D. Title 6, Chapter 100, Part 700-705 of the New York State Code of Rules and Regulations (6NYCRR) defines the best usage of each water quality classification as follows.

- Class A waters are suitable for use as a public water supply.

- Class B waters are suitable for fishing and fish propagation and primary and secondary contact recreation. Class B streams cannot be used as a drinking water source.

- Class C waters are suitable for fish survival and/or reproduction and other aquatic life and for secondary contact recreation but not primary contact recreation.

- Class D waters are suitable for fishing. However, due to natural conditions such as intermittency of flow, water conditions do not favor fish propagation.

The water quality standards presented in 6NYCRR also set measurable limits on pollution indicators including dissolved oxygen, turbidity, colloidal solids, oil and floating substances, phosphorus and nitrogen, and taste-, color- and odor-producing toxic or deleterious substances. Class A, B, and C waters should have a pH greater than 6.5 and no more than 8.5. For nontrout waters, the average daily dissolved oxygen should not be less than 5.0 mg/liter (mg/l) and never less than 4.0 mg/l. For trout waters, the average daily dissolved oxygen should not be less than 7.0 mg/l and at no time be less than 6.0 mg/l.

3.1.2.1 O-Co-Nee Pond

O-Co-Nee Pond is a small residential pond. It is surrounded by residential properties. Several beach-like areas consisting of sand were observed along the shoreline. These areas had benches facing the water, and fishing equipment was observed (*i.e.*, tackle boxes and rods and reels). Weeping willow (*Salix babylonica*), cottonwood (*Populus deltoides*), sweet pepperbush (*Clethra alnifolia*), and nutsedge (*Cyperus esculentus*) dominate the shoreline of the pond. A water depth gauge observed in the pond on September 27, 1999 indicated 18 inches of water approximately 2 feet from shore. The pond has an earthen and sand substrate. The USFWS National Wetland Inventory (NWI) map indicates that this pond is classified as a palustrine, open water, intermittently exposed/permanent (POWZ) wetland. O-Co-Nee Pond has no index number (see 6NYCRR925.6 Table 1).

3.1.2.2 Lawrence Lake

Lawrence Lake is a freshwater pond located south east of West Main Street. The lake is surrounded by residential homes. Due to access restrictions, the fringe of vegetation surrounding the pond could not be identified. Lawrence Lake is classified as a palustrine, open water, and intermittently exposed/permanent (POWZ) wetland on the NWI maps. Lawrence Lake is considered a tributary to Lawrence Creek. The NYSDEC classifies tributaries to Lawrence Creek as Class C (see 6NYCRR925.6 Table 1).

3.1.2.3 Lawrence Creek

The Lawrence Creek shoreline is developed with a bulkhead and boats and houses around the shoreline. A detailed view of the upper portion of the creek is shown in Attachment 1-1E and includes bathymetric contours. This creek is classified as an estuarine, subtidal, open water wetland on the NWI map, while the NYSDEC classifies Lawrence Creek as SC (see 6NYCRR925.6 Table 1).

3.1.2.4 Watchogue Creek/Crum's Brook

The Watchogue Creek/Crum's Brook corridor is a small headwater creek for the tidal Watchogue Creek, and is located in a heavily urbanized area. Storm water runoff and debris have degraded the creek. During the January 2000 field reconnaissance, trash, including shopping carts, metal debris, and tires were observed along the banks and within the creek channel.

The creek corridor between the LIRR and Mechanicsville Road ranged in width from 3 to 10 feet. At the time of the survey (January 28, 2000), a majority of the stream was frozen. However, open areas showed 3 to 6 inches of water. Flow rate was slow near Union Boulevard and increased as the creek flowed south. The stream has an earthen substrate as well as gently sloping earthen banks ranging in height from one to two feet.

In the fall of 2000, KeySpan undertook a stream enhancement project for Watchogue Creek/Crum's Brook from Union Boulevard to Mechanicsville Road as an aesthetic amenity and asset for the local community. These enhancement activities also enhanced the quality of the wildlife habitat adjacent to the creek. The enhancement work entailed reconfiguration of the creek to enhance drainage (*i.e.,* increase flow rate to prevent depositional areas) and accommodation of storm water runoff from the proposed development. After reconfiguration, the creek banks were replanted with alternating shrub, wildflower, and grass areas. The species selected have both aesthetic value as well as food and shelter value for wildlife, especially birds. The shrubs were planted in the fall of 2001 and the wildflower seed mix was planted in the spring of 2002.

The freshwater portion of Watchogue Creek/Crum's Brook has no index number (see 6NYCRR925.6 Table 1). The tidal portion of Watchogue Creek is classified as SC. The tidal portion is also classified as an estuarine, subtidal, open water wetland on the NWI map.

3.1.3 Freshwater and Tidal Wetlands

As mentioned, wetlands have been identified on the U.S. Fish and Wildlife NWI Maps (Bay Shore East and Bay Shore West, NY quadrangles) and NYSDEC Tidal and Freshwater Wetland Maps (see Attachment 1-1C). O-Co-Nee Pond is listed as State Wetland BW-3 and is classified as federal wetland POWZ and Lawrence Lake is listed as State Wetland BW-21 and is classified as federal wetland POWZ. Lawrence Creek is classified as federal wetland EIOWL. The tidal portion of Watchogue Creek is classified as EIOWL.

O-Co-Nee Pond is an open water wetland with a fringe of forested wetland. The shoreline was vegetated with weeping willow, cottonwood and sweet pepperbush. These species are classified as either facultative wetland (FACW) or obligate wetland (OBL) species (Reed, 1988). Due to access restrictions, dominant wetland vegetation along Lawrence Lake could not be identified. Lawrence Lake is surrounded by residential properties.

A review of the NYSDEC wetland maps and the U.S. Fish and Wildlife Service NWI Maps indicated no wetlands associated with the freshwater portion of Watchogue Creek. Field observations of vegetation were used to verify the mapping. The banks were heavily vegetated and several large (>24-inch diameter) trees were present. Dominant trees were red oak (*Quercus rubra*) and tree of heaven (*Ailanthus altissima*), which are classified as facultative upland species (FACU) (Reed, 1988). Dominant under story species consisted of common buckthorn (*Rhamnus cathartica*), which is classified as an upland species (UPL) (Reed, 1988). Snow covered the ground, prohibiting view of the ground layer. However, a few taller plants were observed and consisted of bamboo (an escaped exotic) and Japanese knotweed (*Polygonella cuspidatum*), which is classified as UPL (Reed, 1988). Based on the vegetation present and wetland map information, no wetlands are associated with the creek corridor.

Some of the remaining wetlands are down gradient from the site and Watchogue Creek/Crum's Brook. However, there are no known direct migration pathways from the site into the wetlands. Also, due to distance involved and fate and transport mechanisms, no significant effects on wetlands are expected.

3.1.4 Fish and Wildlife Resources

Federally listed endangered, threatened or species of concern are not known to occur within 2 miles of the site (Clough, 1999). Federally and state listed endangered, threatened or species of concern are not known to occur within a one-half mile radius of the site (Clough, 1999 and Mackey, 1999; Attachment 1-1C).

Wildlife uses in the area were evaluated using literature sources and field observations. Wildlife sightings included direct observations and identifications based on vocalizations, tracks, browse, and scat, and general wildlife values (*e.g.*, food and cover availability) noted.

The surrounding 0.5-mile radius consists of residential homes and industrial/ commercial properties. These areas typically consist of mowed lawns interspersed with trees and shrubs, which oftentimes are introduced exotics used for ornamental purposes. These areas do not support an abundance of wildlife because of the lack of vegetation, which could provide food and cover, and constant human activity. The successional fields with invading trees and shrubs, identified during the field reconnaissance do provide habitat for wildlife. However, the small size limits the size of the population it can support. Tables 3-3 through 3-6 list the fish, herptile (amphibian and reptile), bird, and mammal species that may potentially occur within and adjacent to the site based on the land uses identified during the field reconnaissance. The species observed during the field reconnaissance (which are representative for the point in time of the field reconnaissance) also are identified in the tables.

3.1.5 Observation of Stress

No signs of stress to vegetation and wildlife at or around the site were observed during the field reconnaissance.

3.1.6 Value of Habitat to Associated Fauna

The residential, commercial and industrial properties are of little value to wildlife. The area is developed, and only isolated pockets of vegetation exist, and in most cases, these areas are maintained by frequent mowing. The wildlife expected to occur in the vicinity of the site includes more urbanized bird and mammalian species such as mockingbird (*Mimus polyglottos*), gray squirrel (*Sciurus carolinensis*), and Norway rat (*Rattus norvegicus*).

The successional fields, including a portion of the site, do provide minimal habitat and provide cover and food for wildlife. These areas typically have songbirds such as goldfinch (*Carsuelis tristis*) and song sparrow (*Melospiza melodia*), and small mammalian species, such as white-footed mouse (*Peromyscus leucopis*) and meadow vole (*Microtus pennsylcanicus*), which consume the seeds of grasses and forbs. Due to the limited size of these fields, larger mammalian and bird of prey species are not likely to occur.

3.1.7 Value of Resources to Humans

The site and surrounding area are of little value to humans for recreational use of wildlife. Bird feeders may be in residential yards. The developed nature of the area precludes small game and deer hunting. The resources are what would be expected for a residential community.

3.2 Exposure Pathways Analysis

3.2.1 Chemicals of Potential Ecological Concern

A number of substances were detected in surface soil, surface water, sediment and groundwater. Section 4 of the Remedial Investigation (RI) Report provides the specific constituent data. To focus the FWRIA on those chemicals that may pose risks to the environment, COPECs were selected.

For this assessment, the chemicals detected in groundwater are not considered COPECs for ecological receptors except indirectly as a potential source of chemicals to surface water or sediment downgradient of the site. The depth to groundwater is generally greater than three feet below ground surface (bgs), which is below the root zone of most plants. Therefore, no exposure routes exist, and the chemicals detected in groundwater are not discussed.

3.2.1.1 On-Site

Surface and subsurface soil samples were collected from the Bay Shore/Brightwaters site and analyzed for VOCs, SVOCs, RCRA metals, limited target analyte list (TAL) and total cyanide. Only shallow subsurface soil data (up to 4 feet bgs) were considered in this FWRIA. Data is presented in Sections 4.2 and 4.3 of the RI Report. A total of 54 samples (29 surface soil and 27 subsurface soil) were analyzed in this depth interval. Data for deeper subsurface soils were not evaluated due to lack of exposure routes to wildlife. Most burrowing animals create dens in the upper 4 feet of soil. In addition, the deeper subsurface soil samples (*i.e.*, greater than 4 feet) are below the root zone of most plants. Essential nutrients (calcium, iron, potassium, sodium and magnesium) are not considered COPECs. All other chemicals detected above detection limits are considered COPECs.

3.2.1.2 Off-Site

Soil

Surface and subsurface soil samples were collected near Watchogue Creek/Crum's Brook and analyzed for VOCs, SVOCs, RCRA metals, limited TAL, and total cyanide. Data is presented in Section 4.4 of the RI Report. Only shallow subsurface soils data (up to 4 feet bgs) were considered in this FWRIA. A total of 32 samples (13 surface soil and 19 subsurface soil) were analyzed in this depth interval. Essential nutrients (calcium, iron, potassium, sodium and magnesium) are not considered COPECs. All other chemicals detected above detection limits are considered COPECs.

Surface Water

Surface water samples were collected from four water bodies located near the site: O-Co-Nee Pond (15 samples surface water and six samples pore water), Lawrence Lake (three samples), Lawrence Creek (15 samples surface water and six samples pore water), and Watchogue Creek/Crum's Brook (10 samples). These samples were analyzed for VOCs, SVOCs, RCRA metals and total cyanide. Chemicals detected above detection limits are considered COPECs. Data is presented in Sections 4.4 and 4.7 of the RI Report.

In October 1999, Suffolk County Department of Health Services (SCDHS) conducted a groundwater investigation. The purpose of this investigation was to determine if the plume originating from the Bay Shore site was discharging chemicals into Lawrence Creek through submarine groundwater discharge. SCDHS collected groundwater, sediment and pore water samples in and near Lawrence Creek. These samples were analyzed for BTEX compounds, PAHs, and MTBE. The major constituent detected during this investigation was naphthalene, which is a by-product of the gas manufacturing process. The SCDHS results indicated naphthalene concentrations ranging from 0.006 to 7 ppm in groundwater, 0.01 to 3.8 ppm in pore water, and 0.019 to 0.3 ppm in surface water. One sediment sample contained naphthalene at a concentration of 6.4 ppm (Bradley *et al.*, 2001). Additional testing of Lawrence Creek was conducted as part of the Remedial Investigation. The results of this testing are discussed further in Sections 3.3.2.2 and 3.3.3.3, below. Additional information concerning Lawrence Creek is found in Sections 4.4.3, 4.4.4 and 4.4.5 of the Report.

Sediment

Sediment samples were collected from the same water bodies as the surface water: O-Co-Nee Pond (16 samples), Lawrence Lake (three samples), Lawrence Creek (15 samples), and Watchogue Creek/Crum's Brook (17 samples). These samples were analyzed for VOCs, SVOCs, RCRA metals and total cyanide. Data is presented in Sections 4.4 and 4.7 of the RI Report. Chemicals detected above detection limits are considered COPECs.

Table 3-7 lists the COPECs by environmental medium and location for the Bay Shore/Brightwaters site.

3.2.2 Exposure Pathways

Wildlife resources in the industrial/residential areas surrounding the site are limited due to the general lack of quality food and appropriate cover. In addition, constant human disturbance limits the population to those wildlife species more tolerant of human activity. No state- or federally-listed species were identified as occurring on the site. O-Co-Nee Pond is listed as state wetland BW-3 and classified as a POWZ federal wetland. Lawrence Lake is listed as state wetland BW-21 and classified as a POWZ federal wetland. Lawrence Creek is classified as an EIOWL federal wetland. Chemicals migrating from the site may affect these wetlands. Several other wetlands were identified in the 0.5-mile radius study area. These wetlands are currently too distant and/or up gradient of the site for any likely exposure to site-related chemicals. In addition, most of the COPECs are PAHs and metals. The fate and transport mechanisms of these chemicals reduce the likelihood of future migration into these areas. Thus, exposure is likely to be limited to wildlife on, near, or immediately down-gradient from the site.

Plant roots are not discriminating in the uptake of small organic molecules (molecular weight less than 500) except on the basis of polarity. The more water-soluble molecules pass through the root epidermis and translocate throughout the plant and are eventually volatilized from the leaves (Efroymson et al., 1997a). Plants selectively uptake metals in soil by absorption from soil solution by the root. Metals may be bound to exterior exchange sites on the root and not actually taken up. They may enter the root passively in organic or inorganic complexes or actively by way of metabolically controlled membrane transport (Kabata-Pendias and Pendias, 1992). Once in the plant, a metal can be stored in the root or translocated to other plant parts. Wildlife will have limited exposure to these chemicals. Potential exposure could occur through direct contact with or accidental ingestion of contaminated soil or through the terrestrial food chain.

Like the terrestrial food chain, chemicals can be mobilized in the aquatic food chain. Roots of aquatic macrophytes can mobilize and uptake chemicals that are bound to sediments. Wildlife could be exposed by contact or ingestion of surface water and sediment or through the aquatic food chain. Therefore, a possible potential for exposure to the COPECs exists for aquatic macrophytes and wildlife inhabiting the water bodies associated with the site.

3.3 Criteria-Specific Toxicity Assessment

3.3.1 Soil

NYSDEC does not have soil cleanup criteria relating to the protection of wildlife and the availability of applicable soil screening values in scientific literature is limited. The screening of soil COPECs was conducted by comparing the chemical concentrations to available screening benchmark values derived by the Oak Ridge National Laboratory (ORNL) (Efroymson et al., 1997a, 1997b and Sample et al., 1996) for the U.S. Department of Energy. The benchmark values are the 10^{th}-percentile of the distribution of various toxic effects thresholds for the chemicals in soil for a given group of organisms.

Transformation or loss due to environmental degradation is not considered in this analysis. It is possible that following uptake, concentration in soil will equal concentrations in organisms. This assumption overestimates potential risk in that wildlife has limited contact with these chemicals in soil and plants.

Benchmark values for three groups of organisms, where available or derived, are presented in Table 3-8. Terrestrial plants were selected since they are critical in nutrient cycling and are a source of food in the diets of higher animals. In addition, plants may take up some of the COPECs. Earthworms were selected because of their importance in maintaining soil fertility through burrowing and feeding activities. Also, earthworms are at the base of the food chain and are an important food item for higher organisms. Meadow voles were selected to represent an herbivorous small mammal. The benchmark values for meadow vole are presented as dietary concentrations in mg of chemical per kg of diet that would result in no observed adverse effect levels (NOAELs). For screening purposes, it is possible that the chemical concentration in soil would be found in the food items of these species. As stated previously, this is a conservative approach that should result in the overestimation of potential exposure and risk.

As indicated in Table 3-8, screening values are available for a few of the COPECs. Therefore, the methodology of the ORNL (Sample et al., 1996) was used to derive toxicological benchmarks for the meadow vole from published toxicological data for laboratory animals. Literature sources included IRIS (EPA, 2001a), HEAST (EPA, 1997), and the National Toxicology Program. It should be emphasized that the resulting benchmarks obtained from this methodology and toxicological data are based on a conservative approach whose resulting relationship to potential population effects is uncertain.

No observed adverse effect levels (NOAELs) and lowest observed adverse effect levels (LOAELs) are daily dose levels normalized to the weight of the test animal [e.g., milligrams of chemical per kilogram body weight per day (mg/kg/day)]. The presentation of toxicity data on a mg/kg/day basis allows for comparison across species with appropriate consideration for differences in body sizes. If a NOAEL (or LOAEL) for a mammalian test species ($NOAEL_t$) is available, then the equivalent NOAEL (or LOAEL) for a mammalian wildlife species ($NOAEL_w$) can be calculated by using an adjustment factor for the difference in body size:

$$NOAEL_w = NOAEL_t \times \left({bw_t}/{bw_w} \right)^{1/4}$$

Where:

$NOAEL_w$ = No observed adverse effect level for wildlife species (mg/kg/day)
$NOAEL_t$ = No observed adverse effect level for test species (mg/kg/day)
bw_w = Body weight for wildlife species (kg)
bw_t = Body weight for test species (kg)

In some cases, a NOAEL for a specific chemical was not available, but a LOAEL or lethal dose (LD_{50}) had been determined experimentally. The NOAEL can be estimated by applying an uncertainty factor (UF) to the LOAEL or LD_{50}. In the EPA methodology (EPA, 1989), the LOAEL or LD_{50} can be reduced by a factor of 10 or 50, respectively, to derive the NOAEL.

The dietary level or concentration in food (C_f) of a chemical in milligrams of chemical per kilogram of food that would result in a dose equivalent to the NOAEL can be calculated from the food factor (f).

$$C_f = \frac{NOAEL_w}{f}$$

The food factor, (f) is the amount of food consumed per day per unit of body weight. Table 3-9 provides the body weight, food intake and food factors used in the derivation of chemical-specific NOAELS for the meadow vole. Table 3-10 provides the derived toxicological benchmarks for the meadow vole.

3.3.1.1 On-Site Soil Comparison

Screening the maximum concentrations of the on-site soil COPECs against the literature and derived benchmark values indicated the following.

- Several chemicals did not exceed their respective benchmark values and do not pose a risk to environmental receptors. These include all the detected pesticides, benzene, ethylbenzene, toluene, total xylene, 4-methylphenol, acenaphthene, acenaphthylene, anthracene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, carbazole, dibenzo(a,h)anthracene, dimethylphthalate, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, pyrene, antimony, beryllium, cadmium, chromium, cobalt, copper, total cyanide, manganese, nickel, silver, and zinc.

- Several chemicals exceeded their respective benchmark values and may pose a risk to environmental receptors. They include 2-methylnaphthalene, benzo(a)anthracene, benzo(a)pyrene, chrysene, dibenzofuran, phenanthrene, aluminum, arsenic, barium, lead, mercury, selenium, thallium, vanadium, and Aroclor 1260.

3.3.1.2 Off-Site Soil Comparison

Screening the maximum concentration of the Watchogue Creek/Crum's Brook soil COPECs against the literature and derived benchmark values indicated the following.

