REPORT

Pre-Design Investigation Report for Silver Lake Sediments

Volume I

General Electric Company
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engineers & scientists

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1. Introduction

1.1 General

On October 27, 2000, a Consent Decree (CD) executed in 1999 by the General Electric Company (GE), the United States Environmental Protection Agency (EPA), the Massachusetts Department of Environmental Protection (MDEP), and several other government agencies was entered by the United States District Court for the District of Massachusetts. The CD governs (among other things) the performance of response actions to address polychlorinated biphenyls (PCBs) and other hazardous constituents in soils, sediment, and groundwater in several Removal Action Areas (RAAs) located in or near Pittsfield, Massachusetts, that are part of the GE-Pittsfield/Housatonic River Site (the Site). For each Removal Action, the CD and accompanying *Statement of Work for Removal Actions Outside the River* (SOW) establish Performance Standards that must be achieved, as well as specific work plans and other documents that must be prepared to support the response actions for each RAA. One of these RAAs – the Silver Lake Area – is addressed in this document (Figure 1).

To characterize the soils and (where applicable) sediments in each RAA, and to support the development of any future response actions, the SOW requires the preparation of a Pre-Design Investigation Work Plan. In January 2003, GE submitted a *Pre-Design Investigation Work Plan for the Silver Lake Area Removal Action* (PDI Work Plan) that described the pre-design activities proposed by GE for sediments within Silver Lake and bank soils located in certain areas adjacent to Silver Lake. That PDI Work Plan was a revision of an earlier version of the work plan (submitted in April 2002) and was prepared in response to EPA comments contained in a letter dated November 21, 2002. The January 2003 PDI Work Plan was conditionally approved by EPA in a letter dated February 11, 2003.

Pursuant to the EPA-approved PDI Work Plan, the performance of pre-design investigations and related reporting has been and will continue to be conducted separately for sediments and soils within the Silver Lake Area. For soils, pre-design activities proposed in the PDI Work Plan have been performed and summarized in a document entitled *Pre-Design Investigation Work Plan Addendum for Soils Adjacent to Silver Lake* submitted to EPA in October 2003. This document entitled *Pre-Design Investigation Report for Silver Lake Sediments* (Sediments PDI Report) summarizes the pre-design sediment investigations that have been performed to date for the sediments within Silver Lake. This Sediments PDI Report also evaluates and reports on the sufficiency of these data (and data from prior investigations) to characterize the sediments within the Silver Lake Area and, thus, support the preparation of a Conceptual Removal Design/Removal Action (RD/RA) Work Plan for the Silver Lake sediments.

The pre-design activities summarized in this Sediments PDI Report pertain to sediment-related activities only. Where necessary and appropriate, pre-design activities related to groundwater in the vicinity of the Silver Lake Area (specifically the groundwater seepage rate into the lake) have been used for evaluation purposes related to Silver Lake sediments. However, activities concerning groundwater quality in the vicinity of the Silver Lake Area are currently being addressed separately as part of the Plant Site 1 Groundwater Management Area (GMA 1) baseline monitoring program.

1.2 Format of this Report

This report contains three text sections as well as several supporting tables, figures, and attachments. Section 1 presents introductory information and a description of Silver Lake. Section 2 describes the pre-design investigation activities performed to further characterize sediments at Silver Lake, and the results and assessment of potential data needs (as necessary). Section 3 summarizes the proposed supplemental pre-design investigations and presents a schedule for implementation and data reporting.

1.3 Description of Silver Lake

Silver Lake is located immediately west of and across Silver Lake Boulevard from the former 30s Complex portions of the GE Plant Area in Pittsfield, Massachusetts. The lake is bordered to the north by Silver Lake Boulevard and to the west and south by several commercial/industrial and residential properties. Silver Lake has a surface area of approximately 26 acres and a maximum water depth of about 30 feet. It receives storm water discharges from several municipal storm water outfalls, a portion of the GE Plant Area (via National Pollutant Discharge Elimination System [NPDES] permitted outfalls), and several adjacent residential and commercial/industrial properties. Silver Lake discharges to the East Branch of the Housatonic River through a 48-inch diameter concrete pipe located in the southwest portion of the lake. This pipe conveys surface water from Silver Lake and storm water runoff from Fenn and East Streets to the Housatonic River (Figure 2).

2. Summary of Pre-Design Investigations

2.1 Summary of Performance Standards and Work Performed

Response actions for the sediments in Silver Lake must achieve the Performance Standards set forth in Section 2.6.2 of the SOW. The Performance Standards for the removal and capping activities (i.e., excluding Post-Removal Site Control activities) are discussed in Section 3.1 of the PDI Work Plan and are briefly summarized below.

- GE shall remove a maximum of 400 in-situ cubic yards (cy) of sediments from an area in the general vicinity of existing outfall 01A and shall replace the removed sediments and restore and vegetate that portion of the affected area that is not underwater in coordination with the installation of the sediment cap and the performance of natural resource restoration/enhancement activities.

- GE shall install a cap over the entire bottom of the lake to achieve the design standards set forth in Attachment K to the SOW including an isolation layer consisting of silty sand with a presumptive thickness of 10 inches if geotextile is placed between the sediments and the cap (or 12 inches without a geotextile), a total organic carbon (TOC) content of 0.5%, and concentrations of PCBs at non-detectable levels and other constituents at background levels (with the appropriateness of these design parameters being subject to confirmation in the pre-design investigation).

- The capping system shall include an overlaying armoring layer of stone incorporated along the shoreline as necessary to prevent potential erosion of the isolation layer due to wind-induced wave action.

To support the performance of RD/RA activities and achieve the required performance standards, GE proposed (and EPA approved) various pre-design investigations as described in the PDI Work Plan.

This section summarizes the results of these pre-design investigations. These investigations were completed by GE between April and November 2003. These investigations were primarily performed on behalf of GE by Blasland, Bouck & Lee, Inc. (BBL) and Quantitative Environmental Analysis, Inc. (QEA), while analytical services were provided by Northeast Analytical, Inc and Mass Spec Services Division of GeoNuclear, Inc. During the performance of these activities, EPA, US Army Corps of Engineers (USACE), and/or Weston Solutions, Inc. (Weston) performed oversight activities.

The PDI Work Plan provided a description of sampling locations and procedures to be performed in and around Silver Lake to support design of a sediment removal action and sediment cap and to characterize existing vegetative types and potential wildlife usage on the banks of Silver Lake. A summary of the investigations and results, along with recommendations for any additional data collection activities is presented in Sections 2.2 - 2.4 below. Modifications to the pre-design investigation activities proposed in the PDI Work Plan are also identified under the individual investigation activities sections. A complete set of the available analytical data generated during the pre-design sampling effort is provided in Appendix A and summarized in the sections below.

All sampling and analysis activities were performed in accordance with the procedures set forth in GE's approved *Field Sampling Plan/Quality Assurance Project Plan* (FSP/QAPP), or in the absence of such procedures, in accordance with procedures