- Several chemicals did not exceed their respective benchmark values and do not pose a risk to environmental receptors. These include all the BETX compounds and detected pesticides, acenaphthene, acenaphthylene, anthracene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, bis(2-ethylhexyl)phthalate, carbazole, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, beryllium, cadmium, chromium, cobalt, copper, total cyanide, nickel, and silver.

- Several chemicals exceeded their respective benchmark values and may pose a risk to environmental receptors. They include 2-methylnaphthalene, benzo(a)anthracene, benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, dibenzofuran, phenanthrene, pyrene, aluminum, arsenic, barium, lead, manganese, mercury, selenium, vanadium, and zinc.

3.3.2 Surface Water

3.3.2.1 Freshwater

The NYSDEC ambient water quality standards and guidance values (NYSDEC, 1998a) for the protection of freshwater aquatic life were used to evaluate chemical concentrations in surface water from O-Co-Nee Pond, Lawrence Lake, and Watchogue Creek/Crum's Brook. The values are generally based on acute toxicity endpoints from laboratory studies of aquatic species, or endpoints related to bioaccumulation. Class C water standards (secondary contact recreation and fish propagation) were used because Lawrence Lake was classified as Class C water. All surface water quality standards were obtained from either 6 NYCRR 703.5 or TOGS 1.1.1. NYSDEC surface water quality standards are not available for several of the organic chemicals detected in the surface water bodies. Therefore, chemical concentrations in surface water also were compared to toxicological benchmarks derived by the EPA Office of Solid Waste and Emergency Response (OSWER) (Tier II values) and the EPA Region IV (screening values) presented by the ORNL (Suter and Tsao, 1996). These comparisons are presented in Table 3-11.

O-Co-Nee Pond

Screening the maximum surface water concentration against the literature benchmarks indicated the following.

- Several chemicals did not exceed their respective benchmark values and do not pose a risk to environmental receptors. These include xylene (total), arsenic and chromium.
- Several chemicals exceeded their respective benchmark values and may pose a risk to environmental receptors. They include phenanthrene, barium and lead.
- Toxicological benchmark values were not available for anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, fluoranthene, indeno(1,2,3-cd)pyrene, and total cyanide, and use of a free cyanide benchmark would be inappropriate for this analysis.

Lawrence Lake

Screening the maximum surface water concentration against the literature benchmarks indicated the following.

- PAHs did not exceed their respective benchmark values and do not pose a risk to environmental receptors.
- Several chemicals exceeded their respective benchmark values and may pose a risk to environmental receptors. They include barium, lead, and selenium.
- Toxicological benchmark values were not available for total cyanide, and use of a free cyanide benchmark would be inappropriate for this analysis.

Watchogue Creek/Crum's Brook

Screening the maximum surface water concentration against the literature benchmarks indicated the following.

- Several chemicals did not exceed their respective benchmark values and do not pose a risk to environmental receptors. These include acenaphthene, acenaphthylene, phenanthrene, pyrene, arsenic and chromium.
- Several chemicals exceeded their respective benchmark values and may pose a risk to environmental receptors. They include fluorene, barium, cadmium, lead, and silver. The source of the barium and silver are not related to MGP activities.

3.3.2.2 Salt Water

The NYSDEC ambient water quality standards and guidance values (NYSDEC, 1998a) for the protection of salt water aquatic life were used to evaluate chemical concentrations in surface water and pore water from Lawrence Creek. These values are generally based on acute toxicity endpoints from laboratory studies of aquatic species, or endpoints related to bioaccumulation. Class SC water standards (primary and secondary contact recreation; fish propagation and survival) were used because Lawrence Creek, the discharge point for the groundwater plume, is classified as SC. All surface water quality standards were obtained from either 6 NYCRR 703.5 or TOGS 1.1.1. NYSDEC surface water quality standards are not available for several of the organic chemicals detected in Lawrence Creek. Therefore, chemical concentrations in surface water also were compared to toxicological benchmarks derived by the EPA OSWER (Tier II values) and presented by ORNL (Suter and Tsao, 1996) and EPA Region IV (saltwater chronic screening values) (EPA, 2001b). These comparisons are presented in Table 3-12.

Screening the maximum surface water concentration against the literature benchmarks indicated the following.

- Detected concentrations of benzene, toluene, fluorene, and selenium did not exceed respective benchmark values and do not pose a risk to environmental receptors.
- Concentrations of ethylbenzene, xylene (total), acenaphthylene, naphthalene, phenanthrene, and barium exceeded respective benchmark values and may pose a risk to environmental receptors.
- Toxicological benchmark values were not available for MTBE, 2-methylnaphthalene, acenaphthylene, and total cyanide.

3.3.3 Sediment

The NYSDEC technical guidance for screening contaminated sediments (NYSDEC, 1998b) was used to evaluate chemicals concentrations in sediment. The results are provided in Table 3-13. The NYSDEC has derived criteria for non-polar organic compounds using the equilibrium partitioning methodology recommended by the EPA. This methodology contends that sediment toxicity is attributable to the concentration of chemical in the interstitial pore water, which is considered to be biologically available to benthic organisms. It can be inferred that the water quality criteria developed to protect aquatic life from chemicals dissolved in the water column should also protect aquatic life from chemicals dissolved in the pore water. To derive an organic carbon-normalized sediment criterion, the following information is needed:

- an ambient water quality criterion (WQC) for a particular chemical; and

- the octanol/water partition coefficient (K_{ow}) for the chemical.

The organic carbon-normalized sediment criterion (SC_{oc}) would be:

$$SC_{oc} = WQC * K_{ow}$$

NYSDEC sediment criteria values are not available for several of the organic chemicals detected in the waterbodies sampled. Therefore, chemical concentrations in sediment were also compared to toxicological benchmarks for sediment presented in the Oak Ridge National Laboratory guidance (Jones et al, 1997). Three sets of benchmarks are presented. The first two are the ORNL and EPA OSWER toxicological benchmarks, which were also derived using the equilibrium partitioning methodology. The difference between ORNL and the OSWER values is that the OSWER uses the lower limit of the 95% confidence interval rather than the central tendency value. The third set of values is from the Ontario Ministry of Environment (OME). The OME derived criteria use a screening-level approach. This approach provides two values, a lowest value (viz., a level at which actual ecotoxic effects become apparent) and a severe value (viz., a level that could potentially eliminate most of the benthic organisms). These values also are presented in Table 3-13.

The NYSDEC has established two levels of criteria for inorganic chemicals in sediments. These are the lowest effect level (LEL) and severe effect level (SEL). The LEL indicates a level of sediment contamination that can be tolerated by the majority of the benthic organisms, but still causes toxicity to a few species. The SEL indicates the concentration at which effects to the sediment-dwelling community indicate highly contaminated sediments.

3.3.3.1 O-Co-Nee Pond

Screening the maximum sediment concentration against the benchmarks indicated the following.

- Several chemicals did not exceed their respective benchmark values and do not pose a risk to environmental receptors. These include all BTEX compounds, anthracene, fluorene, arsenic, cadmium, chromium, and lead.

- Several chemicals exceeded their respective benchmark values and may pose a risk to environmental receptors. They include benzo(a)anthracene, benzo(a)pyrene, chrysene, phenanthrene and fluoranthene.

- Toxicological benchmark values were not available for benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, pyrene, barium, selenium and total cyanide.

3.3.3.2 Lawrence Lake

Screening the maximum sediment concentration against the benchmarks indicated the following.

- Several chemicals did not exceed their respective benchmark values and do not pose a risk to environmental receptors. These include acenaphthylene, anthracene, dibenzo(a,h)anthracene, fluoranthene, fluorene, phenanthrene, arsenic, and lead.

- Several chemicals exceeded their respective benchmark values and may pose a risk to environmental receptors. They include benzo(a)anthracene, benzo(a)pyrene, chrysene, cadmium, and chromium.

- Toxicological benchmark values were not available for benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, pyrene, barium, selenium and total cyanide.

3.3.3.3 Lawrence Creek

Screening the maximum sediment concentration against the benchmarks indicated the following.

- Several chemicals did not exceed their respective benchmark values and do not pose a risk to environmental receptors. These include xylene (total), acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, fluoranthene, phenanthrene, arsenic, cadmium, chromium, lead and mercury.

- Several chemicals exceeded their respective benchmark values and may pose a risk to environmental receptors. They include acenaphthene, chrysene, fluorene and naphthalene.

- Toxicological benchmark values were not available for MTBE, 2-methylnaphthene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, pyrene, barium, and total cyanide.

3.3.3.4 Watchogue Creek/Crum's Brook

Screening the maximum sediment concentration against the benchmarks indicated the following.

- Several chemicals did not exceed their respective benchmark values and do not pose a risk to environmental receptors. These include ethylbenzene, toluene, and dibenzo(a,h)anthracene.

- Several chemicals exceeded their respective benchmark values and may pose a risk to environmental receptors. They include benzene, total xylene, acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, chrysene, fluoranthene, fluorene, naphthalene, phenanthrene, arsenic, cadmium, chromium, lead, mercury and silver.

- Toxicological benchmark values were not available for 2-methylnaphthalene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, dibenzofuran, indeno(1,2,3-cd)pyrene, pyrene, barium, selenium and total cyanide.

3.4 Conclusions

3.4.1 Habitat Characterization

The site reconnaissance conducted as part of this analysis indicates that the site and surrounding area are poor quality environmental resources, due to the limited presence of vegetation. The site is partially covered with buildings, blue stone and asphalt. Wildlife species typically present are adapted to urban setting. Due to the size of the vegetated areas, only a few individuals will be present.

3.4.2 Soil

Virtually all wildlife species in the community are transient and present on the site or in the plume path areas for brief periods, reflecting the degree of urbanization. Thus, there is little opportunity for exposure to any of the COPECs.

3.4.2.1 On-Site Soil

Several COPECs were detected at concentrations greater than the toxicological benchmark values. This suggests that these chemicals may pose a risk to wildlife. The potential risk from COPECs is minimal, for several reasons. Exposure frequency, chemical concentration (especially within the upper 6 inches), mechanism of exposure, and duration of exposure determines risk. The site and immediate surrounding area are residential, commercial or industrial properties. The commercial and industrial areas have minimal habitat in the form of "weedy" patches that would not support a wildlife population. Maintained lawns surround the residential areas. These areas experience constant physical disturbance that prevents populations of wildlife from developing. Because only transient species and a few individual animals would use this area, the frequency and duration of exposure is limited. Thus, the chemicals detected on-site do not pose a current risk, nor is any expected in the future. Conceptually, the future use of the site could be for commercial-type properties. These properties would be surrounded by paved parking areas and limited landscaping. The buildings and pavement would eliminate potential exposure of wildlife to soils on-site.

In addition, availability for biological uptake and migration from soil is an essential factor in controlling the potential risk these chemicals pose to biota. Many PAHs become less available as they age within soil. Furthermore, the presence and nature of the organic material in the soil has a profound influence on the availability of PAHs. This reduced availability, which results from chemical complexation or entrapment in very fine pores, results in an overestimation of risk (Stroo et al., 2000).

3.4.2.2 Off-Site Soil

Several COPECs were detected at concentrations greater than the toxicological benchmark values near Watchogue Creek/Crum's Brook. This suggests that these chemicals may pose a risk to wildlife. The potential risk from COPECs is minimal, for several reasons. Exposure frequency, chemical concentration (especially within in the upper 6 inches), mechanism of exposure, and duration of exposure determines risk. Watchogue Creek/Crum's Brook flows through an urbanized area, with residential, commercial and industrial properties bordering it. Vegetation is limited to a narrow band on either side of the shoreline. These areas experience constant physical disturbance that prevents populations of wildlife from developing. Because only transient species and a few individual animals would use this area, the frequency and duration of exposure is limited. Thus, the chemicals detected in the soil do not pose a risk to this resource.

For a chemical in a soil to pose a risk, it must first be made available to a receptor through mobilization, transport, and exposure; and then the chemical must elicit an adverse response from the ecological receptor due to that exposure.

The availability of a chemical in the soil is affected by existing site conditions. These conditions may include "fresh" chemicals or "weathered" chemicals. Fresh conditions refer to sites where a recent spill or chemical release has occurred. Weathered or aged chemicals are chemicals that have been in soils for many years, even decades. Chemical availability differs for fresh and weathered chemicals: chemicals recently released to soils will be more available for leaching, degradation, and bio-uptake than will weathered chemicals. At the Bayshore/ Brightwaters site, the chemicals have weathered for decades, and the chemicals are held tightly by the soil and are unavailable for transport.

In addition, PAHs become less available as they age within soil. Furthermore, the presence and nature of the organic material in the soil has a profound influence on the availability of PAHs.

From the moment that a chemical comes into contact with a soil, a series of natural physical and chemical processes occur. These processes result in the diffusion and distribution of the chemical onto the surfaces and into the pores of the individual soil particles. As the time of contact increases, the "aging" process results in movement of some of the chemical to the interior of the soil particle surfaces. In addition to the physical interaction, there can be chemical reactions that cause the chemicals in the soil to be more complex and less available for leaching and degradation. This "sequestration" and "complexation" of the chemical over time has an impact on the availability of the chemicals to living organisms (Stroo et al., 2000). Environmental laboratory analytical methods use aggressive extraction techniques in order to obtain total chemical levels within a tested medium. Thus, the analytical data indicates total concentrations versus what is really bioavailable to receptors.

In recent studies using bioremediation techniques, it was found that aging was a primary factor in determining the success of bioremediation. Adding bacteria did not increase the amount of PAHs remediated because the aged PAHs were not available to the bacteria

(Allard et al, 2000). In studies of pyrene and phenanthrene, only a small portion of the aged compounds remained available to earthworms after remediation (Chung and Alexander, 1999). Other studies indicate that at high application rates of bacteria, soil contact time may not play as significant a role in determining availability as simple dispersion and sorption on soil (Reeves et al, 2001). These studies suggest aged compounds are less available than fresh compounds and this availability is related to several environmental factors.

3.4.3 Surface Water

According to results of the Remedial Investigation and in confirmation of the SCDHS' independent investigation (Bradley et al., 2001), due to the presence of a strong upward vertical gradient within the Upper Glacial aquifer in the immediate vicinity of the northeastern corner of Lawrence Creek, the Bay Shore plume discharges through a narrow zone of the creek bottom adjacent to the shoreline. Total BTEX and PAH concentrations were detectable along and within 1-foot of the sediments in this area. Samples just below the water surface had no detectable concentrations of these COPECs. The data suggest that the BTEX and PAHs are rapidly dispersed and diluted due to mixing with the tidally influenced surface water. Moreover, these COPECs are known to volatilize and undergo biological degradation in surface waters (Wick et al., 2000).

The NYSDEC surface water quality standards plus criteria for the OSWER and EPA Region IV were used to screen the data collected from the four water bodies (O-Co-Nee Pond, Lawrence Lake, Lawrence Creek, and Watchogue Creek/Crum's Brook). Several COPECs were detected at concentrations greater than the toxicological benchmark values. This suggests that these chemicals may pose a risk to aquatic wildlife. These water bodies receive urban run-off. Fecal coliform bacteria, high flow rates, sediment, toxic heavy metals and organic pollutants are most commonly associated with urban receiving waters (Field and Pitt, 1989). While this runoff contains a variety of potentially toxic constituents, such as heavy metals and certain organics, at concentrations that could be adverse to aquatic life in the receiving waters for the runoff, a number of studies have found that the heavy metals in residential street and highway storm water runoff are in nontoxic forms (Lee and Lee, 1999).

3.4.4 Sediment

Several COPECs in each of the four water bodies were detected at concentrations greater than the toxicological benchmark values. This suggests that these chemicals may pose a risk to wildlife. In O-Co-Nee Pond, Lawrence Lake and Lawrence Creek, PAHs and metals were the chemicals that exceeded benchmark values. Given the fact that the four water bodies have, and continue to, receive urban/suburban discharges and general storm water runoff from immediately surrounding areas (including roadways), the observations are not surprising.

These potential effects are considered to have minimal ecological significance. The major effects are caused by heavy metals and PAHs. Because these metals readily adsorb to settling particles (Sigg, 1985), high concentrations of these metals are frequently found in sediment from lakes and streams in industrial areas. The toxicity of metals in sediments is influenced by the extent that metals bind to the sediment. Metals that are strongly bound have very low pore water concentrations and exhibit little or no toxicity. Conversely, metals that are weakly bound have comparatively higher pore water concentrations and are potentially toxic.

PAHs are a major component of coal tars. PAHs contain only carbon and hydrogen and consist of two or more fused benzene rings in linear, angular or cluster arrangements. The number of rings in a PAH molecule affects its biological activity, and fate and transport in the environment. In general, most PAHs can be characterized as being hydrophobic, and having low vapor pressure, low to very low water solubility, low Henry's Law constant, high log K_{ow}, and high organic carbon partition coefficient (K_{oc}). High partition coefficients and low solubilities suggest that PAHs are likely to be adsorbed onto sediment particles and are thus not bioavailable.

Bioavailability represents the accessibility of a chemical for assimilation and possible toxicity to an organism. The bioavailability of PAHs in sediment declines with time and the current analytical methods, because they measure total and not bioavailable concentrations, may overestimate the magnitude of the environmental and societal problem from these pollutants. Aging is toxicologically significant because the assimilation and acute and chronic toxicity of harmful compounds decline as they persist and become increasingly sequestered with time (Alexander, 2000).

During the aging process, molecules slowly move into sites within the soil/sediment matrix that are not readily accessed by even the smallest of microorganisms, no less tissues of higher organisms. Organic matter is the chief sorbent for hydrophobic molecules. If sequestered molecules are inaccessible to organisms and even to extracellular enzymes of microorganisms and if diffusion out of these remote sites is extremely slow, the bioavailability of PAHs will be governed by the very slow rate of release to an accessible site. In a reasonably short time period, therefore, little would be available to an animal, plant, or microorganism (Alexander, 2000).

The Remedial Investigation and FWRIA have indicated that there are pathways through which fish and wildlife could be exposed to potentially hazardous materials related to former MGP activities. However, because of the level of urbanization in the community and the transient nature of wildlife present, remedial activities specifically directed at fish and wildlife exposure are not required.

4.0 References

Alexander, M. 2000. *Aging, Bioavailability, and Overestimation of Risk from Environmental Pollutants.* Environmental Science & Technology. 34: 4259-4265.

Allard, A. S., Remberger, M., Neilson, A. H. 2000. *The Negative Impact of Aging on the Loss of PAH Components in a Creosote-Contaminated Soil.* International Biodeterioration & Biodegradation. 46(1): 43-49.

Bradley, C.B., V. Minei, J. Pim, and R. Paulsen. 2001. *Bayshore Gas Manufacturing Plant Discharge of Contaminated Groundwater into Lawrence Creek.* Suffolk County Department of Health Services.

Chung, N., Alexander, M. 1999. *Effect of Concentration on Sequestration and Bioavailability of Two Polycyclic Aromatic Hydrocarbons.* Environmental Science and Technology. 33(20): 3605-3608.

Clough, M.W. 1999. Personal Communication. United States Department of the Interior, Fish and Wildlife Service, Cortland, NY.

Dvirka and Bartilucci Consulting Engineers, Inc. (D&B), 1999, Remedial Investigation/Feasibility Study Work Plan, Bay Shore/Brightwaters Former Manufactured Gas Plant Site Investigation, August, 1999.

Dvirka and Bartilucci Consulting Engineers, Inc. (D&B), 2002, Remedial Investigation Report, Bay Shore/Brightwaters Former Manufactured Gas Plant Site, April, 2002.

Efroymson, R.A., M.E. Will, and G.W. Suter III. 1997a. *Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process: 1997 Revision.* ES/ER/TM-126/R2. Oak Ridge National Laboratory, Oak Ridge, TN.

Efroymson, R.A., ME Will, G.W. Suter III and AC Wooten. 1997b. *Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision.* ES/ER/TM-126/R2. Oak Ridge National Laboratory, Oak Ridge, TN.

Eisler, R, 1987, *Polycyclic Aromatic Hydrocarbon Hazards to Fish, Wildlife, and Invertebrates: A synoptic Review*, Biological Report 85(1.11), U.S. Fish and Wildlife Service, Laurel, MD.

Field, R. and R.E. Pitt, 1989. Urban Storm-Induced Impacts: U.S. Environmental Protection Agency Research Program Review. Risk Reduction Engineering Lab. NTIS PB-90-112566/ XAB. Washington, DC.

GEI Consultants, Inc., 1998, Subsurface Investigation Report, Brightwaters/Bay Shore Site, Long Island, New York.

Howard, P.H. 1990. *Handbook of Environmental Fate and Exposure Data for Organic Chemicals.* Lewis Publishers, Chelsea, MI.

Jones, D.S., G.W. Suter and R.N. Hall. 1997. *Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Sediment-Associated Biota: 1997 Revision.* ES/ER/TM-95/R4. Oak Ridge National Laboratory, Oak Ridge, TN.

Kabata-Pendias, A. and H. Pendias. 1992. *Trace Elements in Soils and Plants.* P.T. Kostecki, E.J. Calabrese, eds. Lewis Publishers, Inc., Chelsea, MI.

Lee, G.E. and A. Jones-Lee, 1999, *Assessing and Managing Water Quality Impacts of Urban Stormwater Runoff.* G. Fred Lee & Associates, El Macero, CA.

Mackey, T. 1999. Personal Communication. New York State Department of Environmental Conservation, Division of Fish, Wildlife & Marine Resources. NYS Natural Heritage Program. Latham, NY.

Malcolm Pirnie Environmental Engineers, Scientists and Planners, 1993, Field Investigation Report, Bayshore Manufactured Gas Plant, Bayshore, New York, Project 1249-02-03.

McIntosh, A. 1992. *Trace Metals in Freshwater Sediments: A Review of the Literature and an Assessment of Research Needs.* In: *Metal Ecotoxicology Concepts & Applications.* Edited by M.C. Newman and A.W. McIntosh, Lewis Publishers, Inc., Chelsea, MI.

New York State Department of Environmental Conservation (NYSDEC), 1998a. *Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations.* Division of Water Technical and Operational Guidance Series (TOGS) 1.1.1, Albany, NY.

New York State Department of Environmental Conservation (NYSDEC), 1998b, Technical Guidance for Screening Contaminated Sediments, Division of Fish and Wildlife, Albany, New York.

New York State Environmental Conservation Rules and Regulations, 6NYCRR, Title 6 of the Official Compilation of Codes, Rules and Regulations of the State of New York, http://www.dec.state.ny.us/website/regs/.

Reed, P.B., 1988, *National List of Plant Species that Occur in Wetlands: Northeast (Region 1),* United States Department of the Interior, Washington, D.C.

Reeves, W. R., Mcdonald, T. J., Bordelon, N. R., George, S. E., Donnelly, K. C. 2001. *Impacts of Aging on In Vivo and In Vitro Measurements of Soil-Bound Polycyclic Aromatic Hydrocarbon Availability.* Environmental Science & Technology. 35(8): 1637-1643.

Reschke, C., 1990, *Ecological Communities of New York State,* New York Natural Heritage Program, Latham, NY.

Sample, B. E., D. M. Opresko and G.W. Suter. 1996. *Toxicological Benchmarks for Wildlife: 1996 Revision.* ES/ER/TM-86/R3. Prepared for the U.S. Department of Energy, Office of Environmental Management, Oak Ridge National Laboratory, Oak Ridge, TN.

Sigg, L., 1985, "Metal Transfer Mechanisms in Lakes: The Roles of Settling Particles," pp. 283-310 In: W. Stumm (ed.) *Chemical Processes in Lakes,* John Wiley and Sons, Inc., NY.

Stroo, H.F., R. Jensen, R.C. Loehr, D.V. Nakles, A. Fairbrother, and C.B. Liban. 2000. *Environmentally Acceptable Endpoints for PAHs at a Manufactured Gas Plant Site.* Environmental Science & Technology 34: 3831-3836.

Suter, G.W. and C.L. Tsao. 1996. *Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision.* ES/ER/TM-96/R2. Oak Ridge National Laboratory, Oak Ridge, TN.

United States Environmental Protection Agency (EPA), 1989, Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A), Interim Final, EPA/540/1-89/002 and Volume II, Environmental Evaluation Manual, Interim Final, EPA/540/1-89/001, Office of Emergency and Remedial Response.

United States Environmental Protection Agency (EPA), 1997, Health Assessment Effects Summary Tables, FY 1997 update, Washington, D.C.

United States Environmental Protection Agency (USEPA), 2001a, Integrated Risk Information System on-line database, http://www.epa.gov/ngispgm3/iris/index.html; INTERNET.

United States Environmental Protection Agency (USEPA), 2001b, Region 4 Ecological Risk Assessment Bulletins, www.epa.gov/region4/wastepgs/oftecser/ecolbul.htm. INTERNET.

United States Fish And Wildlife Service, 1997, *Significant Habitats and Habitat Complexes of the New York Bight Watershed.* Southern New England-New York Bight Coastal Ecosystem Program, Hadley, MA.

Wick, L.Y., McNeill, K., Rojo, M., Medilanski, E., Geschwend, P.M., 2000, *Fate of Benzene in a Stratified Lake Receiving Contaminated Groundwater Discharges from a Superfund Site*, Vol. 43, No. 20, Environmental Science and Technology.

Tables

Table 2-1
Human Health Chemicals of Potential Concern

Medium	Chemicals of Potential Concern		
	Volatile Organic Chemicals	PAHs, Pesticides, and PCBs	Metals and Total Cyanide
Surface Soil			
Bay Shore Site and Bay Shore West Parcel	Benzene, ethylbenzene, toluene, xylenes	2-Methylnaphthalene, acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, dibenzofuran, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, pyrene, Aroclor-1260	Arsenic, barium, cadmium, chromium, total cyanide, lead, mercury, selenium, silver
Brightwaters Yard Site and Bay Shore West Storage Lot Parcel	Benzene, toluene	2-Methylnaphthalene, acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, dibenzofuran, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, pyrene	Arsenic, barium, cadmium, chromium, total cyanide, lead, mercury, selenium, silver
Brightwaters East Parcel	Benzene, toluene, xylenes	2-Methylnaphthalene, acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, dibenzofuran, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, pyrene	Arsenic, barium, cadmium, chromium, total cyanide, lead, mercury, selenium, silver
Watchogue Creek/Crum's Brook – Area A	None	2-Methylnaphthalene, acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, dibenzofuran, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, pyrene	Arsenic, barium, cadmium, chromium, total cyanide, lead, mercury, selenium, silver
Watchogue Creek/Crum's Brook – Area B	Acetone, methylene chloride, trichloroethane	Anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, bis(2-ethylhexyl)phthalate, butylbenzylphthalate, carbazole, chrysene, 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, dieldrin, alpha-chlordane, gamma-chlordane, fluoranthene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, pyrene	Aluminum, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, manganese, mercury, nickel, selenium, silver, vanadium, zinc
Subsurface Soil			
Bay Shore Site and Bay Shore West Parcel	Benzene, ethylbenzene, toluene, xylenes	2-Methylnaphthalene, acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, dibenzofuran, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, pyrene	Arsenic, barium, cadmium, chromium, total cyanide, lead, mercury, selenium, silver
Brightwaters Yard Site and Bay Shore West Storage Lot Parcel	Benzene, ethylbenzene, toluene, xylenes	1-Methylnaphthalene, 2-Methylnaphthalene, acenaphthene, acenaphthylene, aldrin, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, alpha-BHC, chrysene, 4,4'-DDD, 4,4'-DDT, dibenzo(a,h)anthracene, Endosulfan I, endrin, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, pyrene	Arsenic, barium, cadmium, chromium, total cyanide, lead, mercury, selenium, silver
Brightwaters East Parcel	Benzene, ethylbenzene, toluene, xylenes	1-Methylnaphthalene, 2-Methylnaphthalene, acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, dibenzofuran, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, pyrene	Arsenic, barium, cadmium, chromium, total cyanide, lead, mercury, selenium, silver
Watchogue Creek/Crum's Brook – Area A	Benzene, ethylbenzene, toluene, xylenes	2-Methylnaphthalene, acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, dibenzofuran, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, pyrene	Arsenic, barium, cadmium, chromium, total cyanide, lead, mercury, selenium, silver
Watchogue Creek/Crum's Brook – Area B	Benzene, ethylbenzene, toluene, xylenes	2-Methylnaphthalene, acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, dibenzofuran, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, pyrene	Arsenic, barium, cadmium, chromium, total cyanide, lead, mercury, selenium, silver
Groundwater			
Bay Shore Site and Bay Shore West Parcel	Benzene, ethylbenzene, MTBE, toluene, xylenes	2-Methylnaphthalene, acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, dibenzofuran, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, pyrene	Arsenic, barium, cadmium, chromium, total cyanide, lead, manganese, selenium, silver
Brightwaters Yard Site and Bay Shore West Storage Lot Parcel	Benzene, *p*-dichlorobenzene, ethylbenzene, methylene chloride, toluene, xylenes	1-Methylnaphthalene, 2-Methylnaphthalene, acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, dibenzofuran, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, pyrene	Aluminum, arsenic, barium, chromium, total cyanide, lead, manganese, nickel, selenium, zinc
Brightwaters East Parcel	1,2,3-Trichlorobenzene, 1,2,4-trichlorobenzene, 1,4-dichlorobenzene, acetone, benzene, *sec*-butylbenzene, chlorobenzene, ethylbenzene, hexachlorobutadiene, isopropylbenzene, methylene chloride, *n*-propylbenzene, toluene, xylenes	2-Methylnaphthalene, acenaphthene, acenaphthylene, anthracene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, pyrene	Lead
Watchogue Creek/Crum's Brook – Area A	Benzene, ethylbenzene, toluene, xylenes	2-Methylnaphthalene, acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenzofuran, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, pyrene	Lead
Watchogue Creek/Crum's Brook – Area B	Benzene, ethylbenzene, toluene, xylenes	2-Methylnaphthalene, acenaphthene, acenaphthylene, anthracene, dibenzofuran, fluoranthene, fluorene, naphthalene, phenanthrene, pyrene	Lead

Table 2-1 (cont'd.)
Human Health Chemicals of Potential Concern

Medium	Chemicals of Potential Concern: Volatile Organic Chemicals	Chemicals of Potential Concern: PAHs, Pesticides, and PCBs	Chemicals of Potential Concern: Metals and Total Cyanide
Indoor Air			
Bay Shore Site and Bay Shore West Parcel	1,2,4-Trimethylbenzene, 1,3,5-trimethylbenzene, acetone, benzene, *n*-butylbenzene, cumene, *p*-cymeme, ethylbenzene, MTBE, *n*-propylbenzene, styrene, toluene, xylenes	Aldrin, Aroclor-1260, benzo(a)pyrene, naphthalene, alpha-BHC, beta-BHC, gamma-BHC, bis(2-ethylhexyl)phthalate, alpha-chlordane, gamma-chlordane, 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, dieldrin, heptachlor, heptachlor epoxide	Mercury
Brightwaters Yard Site and Bay Shore West Storage Lot Parcel	Benzene, *p*-dichlorobenzene, ethylbenzene, methylene chloride, toluene, xylenes	Aldrin, Aroclor-1260, benzo(a)pyrene, naphthalene, alpha-BHC, 4,4'-DDD, 4,4'-DDT	Mercury
Brightwaters East Parcel[1]	Benzene, toluene, *m*- and *p*-xylenes	None	None
Off-site (due to Bay Shore groundwater plume)	Benzene, ethylbenzene, toluene, xylenes	2-Methylnaphthalene, acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, dibenzofuran, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, pyrene, Benzo(a)pyrene, naphthalene	None
Off-site (due to Brightwaters groundwater plume)	2-Propanol, acetone, benzene, ethanol, methylene chloride, toluene, trichloroethylene, *m*- and *p*-xylenes	1-Methylnaphthalene, 2-Methylnaphthalene, acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, dibenzofuran, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, pyrene	None
Ambient Air			
Bay Shore Site and Bay Shore West Parcel	1,2,4-Trimethylbenzene, 1,3,5-trimethylbenzene, acetone, benzene, 2-butanone, *n*-butylbenzene, cumene, *p*-cymeme, ethylbenzene, methylene chloride, MTBE, *n*-propylbenzene, styrene, tetrachloroethene, toluene, xylenes	Naphthalene	None
Brightwaters Yard Site and Bay Shore West Storage Lot Parcel	Benzene, *p*-dichlorobenzene, ethylbenzene, methylene chloride, toluene, xylenes	Naphthalene	None
Brightwaters East Parcel[1]	1,2,3-Trichlorobenzene, 1,2,4-trichlorobenzene, acetone, benzene, chlorobenzene, *p*-dichlorobenzene, ethylbenzene, hexachlorobutadiene, isopropylbenzene, methylene chloride, MTBE, *n*-propylbenzene, toluene, xylenes	Naphthalene	
Watchogue Creek/Crum's Brook – Area A	Benzene, ethylbenzene, toluene, xylenes	Naphthalene	
Watchogue Creek/Crum's Brook – Area B	Acetone, benzene, ethylbenzene, methylene chloride, trichloroethane, toluene, xylenes	Naphthalene	
Sediment			
Watchogue Creek/Crum's Brook – Area B	Benzene, ethylbenzene, tetrachloroethene, toluene	2-Methylnaphthalene, acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, dibenzofuran, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, pyrene	Arsenic, barium, cadmium, chromium, total cyanide, mercury, selenium, silver
Watchogue Creek/Crum's Brook – Area C	Benzene, ethylbenzene, toluene, xylenes	2-Methylnaphthalene, acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, dibenzofuran, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, pyrene	Arsenic, barium, cadmium, chromium, total cyanide, lead, mercury, selenium, silver
Lawrence Lake	None	Acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, phenanthrene, pyrene	Arsenic, barium, cadmium, chromium, total cyanide, lead, selenium
Lawrence Creek	Xylenes, MTBE	2-Methylnaphthalene, acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, pyrene	Arsenic, barium, cadmium, chromium, total cyanide, lead, mercury
O-Co-Nee Pond	Xylenes	Acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, fluoranthene, indeno(1,2,3-cd)pyrene, phenanthrene, pyrene	Arsenic, barium, cadmium, chromium, total cyanide, lead, selenium
Surface Water			
Lawrence Lake	None	None	Barium, total cyanide, lead, selenium
Lawrence Creek	Benzene, ethylbenzene, MTBE	2-Methylnaphthalene, acenaphthene, acenaphthylene, fluorene, naphthalene, phenanthrene	Barium, total cyanide, selenium
O-Co-Nee Pond	Xylenes	Benzo(a)anthracene, benzo(a)pyrene, phenanthrene, pyrene, indeno(1,2,3-cd)pyrene, benzo(b)fluoranthene, fluoranthene, benzo(k)fluoranthene, chrysene	Arsenic, barium, chromium, total cyanide, lead

[1] Exposure via inhalation may occur as result of volatilization of chemicals from soil and groundwater.

Table 2-2A
Data/Exposure Matrix for the Bay Shore Site and Bay Shore West Parcel – Operable Unit 1 (OU-1)

Exposure Scenario	Exposure Medium and Pathway							
	Surface Soil		Subsurface Soil		Groundwater		Indoor Air	
		Relevant Pathways		Relevant Pathways		Relevant Pathways		Relevant Pathways
Current Exposure								
On-Site Trespassers	•	Ingestion						
	•	Dermal Contact						
	•	Particulate Inhalation						
Adult On-Site KeySpan Workers	•	Ingestion					•	Vapor Inhalation [1]
	•	Dermal Contact						
	•	Particulate Inhalation						
Adult Nearby Off-Site Utility Workers	•	Ingestion	•	Ingestion	•	Dermal Contact		
	•	Dermal Contact	•	Dermal Contact	•	Vapor Inhalation [2]		
	•	Particulate Inhalation	•	Particulate Inhalation				
	•̲	Vapor Inhalation [2]	•̲	Vapor Inhalation [2]				
Future Exposure								
Adult On-Site Construction Workers	•	Ingestion	•	Ingestion	•	Dermal Contact		
	•	Dermal Contact	•	Dermal Contact	•	Vapor Inhalation [2]		
	•̲	Particulate Inhalation [2]	•̲	Particulate Inhalation [2]				
	•̲	Vapor Inhalation [2]	•̲	Vapor Inhalation [2]				
Adult On-Site Commercial Workers							•	Vapor Inhalation [1]
Adult & Child On-Site Visitors							•	Vapor Inhalation [1]
Adult & Child On-Site Residents	•	Ingestion	•	Ingestion	•	Ingestion	•	Vapor Inhalation [1]
	•	Dermal Contact	•	Dermal Contact	•	Dermal Contact		
	•	Particulate Inhalation	•	Particulate Inhalation	•	Vapor Inhalation		

Notes:
[1] Indoor air concentrations due to VOCs detected in subsurface soil and/or groundwater.
[2] Inhalation exposure assumed to be the sum of soil particulate, soil vapor, and groundwater vapor exposures as a consequence of trenching activities.
• indicates a potentially complete exposure pathway.
•̲ indicates a potentially complete exposure pathway, indicates that exposure to either surface soil or subsurface soil is assumed, whichever has greater chemical concentrations.

Table 2-2B
Data/Exposure Matrix for the Brightwaters Yard Site and Bay Shore West Storage Lot Parcel (OU-3)

Exposure Scenario	Exposure Medium and Pathway							
	Surface Soil		Subsurface Soil		Groundwater		Indoor Air	
		Relevant Pathways		Relevant Pathways		Relevant Pathways		Relevant Pathways
Current Exposure								
On-Site Trespassers	•	Ingestion						
	•	Dermal Contact						
	•	Particulate Inhalation						
Adult On-Site KeySpan Workers	•	Ingestion					•	Vapor Inhalation [1]
	•	Dermal Contact						
	•	Particulate Inhalation						
Future Exposure								
Adult On-Site Construction Workers	•	Ingestion	•	Ingestion	•	Dermal Contact		
	•	Dermal Contact	•	Dermal Contact	•	Vapor Inhalation [2]		
	•̲	Particulate Inhalation [2]	•̲	Particulate Inhalation [2]				
	•̲	Vapor Inhalation [2]	•̲	Vapor Inhalation [2]				
Adult On-Site Commercial Workers							•	Vapor Inhalation [1]
Adult & Child On-Site Visitors							•	Vapor Inhalation [1]
Adult & Child On-Site Residents	•	Ingestion	•	Ingestion	•	Ingestion	•	Vapor Inhalation [1]
	•	Dermal Contact	•	Dermal Contact	•	Dermal Contact		
	•	Particulate Inhalation	•	Particulate Inhalation	•	Vapor Inhalation		

Notes:
[1] Indoor air concentrations due to VOCs detected in subsurface soil and/or groundwater.
[2] Inhalation exposure assumed to be the sum of soil particulate, soil vapor, and groundwater vapor exposures as a consequence of trenching activities.
• indicates a potentially complete exposure pathway.
•̲ indicates a potentially complete exposure pathway, indicates that exposure to either surface soil or subsurface soil is assumed, whichever has greater chemical concentrations.

Table 2-2C
Data/Exposure Matrix for the Brightwaters East Parcel (OU-3)

Exposure Scenario	Exposure Medium and Pathway							
	Surface Soil		Subsurface Soil		Groundwater		Indoor Air	
		Relevant Pathways		Relevant Pathways		Relevant Pathways		Relevant Pathways
Current Exposure								
On-Site Trespassers	•	Ingestion						
	•	Dermal Contact						
	•	Particulate Inhalation						
Adult On-Site KeySpan Workers	•	Ingestion					•	Vapor Inhalation [1]
	•	Dermal Contact						
	•	Particulate Inhalation						
Future Exposure								
Adult On-Site Construction Workers	•	Ingestion	•	Ingestion	•	Dermal Contact		
	•	Dermal Contact	•	Dermal Contact	•	Vapor Inhalation [2]		
	•̲	Particulate Inhalation [2]	•̲	Particulate Inhalation [2]				
	•̲	Vapor Inhalation [2]	•̲	Vapor Inhalation [2]				
Adult & Child On-Site Residents	•	Ingestion	•	Ingestion	•	Ingestion	•	Vapor Inhalation [1]
	•	Dermal Contact	•	Dermal Contact	•	Dermal Contact		
	•	Particulate Inhalation	•	Particulate Inhalation	•	Vapor Inhalation		

Notes:
[1] Indoor air concentrations due to VOCs detected in subsurface soil and/or groundwater.
[2] Inhalation exposure assumed to be the sum of soil particulate, soil vapor, and groundwater vapor exposures as a consequence of trenching activities.
• indicates a potentially complete exposure pathway.
•̲ indicates a potentially complete exposure pathway, indicates that exposure to either surface soil or subsurface soil is assumed, whichever has greater chemical concentrations.

Table 2-2D
Data/Exposure Matrix for Watchogue Creek / Crum's Brook – Area "A" (OU-4)

Exposure Scenario	Exposure Medium and Pathway					
	Surface Soil		Subsurface Soil		Groundwater	
		Relevant Pathways		Relevant Pathways		Relevant Pathways
Future Exposure						
Adult Off-Site Construction Workers	•	Ingestion	•	Ingestion	•	Dermal Contact
	•	Dermal Contact	•	Dermal Contact	•	Vapor Inhalation [1]
	•̲	Particulate Inhalation [1]	•̲	Particulate Inhalation [1]		
	•̲	Vapor Inhalation [1]	•̲	Vapor Inhalation [1]		

Notes:
[1] Inhalation exposure assumed to be the sum of soil particulate, soil vapor, and groundwater vapor exposures as a consequence of trenching activities.
• indicates a potentially complete exposure pathway.
•̲ indicates a potentially complete exposure pathway, indicates that exposure to either surface soil or subsurface soil is assumed, whichever has greater chemical concentrations.

Table 2-2E
Data/Exposure Matrix for Watchogue Creek / Crum's Brook – Area "B" (OU-4)

Exposure Scenario	Exposure Medium and Pathway							
	Surface Soil		Subsurface Soil		Groundwater		Sediment and Surface Water	
		Relevant Pathways		Relevant Pathways		Relevant Pathways		Relevant Pathways
Current Exposure								
Adult & Child Off-Site Residents	•	Ingestion					•	Ingestion
	•	Dermal Contact					•	Dermal Contact
	•	Particulate Inhalation						
Future Exposure								
Adult Off-Site Construction Workers	•	Ingestion	•	Ingestion	•	Dermal Contact		
	•	Dermal Contact	•	Dermal Contact	•	Vapor Inhalation [1]		
	•̲	Particulate Inhalation [1]	•̲	Particulate Inhalation [1]				
	•̲	Vapor Inhalation [1]	•̲	Vapor Inhalation [1]				

Notes:
[1]Inhalation exposure assumed to be the sum of soil particulate, soil vapor, and groundwater vapor exposures as a consequence of trenching activities.
• indicates a potentially complete exposure pathway.
•̲ indicates a potentially complete exposure pathway, indicates that exposure to either surface soil or subsurface soil is assumed, whichever has greater chemical concentrations.

Table 2-2F
Data/Exposure Matrix for Watchogue Creek / Crum's Brook – Area "C" (OU-4)

Exposure Scenario	Exposure Medium and Pathway	
	Surface Soil, Sediment, and Surface Water	
		Relevant Pathways
Current Exposure		
On-Site Trespassers	•	Ingestion
	•	Dermal Contact
	•	Particulate Inhalation (Surface Soil Only)

Notes:
• indicates a potentially complete exposure pathway.

Table 2-2G
Data/Exposure Matrix for Bay Shore Groundwater Plume (OU-2)

Exposure Scenario	Exposure Medium and Pathway			
	Indoor Air		Groundwater	
		Relevant Pathways		Relevant Pathways
Current Exposure				
Adult & Child Off-Site Residents	•	Vapor Inhalation	•	Ingestion
			•	Dermal Contact
			•	Vapor Inhalation

Notes:
• indicates a potentially complete exposure pathway.
Available data from the Well and Basement Survey and indoor air sampling conducted to date, indicate that these are incomplete exposure pathways.

Table 2-2H
Data/Exposure Matrix for Brightwaters Groundwater Plume (OU-3)

Exposure Scenario	Exposure Medium and Pathway			
	Indoor Air		Groundwater	
		Relevant Pathways		Relevant Pathways
Current Exposure				
Adult & Child Off-Site Residents	•	Vapor Inhalation	•	Ingestion
			•	Dermal Contact
			•	Vapor Inhalation

Notes:
• indicates a potentially complete exposure pathway.
Available data from the Well and Basement Survey and indoor air sampling conducted to date indicate that these exposure pathways are generally incomplete.

Table 2-2I
Data/Exposure Matrix for Lawrence Lake (OU-2)

Exposure Scenario	Exposure Medium and Pathway					
	Sediment[1]		Surface Water[2]		Biota	
		Relevant Pathways		Relevant Pathways		Relevant Pathways
Current Exposure						
Adult & Child Off-Site Residents	•	Ingestion	•	Ingestion	•	Fish Consumption
	•	Dermal Contact	•	Dermal Contact		

Notes:
[1]Assumed sediment exposure as a consequence of wading.
[2]Assumed surface water exposure during swimming since exposure would be greater than during wading.
• indicates a potentially complete exposure pathway.

Table 2-2J
Data/Exposure Matrix for Lawrence Creek (OU-2)

Exposure Scenario	Exposure Medium and Pathway					
	Sediment[1]		Surface Water[2]		Biota	
		Relevant Pathways		Relevant Pathways		Relevant Pathways
Current Exposure						
Adult & Child Off-Site Residents	•	Ingestion	•	Ingestion	•	Fish Consumption
	•	Dermal Contact	•	Dermal Contact		

Notes:
[1]Assumed sediment exposure as a consequence of wading.
[2]Assumed surface water exposure during swimming since exposure would be greater than during wading.
• indicates a potentially complete exposure pathway.

Table 2-2K
Data/Exposure Matrix for O-Co-Nee Pond (OU-3)

Exposure Scenario	Exposure Medium and Pathway					
	Sediment[1]		Surface Water[2]		Biota	
		Relevant Pathways		Relevant Pathways		Relevant Pathways
Current Exposure						
Adult & Child Off-Site Residents	•	Ingestion	•	Ingestion	•	Fish Consumption
	•	Dermal Contact	•	Dermal Contact		

Notes:
[1]Assumed sediment exposure as a consequence of wading.
[2]Assumed surface water exposure during swimming since exposure would be greater than during wading.
• indicates a potentially complete exposure pathway.

Table 2-3A
Bay Shore Former MGP Site – Summary of Potential Exposures
Operable Unit 1 – Bay Shore Site and Bay Shore West Parcel
(listed in Table 2A of existing Qualitative Human Exposure Assessment)

Potentially Exposed Population	***Exposure Media***	***Exposure Potential***	***Pathway Complete?***		***Comments***
Current Scenarios			*As Is* [1]	*With Remediation* [2]	
On-site trespassers	▪ Surface soil ▪ Ingestion ▪ Dermal contact ▪ Particulate inhalation	Minimal	Yes	No	Access to site is restricted by gated fence.
Adult KeySpan workers	▪ Surface soil ▪ Ingestion ▪ Dermal contact ▪ Particulate inhalation	Low to Moderate	Yes	No	Very little exposed soil on site.
	▪ Subsurface soil ▪ Ingestion ▪ Dermal contact ▪ Particulate/vapor inhalation	Low	Yes	No	Excavation work is not frequently performed. KeySpan maintains a policy that only trained workers are used for excavation work at active facilities, *i.e.*, a "no dig" policy is in effect at the site.
	▪ Indoor air ▪ Vapor inhalation	Minimal	No	No	Indoor air concentrations measured in on site buildings are reported as non-detect or are below NYSDOH background.
Adult nearby off-site utility workers	▪ Surface soil ▪ Ingestion ▪ Dermal contact ▪ Particulate/vapor inhalation	Moderate	Yes	No	If utility work is performed in the vicinity of the site, the potential exists for exposure. The probability that utility work will be performed is considered moderate.
	▪ Subsurface soil ▪ Ingestion ▪ Dermal contact ▪ Particulate/vapor inhalation	Moderate	Yes	No	If utility work is performed in the vicinity of the site, the potential exists for exposure. The probability that utility work will be performed is considered moderate.

[1] Those conditions present in the absence of remedial action, *i.e.*, conditions as they currently exist.
[2] Remediation – The selection of remedial technologies is part of the next phase of this program, the Remedial Action Plan. These remedial actions will be designed to either eliminate a potential exposure pathway or to reduce the exposure to levels deemed appropriate by the NYSDOH and NYSDEC. Remedial activity may include engineering and administrative controls or a combination thereof.

Table 2-3A (continued)
Bay Shore Former MGP Site – Summary of Potential Exposures
Operable Unit 1 – Bay Shore Site and Bay Shore West Parcel
(listed in Table 2A of existing Qualitative Human Exposure Assessment)

Potentially Exposed Population	*Exposure Media*	*Exposure Potential*	*Pathway Complete?*		*Comments*
Current Scenarios (continued)			*As Is* [1]	*With Remediation* [2]	
Adult nearby off-site utility Workers (continued)	▪ Groundwater ▪ Ingestion ▪ Dermal contact ▪ Vapor inhalation	Minimal	Yes	No	Groundwater in the vicinity of the site is 8' to 10' below ground surface. This is deeper than the typical utility excavation.
Future Scenarios					
Adult on-site construction workers	▪ Surface soil ▪ Ingestion ▪ Dermal contact ▪ Particulate/vapor inhalation	High	Yes	No	Given the nature of construction work, *i.e,* excavation of large quantities of soil, the potential for exposure to soil is high.
	▪ Subsurface soil ▪ Ingestion ▪ Dermal contact ▪ Particulate/vapor inhalation	High	Yes	No	Given the nature of construction work, *i.e,* excavation of large quantities of soil, the potential for exposure to soil is high.
	▪ Groundwater ▪ Dermal contact ▪ Vapor inhalation	Moderate to High	Yes	No	Groundwater in the vicinity of the site is 8' to 10' below ground surface. This is within the range of typical depths of construction, especially if basements are a component of the proposed structure.
Adult on-site commercial workers and adult and child visitors to commercial establishments	▪ Indoor air ▪ Vapor inhalation	Minimal	No	No	Indoor air concentrations measured in on site buildings are reported as non-detect or are below NYSDOH background.

[1] Those conditions present in the absence of remedial action, *i.e.,* conditions as they currently exist.
[2] Remediation – The selection of remedial technologies is part of the next phase of this program, the Remedial Action Plan. These remedial actions will be designed to either eliminate a potential exposure pathway or to reduce the exposure to levels deemed appropriate by the NYSDOH and NYSDEC. Remedial activity may include engineering and administrative controls or a combination thereof.

Table 2-3A (continued)
Bay Shore Former MGP Site – Summary of Potential Exposures
Operable Unit 1 – Bay Shore Site and Bay Shore West Parcel
(listed in Table 2A of existing Qualitative Human Exposure Assessment)

Potentially Exposed Population	*Exposure Media*	*Exposure Potential*	*Pathway Complete?*		*Comments*
Future Scenarios (continued)			*As Is* [1]	*With Remediation* [2]	
Adult and child on-site residents	▪ Surface soil ▪ Ingestion ▪ Dermal contact ▪ Particulate/vapor inhalation	High	Yes	No	Children often play in areas where soil is exposed and through repetitive play action expose soil (*e.g.*, under swings).
	▪ Subsurface soil ▪ Ingestion ▪ Dermal contact ▪ Particulate/vapor inhalation	Moderate	Yes	No	In consideration of an individual who may garden or engage in subsurface work for another purpose.
	▪ Groundwater ▪ Dermal contact ▪ Vapor inhalation	Moderate to High	Yes	No	Exposure potential is moderate to high only if wells are installed on site for domestic purposes.
	▪ Indoor air ▪ Vapor inhalation	Minimal	No	No	Indoor air concentrations measured in on site buildings are reported as non-detect or are below NYSDOH background.

[1] Those conditions present in the absence of remedial action, *i.e.*, conditions as they currently exist.
[2] Remediation – The selection of remedial technologies is part of the next phase of this program, the Remedial Action Plan. These remedial actions will be designed to either eliminate a potential exposure pathway or to reduce the exposure to levels deemed appropriate by the NYSDOH and NYSDEC. Remedial activity may include engineering and administrative controls or a combination thereof.

Table 2-3B
Bay Shore Former MGP Site – Summary of Potential Exposures
Operable Unit 3 – Brightwaters Yard Site, Bay Shore West Storage Lot Parcel, Brightwaters East Parcel, and Brightwaters Groundwater Plume

(listed in Table 2B, 2C, and 2H of existing Qualitative Human Exposure Assessment)

Potentially Exposed Population	*Exposure Media*	*Exposure Potential*	*Pathway Complete?*		*Comments*
Current Scenarios			*As Is* [1]	*With Remediation* [2]	
On-site trespassers (BYS, BSWSLP, BEP)	▪ Surface soil ▪ Ingestion ▪ Dermal contact ▪ Particulate inhalation	Minimal	Yes	No	Access to site is restricted by gated fence.
Adult KeySpan workers (BYS, BSWSLP, BEP)	▪ Surface soil ▪ Ingestion ▪ Dermal contact ▪ Particulate inhalation	Low to moderate	Yes	No	Very little exposed soil on site.
	▪ Subsurface soil ▪ Ingestion ▪ Dermal contact ▪ Particulate/vapor inhalation	Low	Yes	No	Excavation work is not frequently performed. KeySpan maintains a policy that only trained workers are used for excavation work at active facilities, *i.e.,* a "no dig" policy is in effect at the site.
	▪ Indoor air ▪ Vapor inhalation	Minimal	No	No	Indoor air concentrations measured in on site buildings are reported as non-detect or are below NYSDOH background.
Adult and child off-site residents (BGP)	▪ Groundwater ▪ Ingestion ▪ Dermal contact ▪ Vapor inhalation	Moderate to High	Yes	No	Exposure potential is moderate to high only if wells are installed for domestic purposes. Based on Survey results, a very small number of properties have been identified for which these pathways are potentially complete.
	▪ Indoor air ▪ Vapor inhalation	Minimal	No	No	Indoor air concentrations measured in businesses and homes in the vicinity of the site are below levels of concern.

[1] Those conditions present in the absence of remedial action, *i.e.,* conditions as they currently exist.
[2] Remediation – The selection of remedial technologies is part of the next phase of this program, the Remedial Action Plan. These remedial actions will be designed to either eliminate a potential exposure pathway or to reduce the exposure to levels deemed appropriate by the NYSDOH and NYSDEC. Remedial activity may include engineering and administrative controls or a combination thereof.

Table 2-3B (continued)
Bay Shore Former MGP Site – Summary of Potential Exposures
Operable Unit 3 – Brightwaters Yard Site, Bay Shore West Storage Lot Parcel, Brightwaters East Parcel, and Brightwaters Groundwater Plume
(listed in Table 2B, 2C, and 2H of existing Qualitative Human Exposure Assessment)

Potentially Exposed Population	*Exposure Media*	*Exposure Potential*	*Pathway Complete?*		*Comments*
Future Scenarios			*As Is* [1]	*With Remediation* [2]	
Adult on-site construction Workers (BYS, BSWSLP, BEP)	▪ Surface soil ▪ Ingestion ▪ Dermal contact ▪ Particulate/vapor inhalation	High	Yes	No	Given the nature of construction work, *i.e*, excavation of large quantities of soil, the potential for exposure to soil is high.
	▪ Subsurface soil ▪ Ingestion ▪ Dermal contact ▪ Particulate/vapor inhalation	High	Yes	No	Given the nature of construction work, *i.e*, excavation of large quantities of soil, the potential for exposure to soil is high.
	▪ Groundwater ▪ Dermal contact ▪ Vapor inhalation	Moderate to High	Yes	No	Groundwater in the vicinity of the site is 8' to 10' below ground surface. This is within the range of typical depths of construction, especially if basements are a component of the proposed structure.
Adult on-site commercial workers and adult and child visitors to commercial establishments	▪ Indoor air ▪ Vapor inhalation	Minimal	No	No	Indoor air concentrations measured in businesses and homes in the vicinity of the site are below levels of concern.

BYS – Brightwaters Yard Site; BSWSLP – Bay Shore West Storage Lot Parcel; BEP – Brightwaters East Parcel; BGP – Brightwaters Groundwater Plume

[1] Those conditions present in the absence of remedial action, *i.e.*, conditions as they currently exist.
[2] Remediation – The selection of remedial technologies is part of the next phase of this program, the Remedial Action Plan. These remedial actions will be designed to either eliminate a potential exposure pathway or to reduce the exposure to levels deemed appropriate by the NYSDOH and NYSDEC. Remedial activity may include engineering and administrative controls or a combination thereof.

Table 2-3B (continued)
Bay Shore Former MGP Site – Summary of Potential Exposures
Operable Unit 3 – Brightwaters Yard Site, Bay Shore West Storage Lot Parcel, Brightwaters East Parcel, and Brightwaters Groundwater Plume
(listed in Table 2B, 2C, and 2H of existing Qualitative Human Exposure Assessment)

Potentially Exposed Population	*Exposure Media*	*Exposure Potential*	*Pathway Complete?*		*Comments*
Future Scenarios (continued)			*As Is* [1]	*With Remediation* [2]	
Adult and child on-site residents	▪ Surface soil ▪ Ingestion ▪ Dermal contact ▪ Particulate/vapor inhalation	High	Yes	No	Children often play in areas where soil is exposed and, through repetitive play action, expose soil (*e.g.*, under swings).
	▪ Subsurface soil ▪ Ingestion ▪ Dermal contact ▪ Particulate/vapor inhalation	Moderate	Yes	No	In consideration of an individual who may garden or engage in subsurface work for another purpose.
	▪ Groundwater ▪ Dermal contact ▪ Vapor inhalation	Moderate to High	Yes	No	Exposure potential is moderate to high only if wells are installed on site for domestic purposes.
	▪ Indoor air ▪ Vapor inhalation	Minimal	No	No	Indoor air concentrations measured in businesses and homes in the vicinity of the site are below levels of concern.

[1] Those conditions present in the absence of remedial action, *i.e.*, conditions as they currently exist.
[2] Remediation – The selection of remedial technologies is part of the next phase of this program, the Remedial Action Plan. These remedial actions will be designed to either eliminate a potential exposure pathway or to reduce the exposure to levels deemed appropriate by the NYSDOH and NYSDEC. Remedial activity may include engineering and administrative controls or a combination thereof.

Table 2-3C
Bay Shore Former MGP Site – Summary of Potential Exposures
Operable Unit 4 – Watchogue Creek/Crum's Brook
(listed in Table 2D, 2E, and 2F of existing Qualitative Human Exposure Assessment)

Potentially Exposed Population	*Exposure Media*	*Exposure Potential*	*Pathway Complete?*		*Comments*
Current Scenarios			*As Is* [1]	*With Remediation* [2]	
Trespassers (Area C) and Adult & child residents (Area B)	▪ Surface soil ▪ Ingestion ▪ Dermal contact ▪ Particulate inhalation	Minimal	No	No	Limited quantity of soil available for contact.
	▪ Sediment ▪ Ingestion ▪ Dermal contact	Minimal to low	No	No	The Creek has undergone restoration efforts that included the removal of shallow sediments and channel realignment, primarily for aesthetic purposes. Sediment was removed from the entire portion of the main body of the Creek. This removal included PAHs that are common to both water discharged from the site and urban background.
	▪ Surface water ▪ Ingestion ▪ Dermal contact	Minimal to low	No	No	Chemicals detected in the Creek are below levels of concern.

[1] Those conditions present in the absence of remedial action, *i.e.,* conditions as they currently exist.
[2] Remediation – The selection of remedial technologies is part of the next phase of this program, the Remedial Action Plan. These remedial actions will be designed to either eliminate a potential exposure pathway or to reduce the exposure to levels deemed appropriate by the NYSDOH and NYSDEC. Remedial activity may include engineering and administrative controls or a combination thereof.

Table 2-3C (continued)
Bay Shore Former MGP Site – Summary of Potential Exposures
Operable Unit 4 – Watchogue Creek/Crum's Brook
(listed in Table 2D, 2E, and 2F of existing Qualitative Human Exposure Assessment)

Potentially Exposed Population	***Exposure Media***	***Exposure Potential***	***Pathway Complete?***		***Comments***
Future Scenarios			*As Is* [1]	*With Remediation* [2]	
Adult construction workers (Areas A and B)	▪ Surface soil ▪ Ingestion ▪ Dermal contact ▪ Particulate/vapor inhalation	Moderate	Yes	No	Given the nature of construction work, *i.e,* excavation of large quantities of soil, the potential for exposure to soil is high. Elevated concentrations do not exist throughout the Creek area.
	▪ Subsurface soil ▪ Ingestion ▪ Dermal contact ▪ Particulate/vapor inhalation	Moderate	Yes	No	Given the nature of construction work, *i.e,* excavation of large quantities of soil, the potential for exposure to soil is high. Elevated concentrations do not exist throughout the Creek area.
	▪ Groundwater ▪ Dermal contact ▪ Vapor inhalation	Moderate to High	Yes	No	Groundwater in the vicinity of the site is 8' to 10' below ground surface. This is within the range of typical depths of construction, especially if basements are a component of the proposed structure.

[1] Those conditions present in the absence of remedial action, *i.e.,* conditions as they currently exist.
[2] Remediation – The selection of remedial technologies is part of the next phase of this program, the Remedial Action Plan. These remedial actions will be designed to either eliminate a potential exposure pathway or to reduce the exposure to levels deemed appropriate by the NYSDOH and NYSDEC. Remedial activity may include engineering and administrative controls or a combination thereof.

Table 2-3D
Bay Shore Former MGP Site – Summary of Potential Exposures
Operable Unit 2 – Bay Shore Groundwater Plume
(listed in Table 2G of existing Qualitative Human Exposure Assessment)

Potentially Exposed Population	*Exposure Media*	*Exposure Potential*	*Pathway Complete?*		*Comments*
Current Scenarios			*As Is* [1]	*With Remediation* [2]	
Adult and child off-site residents	▪ Groundwater ▪ Ingestion ▪ Dermal contact ▪ Vapor inhalation	Moderate to High	No	No	Exposure potential is moderate to high only if wells are installed for domestic purposes. Results of well and basement survey indicate that exposure to groundwater is an incomplete exposure pathway.
	▪ Indoor air ▪ Vapor inhalation	Minimal	No	No	Indoor air concentrations measured in businesses and homes in the vicinity of the site are below levels of concern.

[1] Those conditions present in the absence of remedial action, *i.e.*, conditions as they currently exist.
[2] Remediation – The selection of remedial technologies is part of the next phase of this program, the Remedial Action Plan. These remedial actions will be designed to either eliminate a potential exposure pathway or to reduce the exposure to levels deemed appropriate by the NYSDOH and NYSDEC. Remedial activity may include engineering and administrative controls or a combination thereof.

Table 2-3E
Bay Shore Former MGP Site – Summary of Potential Exposures
Lawrence Lake (OU-2), Lawrence Creek (OU-2), and O-Co-Nee Pond (OU-3)

(listed in Tables 2I, 2J, 2K of existing Qualitative Human Exposure Assessment)

Potentially Exposed Population	***Exposure Media***	***Exposure Potential***	***Pathway Complete?***		***Comments***
Current and Future Scenarios			*As Is* [1]	*With Remediation* [2]	
Adult & child off-site residents	▪ Sediment ▪ Ingestion ▪ Dermal contact	Minimal to low	Yes	Specific remedial actions are not planned. Rather, remedial actions that address the groundwater plumes that may discharge to these water bodies are under development.	Elevated concentrations of some constituents were observed in a few sediment samples. These samples represent a limited area of insufficient size to result in a significant impact.
	▪ Surface water ▪ Ingestion ▪ Dermal contact	Minimal to low	Yes		Chemical concentrations are low. Surface water bodies receive discharge from non-point sources that are independent of the site.
	▪ Biota ▪ Fish and/or crab consumption	Minimal	Yes		Chemical concentrations are generally low. Chemicals do not tend to bioconcentrate or bioaccumulate.

[1] Those conditions present in the absence of remedial action, *i.e.,* conditions as they currently exist.
[2] Remediation – The selection of remedial technologies is part of the next phase of this program, the Remedial Action Plan. These remedial actions will be designed to either eliminate a potential exposure pathway or to reduce the exposure to levels deemed appropriate by the NYSDOH and NYSDEC. Remedial activity may include engineering and administrative controls or a combination thereof.

Table 3-1
Fish and Wildlife Resources Impact Analysis Decision Key

	Yes	No
1. Is the site or area of concern a discharge or spill event?		√
2. Is the site or area of concern a point source of contamination to the groundwater which will be prevented from discharging to surface water? Soil contamination is not widespread, or if widespread, is confined under buildings and paved areas?		√
3. Is the site and all adjacent property a developed area with buildings, paved surfaces and little or no vegetation?		√
4. Does the site contain habitat of an endangered, threatened, or special concern species?		√
5. Has the contamination gone off-site?	√	
6. Is there any discharge or erosion of contamination or the potential for discharge or erosion of contamination?	√	
7. Are the site contaminants PCBs, pesticides, or other persistent, bioaccumulable substances?		√
8. Does contamination exist at concentrations that could exceed SCGs or be toxic to aquatic life if discharged to surface water?	√	
9. Does the site or any adjacent or downgradient property contain any of the following resources?		
a. any endangered, threatened, or special concern species or rare plants or their habitats	√	
b. Any NYSDEC designated significant habitats or rare NYS ecological communities		√
c. Tidal or freshwater wetlands	√	
d. Streams, creeks, or river	√	
e. Pond, lake or lagoon	√	
f. Drainage ditch or channel	√	
g. Other surface water features		√
h. Other marine or freshwater habitats		√
i. Forest		√
j. Grassland or grassy field	√	
k. Parkland or woodland		√
l. Shrubby area		√
m. Urban wildlife habitat	√	
n. Other terrestrial habitat		√
10. Is the lack of resources due to contamination		√
11. Is the contamination a localized source which has not migrated from the source to impact any on-site or off-site resources?		√
12. Does the site have widespread soil contamination that is not confined under and around buildings or paved areas?		√
13. Does the contamination at the site or area of concern have the potential to migrate to, erode into or otherwise impact any on-site or off-site habitat of endangered, threatened or special concern species or other fish and wildlife resources?	√	
14. Fish and wildlife resources impact analysis needed?	√	

Table 3-2
Plant Species Identified During Field Reconnaissance

Common Name	Scientific Name	Common Name	Scientific Name
Weeping willow	*Salix babylonica*	Chicory	*Cichorium intybus*
Cottonwood	*Populus deltoides*	Orchard grass	*Dactylis glomerata*
Crab apple	*Pyrus prunifolia*	Bristly foxtail	*Setaria faberii*
Sugar maple	*Acer saccharum*	Asiatic dayflower	*Commelina communis*
Tree-of-Heaven	*Ailanthus altissima*	Small white aster	*Aster vimineus*
Staghorn sumac	*Rhus typhina*	Gray goldenrod	*Solidago nemoralis*
Tartarian honeysuckle	*Lonicera tatarica*	Japanese knotweed	*Polygonella cuspidatum*
Arbor vitea	*Thuja occidentalis*	Timothy grass	*Phleum pratense*
Black locust	*Robinia pseudo-acacia*	Yellow wood sorrel	*Oxalis europaea*
Choke cherry	*Prunus virginiana*	Butter-n-eggs	*Linaria vulgaris*
Multi-flora rose	*Rosa multiflora*	Red clover	*Trifolium pratense*
Red oak	*Quercus rubra*	Moth mullein	*Verbascum blattaria*
Virginia creeper	*Parthenocissus quinquefolia*	Bitter nightshade	*Solanum dulcamara*
Green briar	*Smilax rotundifolia*	Garlic mustard	*Allaria officinalis*
Dandelion	*Taraxacum officinale*	Late goldenrod	*Solidago gigantea*
English Plantain	*Plantago lanceolata*	Ragweed	*Ambrosia artemisiifolia*
Crab grass	*Digitaria sanguinalis*	Tall fescue	*Festuca gigantea*
Queen Anne's lace	*Daucus carota*	Common milkweed	*Asclepias syriaca*
Bladder campion	*Silene cucubalus*	White-sweet clover	*Melilotus alba*
Spotted knapweed	*Centaurea maculosa*	Spreading dogbane	*Apocynum androsaemifolium*
Evening primrose	*Oenothera biennis*	Pokeweed	*Phytolacca americana*
Green foxtail	*Setaria viridis*	Smartweed	*Polygonum persicaria*
Common mullein	*Verbascum thapsus*	Mugwort	*Artemisia vulgaris*
Red maple	*Acer rubrum*	Northern arrowwood	*Viburnum recognitum*
Sassafras	*Sassafras albidum*	Sweet pepperbush	*Clethra alnifolia*
Holly	*Ilex opaca*	Dewberry	*Rubus flagellaris*
Poison ivy	*Rhus radicans*	Black nightshade	*Solanum nigrum*
Nutsedge	*Cyperus esculentus*	Norway spruce	*Picea abies*
Hydrangea	*Hydrangea quercifolia*	White oak	*Quercus alba*
Mulberry	*Morus rubra*	Lilac	*Syringa vulgaris*
White pine	*Pinus strobus*	Gray birch	*Betulia populifolia*
Rhododendron	*Rhododendron sp.*	Sycamore	*Plantus occidentalis*
American Yew	*Taxus canadensis*	Red pine	*Pinus resinosa*

Table 3-3
Fish Species That May Be Present in the Great South Bay

Common Name	Scientific Name
Sea lamprey	*Petromyzo marinus*
American eel	*Anguilla rostrata*
Alewife	*Alosa pseudoharengus*
American shad	*Alosa sapidissima*
Tidewater silverside	*Menidia beryllina*
Atlantic sturgeon	*Acipenser oxyrhynchus*
Short-nose sturgeon	*Acipenser brevirostrum*
Striped bass	*Morone saxatilis*
Bluefish	*Pomatomus saltatrix*
Winter flounder	*Pleuronectes americanus*
Black sea bass	*Centropristis striata*
Atlantic silverside	*Menidia menidia*
Atlantic tomcod	*Micogadus tomcod*
Striped killifish	*Fundulus* majalis
Bay anchovy	*Anchoa mitchilli*
Mummichog	*Fundulus hereroclitus*
Atlantic menhaden	*Brevoortia tyrannus*
Scup	*Stenotomus chrysops*
Windowpane	*Scophthalmus aquosus*
Blackfish	*Tautaoga onitis*
Weakfish	*Cynoscion regalis*
Summer flounder	*Paralichthys dentatus*
Blueback herring	*Alosa aestivalis*

Source: USFWS, 1997.

Table 3-4
Herptile Species That May Be Present Based on Cover Types

Common Name	Scientific Name	Habitat Requirements
Eastern spadefoot	*Scaphiopus holbrookii*	Sandy soils with temporary pools for breeding.
Fowler's toad	*Bufo woodhousii*	Prefers areas with sandy soil- shorelines, river valleys.
Northern spring peeper	*Hyla crucifer*	Second growth woodlots.
Gray treefrog	*Hyla veriscolor*	Forested regions with small trees, shrubs and bushes near or in shallow water. Will breed in roadside ditches.
Marbled salamander	*Ambystoma opacum*	Sandy and gravelly areas of mixed deciduous woodlands, especially oak-maple and oak-hickory.
Spotted salamander	*Ambystoma maculatum*	Found in moist woods, streambanks, beneath stones, logs and boards.
Red-spotted newt	*Notophthalmus viridescens*	Adults found in water with abundant submerged vegetation including lakes marshes, ditches, backwaters. Terrestrial juveniles live in moist areas on land.
Redback salamander	*Plethodon cinerus*	Entirely terrestrial. Mixed deciduous or coniferous woods, inhabiting interiors of decaying logs and stumps.
Northern two-lined salamander	*Euryce bislineata*	Along brooks and streams. Found under objects at water's edge in moist soil.
Common snapping turtle	*Chelydra serpentina*	Bottom dweller in any permanent body of fresh o brackish water.
Eastern painted turtle	*Chrysemys picta*	Quiet, shallow ponds and marshes. Sometimes in brackish tidal waters and salt marshes.
Spotted turtle	*Clemmys guttata*	Small shallow bodies of water including roadside ditches and brackish tidal creeks.
Eastern box turtle	*Terrapene carolina*	Typically found in well-drained forest bottomlands.
Red-eared slider	*Pseudemys scripta*	Ponds, shallow areas of lakes, creeks and drainage ditches.
Northern water snake	*Nerodia sipedon*	Inhabits salt or fresh water. Common around spillways and bridges.
Northern brown snake	*Storeria dekayi*	Ubiquitous.
Northern ringneck snake	*Diadophis punctatus*	Secretive. Found hiding in stony woodland pastures, rocks, stone walls, junk piles, logs, debris, stumps and logs.
Northern black racer	*Coluber constrictor*	Moist or dry areas, forests and wooded areas, fields, roadsides, near old buildings.
Eastern worm snake	*Carpophis amoenus*	Dry to moist forests, often near streams, in the loose soil of gardens or weedy pastures. Sandy areas are favored.
Eastern ribbon snake	*Thamnophis sauritus*	Semiaquatic, inhabiting stream edges and ditches.
Eastern garter snake	*Thamnophis srtalis*	Ubiquitous.
Eastern hognose snake	*Heterodon platyrhinos*	Where sandy soils predominate, such as beaches, open fields, dry open woods.
Eastern milk snake	*Lampropeltis triangulum*	Various habitats, usually with brushy or woody cover.

Source: DeGraaf and Rudis, 1983; Conat and Collins, 1975

Table 3-5
Bird Species That May Be Present Based on Cover Types

Common Name	Scientific Name	Habitat Requirements	N or M
Common loon	*Gavia immer*	Winters in coastal bays and inlets.	M
Great blue heron	*Ardea herodias*	Shallow shores, coastal areas.	N
Green-backed heron	*Butorides striatus*	Makes use of nearly all fresh and salt water habitats.	N
Black-crowned night heron	*Nycticorax nycticorax*	Occupies fresh, brackish and salt water areas.	N
Bufflehead	*Bucephala albeola*	Winters in tidal creeks, coastal brackish areas.	M
Canada goose[a]	*Branta canadensis*	Coastal salt marshes.	N
Green-winged teal	*Anas crecca*	Winters in tidal creeks, coastal brackish marshes, estuaries.	M
Black duck	*Anas rubripes*	Fresh, salt and brackish marshes and meadows.	N
Mallard duck[a]	*Anas platyrynchos*	Prefers areas with water less than 16 inches deep.	N
Northern pintail	*Anas acuta*	Winters in brackish and salt water marshes.	M
Blue-winged teal	*Anas discors*	Winters in shallow coastal brackish and salt water marshes.	M
Northern shoveler	*Anas clypeata*	Winters in coastal bays and marshes, tidal flats.	M
Gadwall	*Anas stepera*	Winters in coastal bays and marshes.	N
American wigeon	*Anas amercana*	Winters in coastal marshes and bays.	M
Common goldeneye	*Bucephaia clanguia*	Winters in brackish or salt water estuarine bays.	M
Hooded merganser	*Lophodytes cucullatus*	Brackish marshes and coastal brackish bays.	N
Red-breasted merganser	*Mergus serrator*	Winters in mainly coastal water, bays, and inlets.	M
Brant	*Branta bernicla*	Winters mainly salt bays and estuaries.	M
Double-crested cormorant	*Phalacrocorax auritus*	Coastal areas.	N
Oldsquaw	*Clangula hyemalis*	Winters in coastal areas.	M
Canvasback	*Aythya valisneria*	Winters in coastal areas.	M
Lesser scaup	*Aythya affinis*	Winters in bays and estuaries.	M
Greater scaup	*Aythya marila*	Winters in bays and estuaries.	M
Ruddy duck	*Oxyura jamaicensis*	Winters in coastal areas,	M
Herring gull[a]	*Larus argentatus*	Coasts, bays, beaches	N
Greater black-backed gull	*Larus marinus*	Coastal waters, estuaries.	N
Laughing gull	*Larus atricilla*	Salt marshes, beaches, coastal bays.	N
Common tern	*Sterna hirundo*	Beaches, bays.	N
Great egret	*Casmerodiuos albus*	Mud flats.	N
Snowy egret	*Egretta thula*	Tidal flats.	N
Glossy ibis	*Plegadis falcinellus*	Fresh, brackish, and salt water. Favors shallow pools bordered by shrubs.	N

Table 3-5
Bird Species That May Be Present Based on Cover Types

Common Name	Scientific Name	Habitat Requirements	N or M
Killdeer	*Charadrius vociferus*	Fields, roadsides lawns.	N
Greater yellowlegs	*Tringa melanoleuca*	Winters in coastal mudflats.	M
Lesser yellowlegs	*Tringa flavipes*	Winters in coastal mudflats.	M
Spotted sandpiper	*Actitis macularia*	Seashores.	N
Northern harrier	*Circus cyaneus*	Winters in coastal marshes.	M
American kestrel	*Falco sparverius*	Open areas, forest edges, cities.	N
American woodcock	*Scolopax minor*	Moist woodlands in early stages of succession.	N
King rail	*Rallus elegans*	Winters in coastal brackish water	M
Virginia rail	*Rallus limicola*	Winters in mainly tidal marshes.	M
Sora	*Porzana carolina*	Winters in tidal marshes.	M
Rock dove	*Columbia livia*	Near human habitation.	N
Mourning dove[a]	*Zenaida macroura*	Suburbs, cities, open woodlands.	N
Eastern screech owl	*Otus asio*	Shade trees in suburbs.	N
Common nighthawk	*Chordeiles minor*	Cites, open areas.	N
Chiney swift	*Chaetura pelagica*	Buildings, cities.	N
Ruby-throated hummingbird	*Archilochus colubris*	Shade trees in residential landscapes.	N
Belted kingfisher[a]	*Ceryle alcyon*	Near water containing fish.	N
Downy woodpecker	*Picoides pubescens*	Shade trees in towns and suburbs.	N
Hairy woodpecker	*Picoides villosus*	Open coniferous, deciduous and mixed woodlots	N
Northern flicker	*Colaptes auratus*	Suburbs, woodland edges.	N
Eastern wood peewee	*Contopus virens*	Roadsides, parks. Closely associated with oaks.	N
Eastern phoebe	*Sayornis phoebe*	Suburban areas.	N
Purple martin	*Progne subis*	Suburban areas near water.	N
Blue jay[a]	*Cyanocitta cristata*	Suburbs, cities, parks and gardens.	N
American crow[a]	*Corvus brachyrhynchos*	Edges of woodlots, coastal areas.	N
Black-capped chickadee	*Parus atricapilus*	Residential areas, woodlands.	N
Tufted titmouse	*Parus bicolor*	Residential areas in shade trees.	N
White-breasted nuthatch	*Sitta carolinensis*	Shade trees in villages.	N
House wren	*Troglodytes aedon*	Near human dwellings.	N
American robin	*Turdus migratorius*	Shade trees in residential areas.	N
Gray catbird	*Dumetella carolinensis*	Shrubbery around buildings.	N
Mockingbird[a]	*Mimus polyglottos*	Fruit-bearing shrubs in cities and towns.	N
Cedar waxing	*Bombycilla cedrorum*	Shade trees in residential areas.	N
Red-winged blackbird	*Agelaius phoeniceus*	Swamps and marshes.	N
Common grackle	*Quiscalus quiscula*	Suburbs.	N
Northern oriole	*Icterus galbula*	Shade trees in residential areas.	N
Purple finch	*Carpodacus purpureus*	Residential areas.	N
House finch	*Carpodacus mexicanus*	Suburban and urban yards.	N
American goldfinch	*Cardeulis tristis*	Suburban gardens, shade trees.	N

Table 3-5
Bird Species That May Be Present Based on Cover Types

Common Name	Scientific Name	Habitat Requirements	N or M
Starling	*Sturnus vulgaris*	Cities, gardens, parks.	N
Yellow-rumped warbler	*Dendroica coronata*	Winters along the coast.	M
Yellow warbler	*Dendroica petechia*	Farmlands and roadsides.	N
American redstart	*Mniotilta varia*	Shade trees near dwellings.	N
Common yellowthroat	*Geothlypis trichas*	Fresh or salt water marshes.	N
Northern cardinal	*Cardinalis cardinalis*	Suburban gardens.	N
Rose-breasted grosbeak	*Pheucticus ludovicianus*	Shade trees in suburban areas.	N
House sparrow	*Passer domesticus*	Cities, parks.	N
Chipping sparrow	*Spizella paserina*	Suburban residential areas.	N
Field sparrow	*Spizella pusilla*	Briar thickets, old fields.	N
Song sparrow	*Melospiza melodia*	Suburbs, cities.	N
Sharp-tailed sparrow	*Ammospiza caudacutus*	Coastal marshes.	N
Seaside sparrow	*Ammodramus maritimus*	Salt marshes.	N
Brown-headed cowbird[a]	*Molothrus ater*	Open coniferous and deciduous woodlands.	N
Eastern towhee	*Pipilo erythrophthalmus*	Woodland edges.	N
Brown thrasher	*Toxostoma rufum*	Woodland edges. Often in cities.	N
Veery	*Catharus fuscescens*	Low moist deciduous woods.	N
Blue-gray gnatcatcher	*Polioptila caerulea*	Open moist woodlands.	N
Marsh wren	*Cistothorus palustris*	Fresh and brackish marshes.	N
Carolina wren	*Thryothorus ludovicianus*	A variety of places from lowland stream bank tangles to upland brushy slopes.	
Barn swallow	*Hirundo rustica*	Man-made structures for nesting.	N
Northern rough-winged swallow	*Stelgidopteryx serripennis*	Nearly any open area with nest sites.	N
Tree swallow	*Tachycineta bicolor*	Farmlands, river bottomlands.	N
Fish crow	*Corvus ossifragus*	Low coastal areas.	N
Red-eyed vireo	*Vireo olivaceus*	Open deciduous and second-growth woodlands.	N
White-eyed vireo	*Vireo griseus*	Dense shrubby lowlands.	N
Eastern kingbird	*Tyrannus tyrannus*	Shrubby borders, forest edges.	N
Great-crested flycatcher	*Myiarchus crinitus*	Forest edges.	N
Willow flycatcher	*Empidonax traillii*	Open, newly clear cut areas.	N
Acadian flycatcher	*Empidonax virescens*	Deciduous woodlands.	N
Black-billed cuckoo	*Coccyzus erythropthalmis*	Shrubby hedgerows.	N
Northern bobwhite	*Colinus virginianus*	Open fields of grass.	N
Ring-necked pheasant	*Phasianus colchicus*	Meadows with abundant weedy growth.	N

Source: DeGraaf and Rudis, 1983; USFWS, 1997; NYSDEC, 2000.

[a]Species observed during field reconnaissance.

Table 3-6
Mammals That May Be Present Based on Cover Types

Common Name	Scientific Name	Habitat Requirements
Virginia opossum	*Didlphis virginiana*	Near human habitation.
Least shrew	*Cryptosis parva*	Salt marshes, woodland edges.
Northern shot-tailed shrew	*Blarina brevicauda*	Both timbered and fairly open habitats
Eastern moles	*Scalopus aquaticus*	Lawns, sandy soils.
Star-nosed moles	*Condylura cristata*	Prefers low wet ground.
Little brown myotis	*Myotis lucifugus*	Dark warm sites for materinity colonies.
Big brown bat	*Eptesicus fuscus*	Buildings, bridges, tunnels.
Eastern cottontail[a]	*Sylvilagus floridanus*	Suburban areas with adequate food and cover.
Eastern chipmunk	*Tamias striatus*	Tree or shrub cover with elevated perches.
Woodchuck	*Marmota monax*	Edges of woodlands, open cultivated land, meadows, open brushy hillsides.
Gray squirrel	*Sciurus carolinensis*	Suburban parks, shade trees especially oaks.
Deer mouse	*Peromyscus maniculatus*	Near out-buildings in shrubs.
White-footed mouse	*Peromyscus leucopus*	Edges of woodlands.
Meadow vole	*Microtus pennsylvanicus*	Freshwater and salt water marshes.
Norway rat	*Rattus norevegicus*	Buildings, dumps, cities.
House mouse	*Mus musculus*	Buildings.
Red fox	*Vulpes vulpes*	Found in a variety of habitats. A mixture of forest and open areas is preferred.
White-tailed deer[a]	*Odocoileus virginianus*	Forest edges, swamp borders, areas interspersed with fields and woodlands.
Raccoon	*Procyon lotor*	Found in wetlands near human habitation.
Striped skunk	*Mephitis mephitis*	Suburban areas.

Source: DeGraaf and Rudis, 1983

[a]Species observed during field reconnaissance.

Table 3-7
Summary of Chemicals of Potential Ecological Concern

Parameter	Surface Soil		Surface Water				Sediment			
	On-Site	Off-Site	O-Co-Nee Pond	Lawrence Lake	Lawrence Creek	Watchogue Creek/ Crum's Brook	O-Co-Nee Pond	Lawrence Lake	Lawrence Creek	Watchogue Creek/ Crum's Brook
Volatile Organic Compounds										
Benzene	X	X	ND	ND	X	ND	ND	ND	ND	X
Ethylbenzene	X	X	ND	ND	X	ND	X	ND	ND	X
Toluene	X	X	ND	ND	X	ND	ND	ND	ND	X
Xylene, total	X	X	ND	ND	X	ND	X	ND	X	X
MTBE	NA	NA	ND	NA	X	ND	NA	NA	X	NA
Semivolatile Organic Compounds										
2-Methylnaphthalene	X	X	ND	ND	X	ND	ND	ND	X	X
4-Methylphenol	X	ND	ND	ND	ND	ND	ND	NA	NA	NA
Acenaphthene	X	X	ND	ND	X	X	ND	X	X	X
Acenaphthylene	X	X	ND	ND	X	X	ND	X	X	X
Anthracene	X	X	ND	ND	ND	ND	X	X	X	X
Benzo(a)anthracene	X	X	ND	ND	ND	ND	X	X	X	X
Benzo(a)pyrene	X	X	ND	ND	ND	ND	X	X	X	X
Benzo(b)fluoranthene	X	X	ND	ND	ND	ND	X	X	X	X
Benzo(g,h,i)perylene	X	X	ND	ND	ND	ND	ND	X	X	X
Benzo(k)fluoranthene	X	X	ND	ND	ND	ND	X	X	X	X
bis(2-Ethylhexyl)phthalate	ND	X	ND	ND	ND	ND	NA	NA	NA	NA
Butylbenzylphthalate	ND	X	ND	ND	ND	ND	NA	NA	NA	NA
Carbazole	X	X	ND	ND	ND	ND	NA	NA	NA	NA
Chrysene	X	X	ND	ND	ND	ND	X	X	X	X
Dibenzo(a,h)anthracene	X	X	ND	ND	ND	ND	ND	X	ND	X
Dibenzofuran	X	X	ND	ND	ND	ND	ND	ND	ND	X
Dimethylphthalate	X	ND	ND	ND	ND	ND	NA	NA	NA	NA
Fluoranthene	X	X	ND	ND	ND	ND	X	X	X	X
Fluorene	X	X	ND	ND	X	X	X	X	X	X
Indeno(1,2,3-cd)pyrene	X	X	ND	ND	ND	ND	ND	X	X	X
Naphthalene	X	X	ND	ND	X	ND	ND	ND	X	X
Phenanthrene	X	X	ND	ND	X	X	X	X	X	X
Pyrene	X	X	ND	ND	ND	X	X	X	X	X
Inorganic Compounds										
Aluminum	X	X	NA	NA	NA	NA	NA	NA	NA	NA
Antimony	X	ND	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	X	X	X	ND	ND	X	X	X	X	X
Barium	X	X	X	X	X	X	X	X	X	X
Beryllium	X	X	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	X	X	ND	ND	ND	X	X	X	X	X
Chromium	X	X	X	ND	ND	X	X	X	X	X
Cobalt	X	X	NA	NA	NA	NA	NA	NA	NA	NA
Copper	X	X	NA	NA	NA	NA	NA	NA	NA	NA

Table 3-7
Summary of Chemicals of Potential Ecological Concern

Parameter	Surface Soil		Surface Water				Sediment			
	On-Site	Off-Site	O-Co-Nee Pond	Lawrence Lake	Lawrence Creek	Watchogue Creek/ Crum's Brook	O-Co-Nee Pond	Lawrence Lake	Lawrence Creek	Watchogue Creek/ Crum's Brook
Inorganic Compounds (Cont'd.)										
Cyanide, total	X	X	X	X	X	NA	X	X	X	X
Lead	X	X	X	X	ND	X	X	X	X	X
Manganese	X	X	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	X	X	ND	ND	ND	ND	ND	ND	X	X
Nickel	X	X	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	X	X	ND	X	X	ND	X	X	ND	X
Silver	X	X	ND	ND	ND	X	ND	ND	ND	X
Thallium	X	ND	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	X	X	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	X	X	NA	NA	NA	NA	NA	NA	NA	NA
Pesticides/PCBs										
4,4'-DDD	X	X	NA	NA	NA	NA	NA	NA	NA	NA
4,4'-DDT	X	X	NA	NA	NA	NA	NA	NA	NA	NA
Aldrin	X	ND	NA	NA	NA	NA	NA	NA	NA	NA
alpha-BHC	X	ND	NA	NA	NA	NA	NA	NA	NA	NA
beta-BHC	X	ND	NA	NA	NA	NA	NA	NA	NA	NA
Dieldrin	X	X	NA	NA	NA	NA	NA	NA	NA	NA
Endosulfan II	X	ND	NA	NA	NA	NA	NA	NA	NA	NA
Endosulfan sulfate	X	ND	NA	NA	NA	NA	NA	NA	NA	NA
Endrin	X	ND	NA	NA	NA	NA	NA	NA	NA	NA
Endrin aldehyde	X	ND	NA	NA	NA	NA	NA	NA	NA	NA
Endrin ketone	X	ND	NA	NA	NA	NA	NA	NA	NA	NA
gamma-BHC (Lindane)	X	ND	NA	NA	NA	NA	NA	NA	NA	NA
gamma-Chlordane	ND	X	NA	NA	NA	NA	NA	NA	NA	NA
Heptachlor	X	ND	NA	NA	NA	NA	NA	NA	NA	NA
Heptachlor epoxide	X	ND	NA	NA	NA	NA	NA	NA	NA	NA
Methoxychlor	X	ND	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor-1260	X	ND	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
X = Selected as Chemical of Potential Ecological Concern
ND = Chemical not detected in that environmental medium
NA = Chemical not analyzed in that environmental medium

Table 3-8
Comparison of Bay Shore/Brightwaters Surface Soil Data to Toxicological Benchmark Values

Parameter	Toxicological Benchmark			On-Site Surface Soil *		Watchogue Creek/Crum's Brook Surface Soil	
	Earth Worms	Terrestrial Plants	Meadow Vole	Frequency of Detection	Range of Detected Concentrations	Frequency of Detection	Range of Detected Concentrations
Volatile Organic Compounds (mg/kg)							
Benzene			211	25/62	0.001-22	5/32	0.001-0.04
Ethylbenzene			**2003**	23/62	0.001-200	8/32	0.001-0.026
Toluene		200	208	21/62	0.001-150	7/32	0.001-0.81
Xylene, total			16.793	24/62	0.002-500	10/32	0.002-0.46
Semivolatile Organic Compounds (mg/kg)							
2-Methylnaphthalene			**18**	50/65	0.05-300	11/32	0.14-420
4-Methylphenol			**74**	1/5	0.41-0.41	0/4	ND
Acenaphthene			**1395**	22/64	0.045-140	10/32	0.094-840
Acenaphthylene			**1395**	53/64	0.044-160	13/32	0.11-230
Anthracene		20	**7971**	52/64	0.061-96	16/32	0.047-840
Benzo(a)anthracene			**8**	58/65	0.01-92	21/32	0.07-450
Benzo(a)pyrene			8	57/65	0.074-99	21/32	0.067-240
Benzo(b)fluoranthene			**996**	59/65	0.044-66	24/32	0.046-170
Benzo(g,h,i)perylene			**598**	52/65	0.047-28	17/32	0.088-65
Benzo(k)fluoranthene			**996**	52/65	0.059-23	20/32	0.046-54
bis(2-Ethylhexyl)phthalate			146	0/5	ND	1/4	3
Butylbenzylphthalate			**2342**	0/5	ND	1/4	0.88
Carbazole			**88**	3/5	0.28-0.83	1/4	1
Chrysene			**8**	60/65	0.048-100	26/32	0.081-540
Dibenzo(a,h)anthracene			**8**	39/65	0.043-8	12/32	0.037-26
Dibenzofuran			**8**	29/64	0.0049-8.7	11/32	0.066-48
Dimethylphthalate	200		**11049**	1/5	0.76-0.76	0/4	ND
Fluoranthene			**996**	59/65	0.04-130	27/32	0.039-730
Fluorene	30		**996**	46/64	0.046-120	10/32	0.057-600
Indeno(1,2,3-cd)pyrene			**996**	51/65	0.057-21	19/32	0.044-61
Naphthalene			**1473**	50/65	0.048-1100	13/32	0.003-590
Phenanthrene			**20**	59/65	0.044-280	23/32	0.046-2400
Pyrene			**598**	61/65	0.047-220	26/32	0.041-1200
Inorganic Compounds (mg/kg)							
Aluminum	50		15.433	3/5	3230-5430	3/3	4510-7690
Antimony		5	1	3/5	0.22-0.92	0/4	ND
Arsenic	60	10	1.008	52/57	0.82-31.3	27/29	0.33-19.5
Barium		500	79.6	55/57	6-846	29/29	7.9-219
Beryllium		10	9.75	3/5	0.19-0.3	1/3	0.17
Cadmium	20	4	14255	54/55	0.047-12.3	25/28	0.081-4.5
Chromium	0.4	1	40449	53/57	2.6-36.7	29/29	0.96-75.9
Cobalt		20	**88**	3/5	1.8-3.6	3/3	1.7-7.3
Copper	50	100	224.8	3/5	29.6-48.6	3/3	7.4-113
Cyanide, total			945.2	50/57	0.071-81.7	13/29	0.11-1.4
Lead	500	50	118.23	55/57	3.1-2780	29/29	4.1-2200

Table 3-8
Comparison of Bay Shore/Brightwaters Surface Soil Data to Toxicological Benchmark Values

Parameter	Toxicological Benchmark: Earth Worms	Toxicological Benchmark: Terrestrial Plants	Toxicological Benchmark: Meadow Vole	On-Site Surface Soil *: Frequency of Detection	On-Site Surface Soil *: Range of Detected Concentrations	Watchogue Creek/Crum's Brook Surface Soil: Frequency of Detection	Watchogue Creek/Crum's Brook Surface Soil: Range of Detected Concentrations
Inorganic Compounds (Cont'd) (mg/kg)							
Manganese		500	1301	3/5	73-108	3/3	74-2640
Mercury	0.1	0.3	19.21	42/57	0.027-19.6	26/29	0.018-2.6
Nickel	200	30	591.15	3/5	5.6-9	3/3	4.4-29.6
Selenium	70	1	2.956	47/57	0.55-27.9	19/29	0.34-3.6
Silver		2	**15**	36/57	0.24-10	26/29	0.23-2.8
Thallium		1	0.111	2/5	0.45-0.62	0/3	ND
Vanadium		2	2.881	3/5	11.5-15.5	3/3	9.6-44.7
Zinc	200	50	2364.6	3/5	123-169	3/3	36.5-641
Pesticides/PCBs (mg/kg)							
4,4'-DDD			11.82	3/3	0.033-0.29	2/3	0.038-0.1
4,4'-DDT			11.82	3/3	0.049-0.3	3/3	0.037-0.23
Aldrin			2.956	3/3	0.0038-0.032	0/3	ND
alpha-BHC			23.65	2/3	0.0028-0.028	0/3	ND
beta-BHC			5.91	1/3	0.0024	0/3	ND
Dieldrin			0.296	2/3	0.004-0.018	1/3	0.016
Endosulfan II			2.22	3/3	0.054-0.2	0/3	ND
Endosulfan sulfate			**2**	2/3	0.0068-0.078	0/3	ND
Endrin			0.736	3/3	0.024-0.146	0/3	ND
Endrin aldehyde			**0.904**	1/3	0.043	0/3	ND
Endrin ketone			**0.904**	1/3	0.072	0/3	ND
gamma-BHC (Lindane)			118.23	1/3	0.07	0/3	ND
gamma-Chlordane			36.8	0/3	ND	1/3	0.12
Heptachlor			1.921	3/3	0.0019-0.051	0/3	ND
Heptachlor epoxide			**0.009**	1/3	0.0066	0/3	ND
Methoxychlor			59.1	1/3	0.18	0/3	ND
Aroclor-1260	40		**31**	15/28	0.05-43	0/3	ND

Notes:
* - Surface soil includes soils collected to a depth of 4 feet below ground surface.
Bolded values are derived benchmarks (see Table 3-10).

Table 3-9
Parameters for Calculation of Toxicological Benchmarks

Organism	Body Weight (kg)	Food Intake (kg/day)	Food Factor *f*
Mouse	0.03	0.0055	0.18
Rat	0.35	0.028	0.08
Dog	12.7	0.301	0.024
Rabbit	3.8	0.135	0.034
Meadow vole	0.044	0.005	0.114

Table 3-10
Derivation of Toxicological Benchmarks for Meadow Vole

Chemical	Test Organism	Endpoint	$NOAEL_t$ (mg/kg/day)	Reference for Test Species	NOAEL for Meadow Vole (mg/kg/day)	Toxicological Benchmark for Meadow Vole (mg/kg)
Ethylbenzene	Rat	NOAEL	136	IRIS	228.4	2003
2-Methylnaphthalene	Rat	LD50 (1630 mg/kg)	1.20	NTP	2.0	18
4-Methylphenol	Rat	NOAEL	5.00	HEAST	8.4	74
Acenaphthylene[a]	Mouse	NOAEL	175	HEAST	159.0	1395
Acenaphthene	Mouse	NOAEL	175	IRIS	159.0	1395
Anthracene	Mouse	NOAEL	1000	IRIS	908.7	7971
Benzo(a)anthracene[c]	Mouse	NOAEL	1	ORNL	0.9	8
Benzo(b)fluoranthene[b]	Mouse	NOAEL	125	IRIS	113.6	996
Benzo(g,h,i)perylene[d]	Mouse	NOAEL	75	IRIS	68.2	598
Benzo(k)fluoranthene[b]	Mouse	NOAEL	125	IRIS	113.6	996
Butylbenzylphthalate	Rat	NOAEL	159	IRIS	267.0	2342
Carbazole	Rat	LDLo (500 mg/kg)	6.00	NTP	10.1	88
Chrysene[c]	Mouse	NOAEL	1	ORNL	0.9	8
Dibenzo(a,h)anthracene[c]	Mouse	NOAEL	1	ORNL	0.9	8
Dibenzofuran[c]	Mouse	NOAEL	1	ORNL	0.9	8
Dimethylphthalate[g]	Rat	NOAEL	750	IRIS	1259.5	11049
Fluoranthene	Mouse	NOAEL	125	IRIS	113.6	996
Fluorene	Mouse	NOAEL	125	IRIS	113.6	996
Indeno(1,2,3-cd)pyrene[b]	Mouse	NOAEL	125	IRIS	113.6	996
Naphthalene	Rat	NOAEL	100	IRIS	167.9	1473
Phenanthrene	Mouse	LD50 (700 mg/kg)	2.6	NTP	2.3	20
Pyrene	Mouse	NOAEL	75	IRIS	68.2	598
Cobalt	Rat	LDLo (750 mg/kg)	6.00	NTP	10.1	88
Silver[e]	Rat	NOAEL	1	ORNL	1.7	15
Endosulfan sulfate[f]	Rat	NOAEL	0.15	ORNL	0.3	2.210
Endrin aldehyde[h]	Dog	NOAEL	0.025	IRIS	0.103	0.904
Endrin ketone[h]	Dog	NOAEL	0.025	IRIS	0.103	0.904
Heptachlor epoxide	Dog	LEL (0.0125 mg/kg/day)	0.00025	IRIS	0.001	0.009
Aroclor 1260	Rat	LD50 (1315 mg/kg)	2.10	NTP	3.5	31

To convert mg diet/kg body weight, divide the diet component by the food factor times the uncertainty factor

Sources:

IRIS: USEPA, 2000:

HEAST: USEPA, 1997.

NTP: National Toxicology Program's Chemical Health and Safety Data Website: http://ntp-server.niehs.nih.gov/Main_Pages/Chem-HS.html

ORNL: Oak Ridge National Laboratory, Sample et al. 1996.

a Value for acenaphthene used
b Value for fluoranthene used
c Value for benzo(a)pyrene used
d Value for pyrene used
e Value for cadmium used
f Value for endosulfan used
g Value for diethylphthalate used
h Value for endrin used

Table 3-11
Comparison of Bay Shore/Brightwaters Freshwater Surface Water Data to Toxicological Benchmark Values

Parameter	Toxicological Benchmark					O-Co-Nee Pond	
						Surface water	
	NYSDEC			OSWER	Region IV	Frequency of Detection	Range of Detected Concentration
	Lawrence Creek	O-Co-Nee Pond	Watchogue Creek				
Volatile Organic Compounds (µg/l)							
Benzene						0/4	---
Ethylbenzene						0/4	1-1
Xylene (total)						0/4	---
MTBE						0/4	---
Semivolatile Organic Compounds (µg/l)							
Acenaphthene	0.0053			0.023	0.017	0/15	---
Acenaphthylene						0/15	---
Anthracene						1/15	6-6
Benzo(a)anthracene						2/15	1-2
Benzo(a)pyrene						2/15	2-3
Benzo(b)fluoranthene						2/15	3-5
Benzo(ghi)perylene						0/15	---
Benzo(k)fluoranthene						2/15	2-3
Chrysene						2/15	2-4
Dibenzo(a,h)anthracene						0/15	---
Dibenzofuran						0/15	---
Fluoranthene						2/15	4-6
Fluorene	0.00054			0.0039		0/15	---
Indeno(1,2,3-cd)pyrene						1/15	2-2
Naphthalene						0/15	---
Phenanthrene	0.005			0.0063		2/15	2-3
Pyrene	0.0046					2/15	4-6

Table 3-11

Comparison of Bay Shore/Brightwaters Freshwater Surface Water Data to Toxicological Benchmark Values

Parameter	Toxicological Benchmark					O-Co-Nee Pond	
						Surface water	
	NYSDEC			OSWER	Region IV	Frequency of Detection	Range of Detected Concentration
Inorganic Compounds (µg/l)							
Cyanide, total						4/15	0.0019-0.0031
Arsenic	0.15			0.19	0.19	2/15	0.004-0.0082
Barium				0.0039		4/15	0.023-0.0639
Cadmium*	0.001247022	0.00113	0.00170	0.001	0.00066	0/15	---
Chromium*	0.04319064	0.03894	0.05964	0.18	0.117	1/15	0.0032
Lead	0.01628147			0.0025	0.00132	4/15	0.012-0.0353
Selenium	0.0046			0.005	0.005	0/15	---
Silver	0.0001				0.000012	0/15	---

* NYSDEC benchmarks are hardness dependent - the following values were used:

Lawrence Lake 51.72

O-Co-Nee Pond 45.57

Wachogue Creek 76.69

Table 3-11
Comparison of Bay Shore/Brightwaters Freshwater Surface Water Data to Toxicological Benchmark Values

Parameter	Toxicological Benchmark					O-Co-Nee Pond		Lawrence Lake	
						Pore Water			
	NYSDEC			OSWER	Region IV	Frequency of Detection	Range of Detected Concentration	Frequency of Detection	Range of Detected Concentration
	Lawrence Creek	O-Co-Nee Pond	Watchogue Creek						
Volatile Organic Compounds (µg/l)									
Benzene						1/6	170		
Ethylbenzene						1/6	3		
Xylene (total)						1/6	4		
MTBE						0/6	---		
Semivolatile Organic Compounds (µg/l)									
Acenaphthene	0.0053			0.023	0.017	0/6		0/3	---
Acenaphthylene						0/6		0/3	---
Anthracene						0/6		0/3	---
Benzo(a)anthracene						0/6		0/3	---
Benzo(a)pyrene						0/6		0/3	---
Benzo(b)fluoranthene						0/6		0/3	---
Benzo(ghi)perylene						0/6		0/3	---
Benzo(k)fluoranthene						0/6		0/3	---
Chrysene						0/6		0/3	---
Dibenzo(a,h)anthracene						0/6		0/3	---
Dibenzofuran						0/6		0/3	---
Fluoranthene						0/6		0/3	---
Fluorene	0.00054			0.0039		0/6		0/3	---
Indeno(1,2,3-cd)pyrene						0/6		0/3	---
Naphthalene						1/6	2	0/3	---
Phenanthrene	0.005			0.0063		0/6		0/3	---
Pyrene	0.0046					0/6		0/3	---

Table 3-11
Comparison of Bay Shore/Brightwaters Freshwater Surface Water Data to Toxicological Benchmark Values

Parameter	Toxicological Benchmark					O-Co-Nee Pond		Lawrence Lake	
						Pore Water			
	NYSDEC			OSWER	Region IV	Frequency of Detection	Range of Detected Concentration	Frequency of Detection	Range of Detected Concentration
Inorganic Compounds (µg/l)									
Cyanide, total								3/3	0.0026-0.0038
Arsenic	0.15			0.19	0.19			0/3	---
Barium				0.0039				3/3	0.0185-0.025
Cadmium*	0.001247022	0.00113	0.00170	0.001	0.00066			0/3	---
Chromium*	0.04319064	0.03894	0.05964	0.18	0.117			0/3	---
Lead	0.01628147			0.0025	0.00132			3/3	0.0083-0.0155
Selenium	0.0046			0.005	0.005			3/3	0.005-0.0063
Silver	0.0001				0.000012			0/3	---

* NYSDEC benchmarks are hardness dependent - the following values were used:

Lawrence Lake 51.72

O-Co-Nee Pond 45.57

Wachogue Creek 76.69

Table 3-11
Comparison of Bay Shore/Brightwaters Freshwater Surface Water Data to Toxicological Benchmark Values

Parameter	Toxicological Benchmark					Watchogue Creek/Crum's Brook	
	NYSDEC			OSWER	Region IV	Frequency of Detection	Range of Detected Concentration
	Lawrence Creek	O-Co-Nee Pond	Watchogue Creek				
Volatile Organic Compounds (µg/l)							
Benzene							
Ethylbenzene							
Xylene (total)							
MTBE							
Semivolatile Organic Compounds (µg/l)							
Acenaphthene	0.0053			0.023	0.017	3/10	0.002-0.004
Acenaphthylene						3/10	0.002-0.006
Anthracene						0/10	---
Benzo(a)anthracene						0/10	---
Benzo(a)pyrene						0/10	---
Benzo(b)fluoranthene						0/10	---
Benzo(ghi)perylene						0/10	---
Benzo(k)fluoranthene						0/10	---
Chrysene						0/10	---
Dibenzo(a,h)anthracene						0/10	---
Dibenzofuran						0/10	---
Fluoranthene						0/10	---
Fluorene	0.00054			0.0039		1/10	0.001
Indeno(1,2,3-cd)pyrene						0/10	---
Naphthalene						0/10	---
Phenanthrene	0.005			0.0063		1/10	0.001
Pyrene	0.0046					1/10	0.001

Table 3-11
Comparison of Bay Shore/Brightwaters Freshwater Surface Water Data to Toxicological Benchmark Values

Parameter	Toxicological Benchmark					Watchogue Creek/Crum's Brook	
	NYSDEC			OSWER	Region IV	Frequency of Detection	Range of Detected Concentration
Inorganic Compounds (µg/l)							
Cyanide, total						NA	---
Arsenic	0.15			0.19	0.19	2/3	0.0032-0.0117
Barium				0.0039		3/3	0.0279-0.829
Cadmium*	0.001247022	0.00113	0.00170	0.001	0.00066	1/3	0.0036
Chromium*	0.04319064	0.03894	0.05964	0.18	0.117	1/3	0.0055
Lead	0.01628147			0.0025	0.00132	10/10	0.0143-0.171
Selenium	0.0046			0.005	0.005	0/3	---
Silver	0.0001				0.000012	1/3	0.0081

* NYSDEC benchmarks are hardness dependent - the following values were used:

Lawrence Lake 51.72

O-Co-Nee Pond 45.57

Wachogue Creek 76.69

Table 3-12

Comparison of Bay Shore/Brightwaters Salt Water Surface Water Data to Toxicological Benchmark Values

Parameter	Toxicological Benchmark			Lawrence Creek			
				Surface Water		Pore Water	
	NYSDEC	OSWER	Region IV	Frequency of Detection	Range of Detected Concentration	Frequency of Detection	Range of Detected Concentration
Volatile Organic Compounds (µg/l)							
Benzene	0.19	0.046	0.109	1/15	---	3/6	0.001-0.016
Ethylbenzene	0.0045	0.29	0.0043	1/15	---	2/6	0.008-0.039
Toluene	0.092	0.13	0.037	0/15	---	2/6	0.002-0.15
Xylene (total)	0.019	0.0018		0/15	---	3/6	0.005-0.03
MTBE				11/12	---	4/6	0.004-0
Semivolatile Organic Compounds (µg/l)							
2-Methylnaphthalene				1/15	0.008-0.008	2/6	0.07-0.51
Acenaphthene	0.06	0.023	0.0097	2/15	0.001-0.002	1/6	0.065-0.065
Acenaphthylene				2/15	0.002-0.007	3/6	0.004-0.23
Fluorene	0.0025	0.0039		1/15	0.001-0.001	1/6	0.046-0.046
Naphthalene	0.016	0.024	0.0235	3/15	0.001-0.046	2/6	2.1-2.7
Phenanthrene	0.0015	0.0063		1/15	0.002-0.002	2/6	0.001-0.044
Inorganic Compounds (µg/l)							
Cyanide, total	0.001			3/3	0.0012-0.0031	NA	---
Barium		0.0039		3/3	0.0091-0.0128	NA	---
Selenium		0.005	0.071	1/3	0.0042	NA	---

Table 3-13
Comparison of Bay Shore/
Brightwaters Sediment
Data to Toxicological Benchmark Values

Parameter	Toxicological Benchmark							O-Co-Nee Pond		Lawrence Lake	
	NYSDEC					OSWER	Region IV	Frequency of Detection	Range of Detected Concentration	Frequency of Detection	Range of Detected Concentration
	LEL				SEL						
	LC	LL	OP	WC							
VolatileOrganic Compounds (mg/kg)											
Benzene							0.057	0/16	---	0/3	---
Ethylbenzene						3.6		2/16	0.001-0.013	0/3	---
Toluene						0.05		0/16	---	0/3	---
Xylene, total						0.16		6/16	0.002	0/3	---
MBTE								NA	---	NA	---
Semivolatile Organic Compounds (mg/kg)											
2-Methylnaphthalene								0/16	---	0/3	---
Acenaphthene*	1.862	2.142	0.105	1.2362		0.62	0.33	0/16	---	0/3	---
Acenaphthylene							0.33	0/16	---	1/3	0.074
Anthracene							0.33	1/16	0.11	1/3	0.1
Benzo(a)anthracene							0.33	5/16	0.041-3.9	2/3	0.12-0.81
Benzo(a)pyrene						0.43	0.33	2/16	0.44	2/3	0.11-0.84
Benzo(b)fluoranthene								6/16	0.1-7.2	2/3	0.18-1.2
Benzo(g,h,i)perylene								0/16	---	1/3	0.35
Benzo(k)fluoranthene								5/16	0.34	2/3	0.063-0.3
Chrysene							0.33	5/16	0.059-7.1	2/3	0.13-0.65
Dibenzo(a,h)anthracene							0.33	0/16	---	1/3	0.12
Dibenzofuran								0/16	---	0/3	---
Fluoranthene*	13.566	15.606	0.765	9.0066		2.9	0.33	7/16	0.1-10	3/3	0.051-1.1
Fluorene							0.33	1/16	0.055	1/3	0.067
Indeno(1,2,3-cd)pyrene								1/16	2.6-2.6	1/3	0.34
Naphthalene						0.24		0/16	---	0/3	---
Phenanthrene	2.16					1.8		6/16	0.037-5	2/3	0.19-0.34
Pyrene								6/16	0.1-12	3/3	0.049-1.3

Table 3-13
Comparison of Bay Shore/
Brightwaters Sediment
Data to Toxicological Benchmark Values

Parameter	Toxicological Benchmark							O-Co-Nee Pond		Lawrence Lake	
	NYSDEC					OSWER	Region IV	Frequency of Detection	Range of Detected Concentration	Frequency of Detection	Range of Detected Concentration
	LEL				SEL						
	LC	LL	OP	WC							
Inorganic Compounds (mg/kg)											
Arsenic	6				33	8.2	7.24	3/4	0.78-0.94	3/3	0.57-9.3
Barium								4/4	3.9-10	3/3	1.4-22.7
Cadmium	0.6				9	1.2	1	3/4	0.27-0.28	1/3	2.6-2.6
Chromium	26				110	81	52.3	4/4	1.2-3	3/3	0.58-127
Lead	31				110	47	30.2	4/4	20.9-29.3	3/3	6-17.8
Mercury	0.15				1.3	0.15	0.13	0/4	---	0/3	---
Selenium								4/4	0.44-1.3	1/3	16.3-16.3
Silver	1				2.2		2	0/4	---	0/3	---
Cyanide, total								3/4	0.088-0.17	3/3	0.086-0.29

Notes:

* NYSDEC criteria dependent on organic carbon content. The following values were used: LC = 1.33%, LL = 1.53%, OP = 0.075%, WC = 0.883%

NYSDEC = New York State Department of Environmental Conservation

LEL = Lowest Effect Level

SEL = Severe Effect Level

ER-L = Effects Range-Low

ER-M = Effects Range-Median

TEL = Threshold effects level

PEL = Probable effects level

LC = Lawrence Creek

LL = Lawrence Lake

OP = O-Co-Nee Pond

WC = Watchogue Creek

Table 3-13
Comparison of Bay Shore/
Brightwaters Sediment
Data to Toxicological Benchmark Values

Parameter	Lawrence Creek		Watchogue Creek/Crum's Brook	
	Frequency of Detection	Range of Detected Concentration	Frequency of Detection	Range of Detected Concentration
VolatileOrganic Compounds (mg/kg)				
Benzene	0/15	---	3/17	0.002-0.6
Ethylbenzene	0/15	---	4/17	0.001-0.028
Toluene	0/15	---	4/17	0.002-0.032
Xylene, total	4/15	0.001-0.004	7/17	0.001-0.38
MBTE	8/15	0.004-0.012	NA	---
Semivolatile Organic Compounds (mg/kg)				
2-Methylnaphthalene	1/15	8-8	5/17	0.083-25
Acenaphthene*	6/15	0.079-2	13/17	0.064-20
Acenaphthylene	4/15	0.045-7	9/17	0.32-6.2
Anthracene	6/15	0.065-0.31	15/17	0.052-9.3
Benzo(a)anthracene	4/15	0.16-0.31	13/17	0.54-35
Benzo(a)pyrene	4/15	0.12-0.15	12/17	0.41-25
Benzo(b)fluoranthene	4/15	0.22-0.52	12/17	0.31-29
Benzo(g,h,i)perylene	1/15	0.061-0.061	3/17	0.18-0.94
Benzo(k)fluoranthene	4/15	0.079-0.19	12/17	0.13-8.8
Chrysene	5/15	0.05-0.98	13/17	0.61-42
Dibenzo(a,h)anthracene	0/15	---	3/17	0.065-0.31
Dibenzofuran	0/15	---	5/17	0.074-0.48
Fluoranthene*	7/15	0.076-0.82	13/17	0.5-36
Fluorene	5/15	0.066-1	11/17	0.063-3.9
Indeno(1,2,3-cd)pyrene	2/15	0.046-0.089	3/17	0.19-0.85
Naphthalene	5/15	0.05-46	5/17	0.058-10
Phenanthrene	8/15	0.069-2	15/17	0.4-27
Pyrene	7/15	0.11-1	15/17	0.095-85

Table 3-13
Comparison of Bay Shore/ Brightwaters Sediment Data to Toxicological Benchmark Values

Parameter	Lawrence Creek		Watchogue Creek/Crum's Brook	
	Frequency of Detection	Range of Detected Concentration	Frequency of Detection	Range of Detected Concentration
Inorganic Compounds (mg/kg)				
Arsenic	3/3	0.99-3.4	16/17	0.95-52.3
Barium	3/3	0.94-4.3	17/17	0.94-330
Cadmium	2/3	0.23-0.29	16/17	0.16-6.4
Chromium	3/3	1-3.3	17/17	0.72-246
Lead	3/3	1.7-9.3	17/17	0.96-697
Mercury	1/3	0.12-0.12	12/17	0.028-0.62
Selenium	0/3	---	11/17	0.67-11.9
Silver	0/3	---	10/17	0.64-3.2
Cyanide, total	2/3	0.082-0.24	7/14	0.082-5

Notes:

* NYSDEC criteria dependent on organic carbon content. The followi

NYSDEC = New York State Department of Environmental Conserv

LEL = Lowest Effect Level

SEL = Severe Effect Level

ER-L = Effects Range-Low

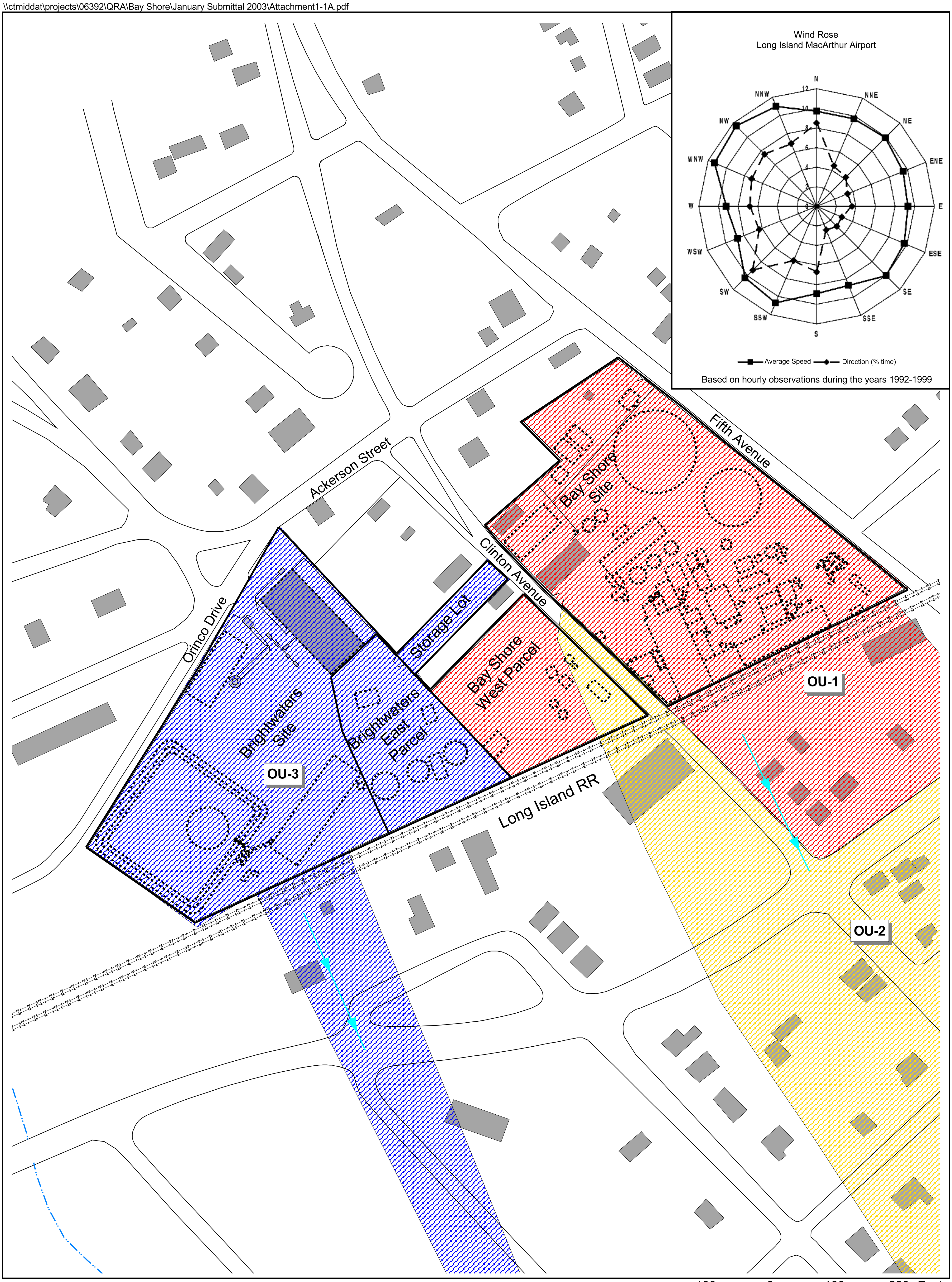
ER-M = Effects Range-Median

TEL = Threshold effects level

PEL = Probable effects level

Attachments

\\ctmiddat\projects\06392\QRA\Bay Shore\January Submittal 2003\Attachment1-1A.pdf



SOURCE: Bay Shore/Brightwaters Site Plan prepared by Dvirka & Bartilucci

100 0 100 200 Feet

Map Key

- OU-1 Bay Shore Site, Bay Shore West Parcel and Adjacent Off-site
- OU-2 Bay Shore Groundwater Plume
- OU-3 Brightwaters Yard and Brightwaters Groundwater Plume
- OU-4 Watchogue Creek/Crum's Brook (Cesspool, Pond and Creek)
- Historic Site Features
- Existing Buildings
- Creek
- Approximate Groundwater Flow Direction

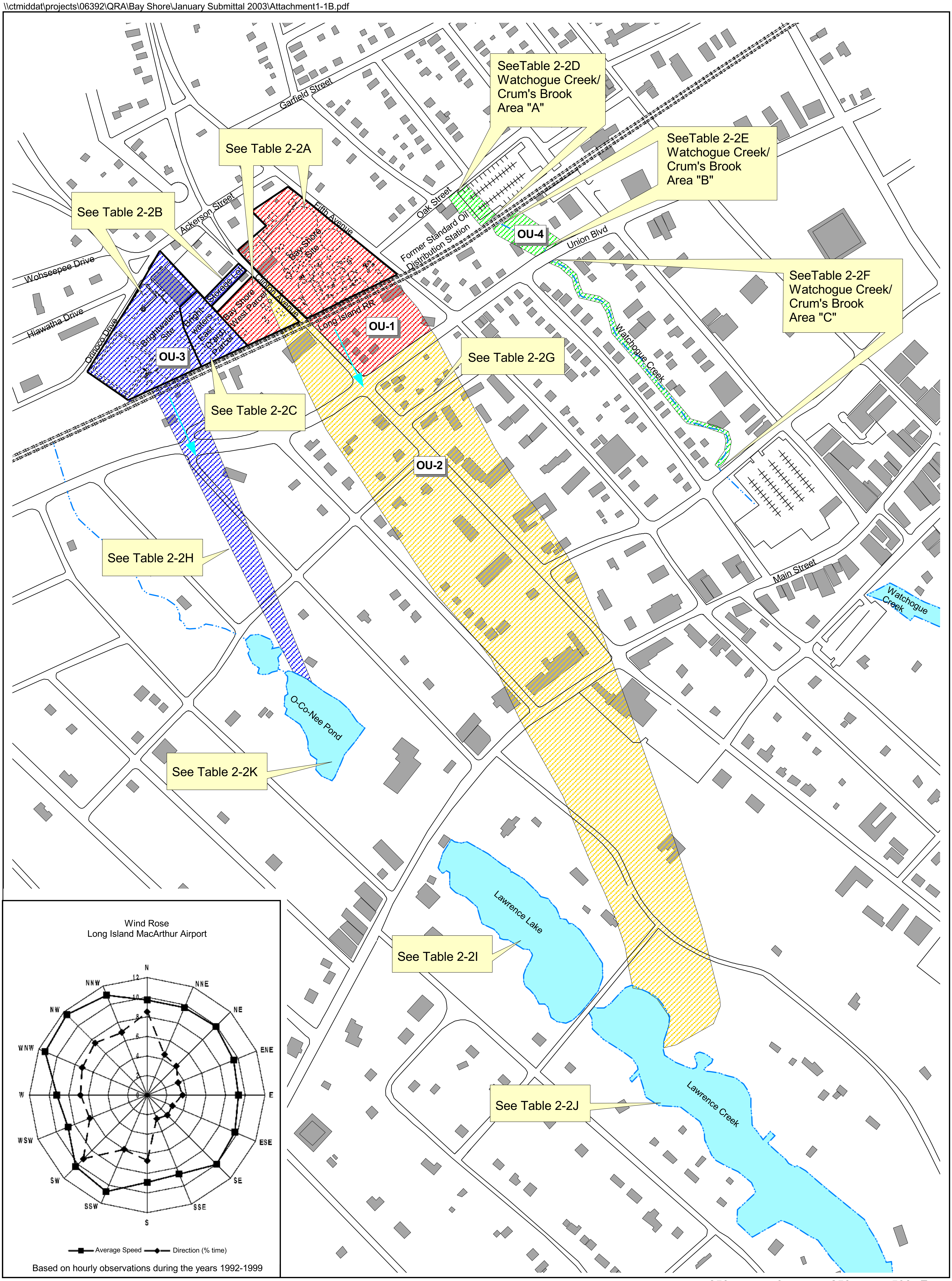
Map Compiled By:
VHB
Vanasse Hangen Brustlin, Inc.
January 2003

N

KEYSPAN

Attachment 1-1A
Conceptual Site Model - Current Site Plan Closeup

Bay Shore/Brightwaters
Former MGP Site
Suffolk County, New York



SOURCE: Bay Shore/Brightwaters Site Plan prepared by Dvirka & Bartilucci

250 0 250 500 Feet

Map Key

- OU-1 Bay Shore Site, Bay Shore West Parcel and Adjacent Off-site
- OU-2 Bay Shore Groundwater Plume
- OU-3 Brightwaters Yard and Brightwaters Groundwater Plume
- OU-4 Watchogue Creek/Crum's Brook (Cesspool, Pond and Creek)
- Historic Site Features
- Existing Buildings
- Water
- Creek
- Approximate Groundwater Flow Direction

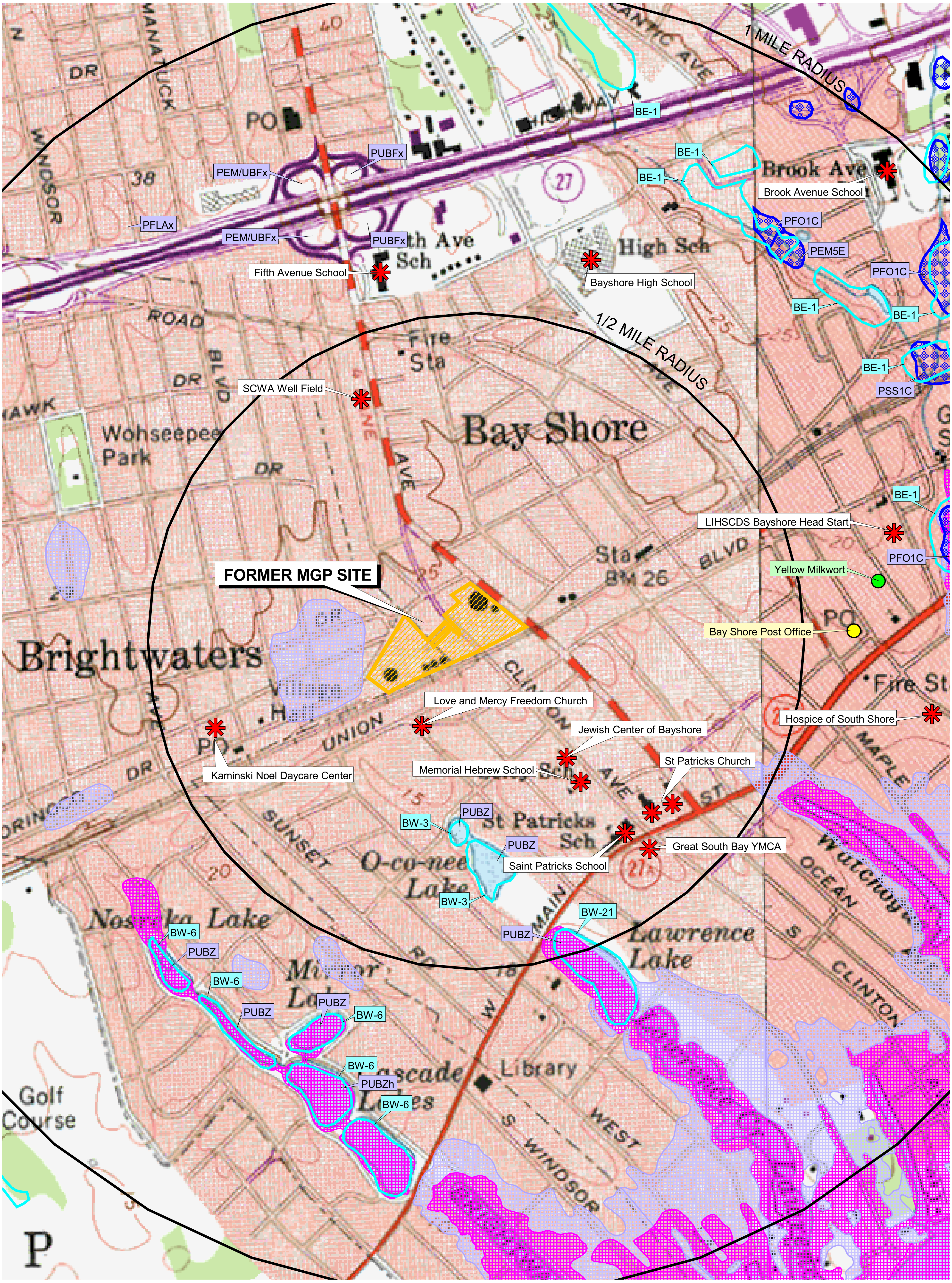
Map Compiled By:
VHB
Vanasse Hangen Brustlin, Inc.
January 2003

N

KEYSPAN

Attachment 1-1B
Conceptual Site Model - Current Site Plan Parcels

Bay Shore/Brightwaters
Former MGP Site
Suffolk County, New York



SOURCES:
Offsite Receptors, Historic Places - Environmental Data Resources, Inc.
USGS Topographic Map, Bayshore East, NY, Photorevised 1979
USGS Topographic Map, Bayshore West, NY, Photorevised 1979
US Fish and Wildlife National Wetlands Inventory
Fresh Water Wetlands - NYSDEC
Protected Species - NYSDEC
FEMA Q3 Floodplain Data, 1996

Map Compiled By:
VHB
Vanasse Hangen Brustlin, Inc.

January 2003

500 0 500 1000 1500 Feet

N

Map Key

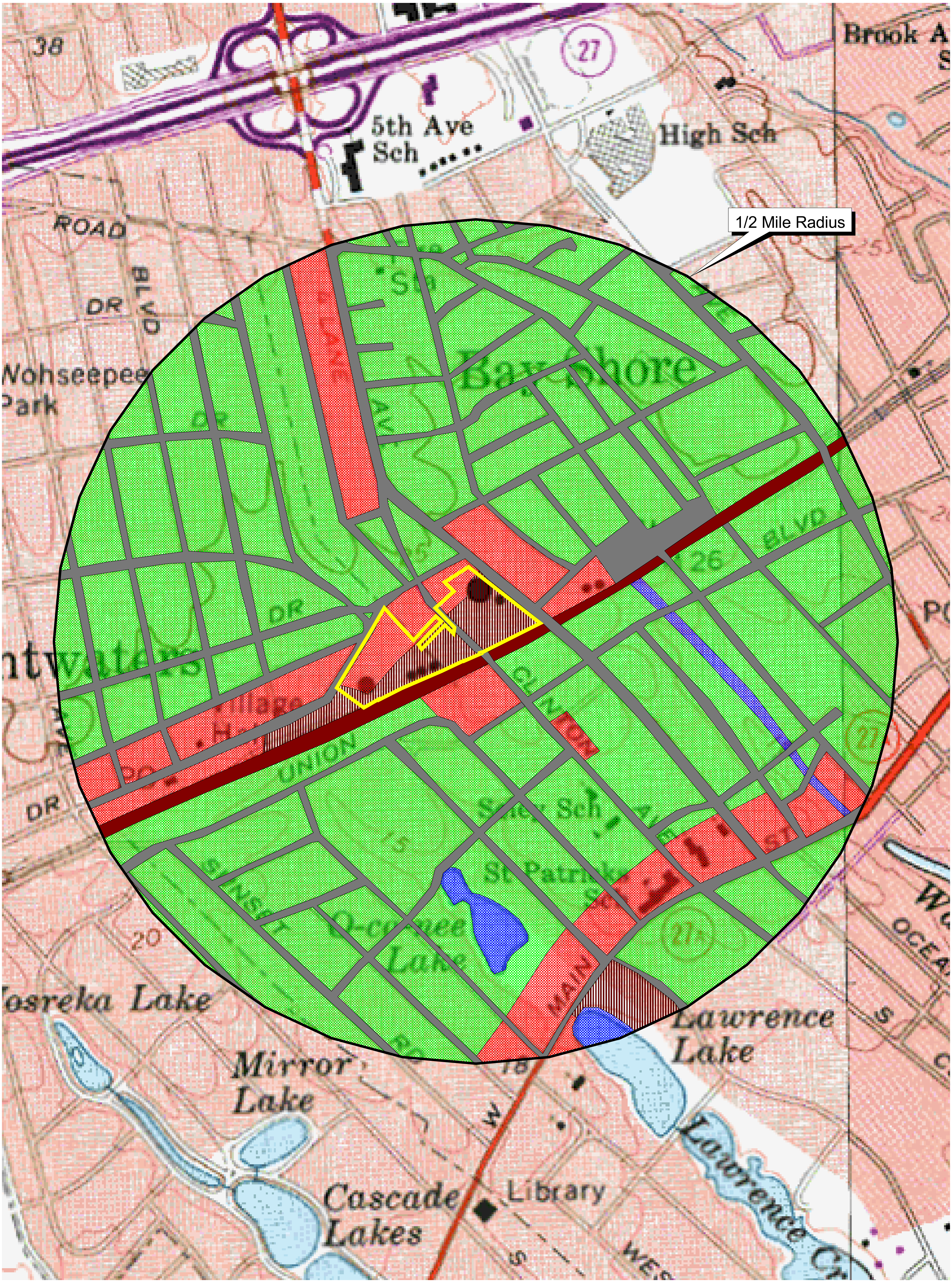
- Former MGP Site
- Fresh Water Wetlands
- National Wetlands Inventory
- 100 Year Floodplain
- 500 Year Floodplain
- Protected Species
- Historic Places
- Offsite Receptors

KEYSPAN

Attachment 1-1C
Conceptual Site Model -
Environmental Attributes
and Sensitive Receptors

Bay Shore/Brightwaters
Former MGP Site
Suffolk County, New York

\\ctmiddat\projects\06392\QRA\Bay Shore\January Submittal 2003\Attachment1-1D.pdf



SOURCES:
USGS Topographic Map, Bayshore East, NY, Photorevised 1979
USGS Topographic Map, Bayshore West, NY, Photorevised 1979
Site Reconnaissance

Map Key

- Former MGP Site
- Paved
- Railroad R.O.W.
- Commercial/Industrial
- Residential
- Successional Field
- Water

Map Compiled By:
VHB
Vanasse Hangen Brustlin, Inc.

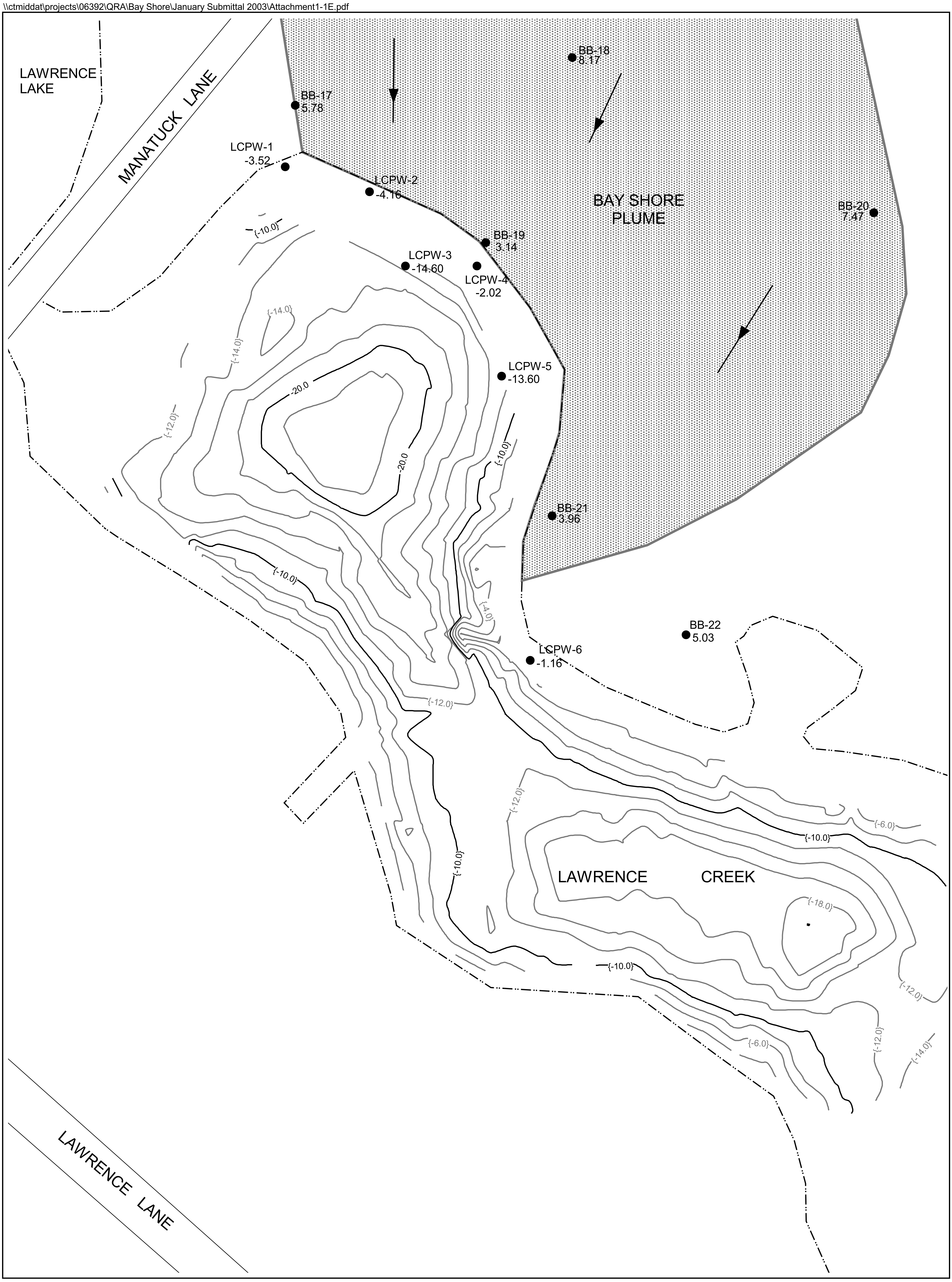
January 2003

KEYSPAN

Attachment 1-1D
Conceptual Site Model-
Land Cover Map

Bay Shore/Brightwaters
Former MGP Site
Suffolk County, New York

\\ctmiddat\projects\06392\QRA\Bay Shore\January Submittal 2003\Attachment1-1E.pdf



SOURCE: Lawrence Creek drawing prepared by Dvirka & Bartilucci, 01/23/01

50 0 50 Feet

KEYSPAN

Map Key

- Shoreline (approximate)
- Major Bathymetric Contour
- Minor Bathymetric Contour
- Approximate Groundwater Flow Direction
- Groundwater Plume
- Sample Points (with elevation/depth in feet MSL)

Map Compiled By:
VHB
Vanasse Hangen Brustlin, Inc.
January 2003

N

Attachment 1-1E
Conceptual Site Model -
Lawrence Creek Detail

Bay Shore/Brightwaters
Former MGP Site
Suffolk County, New York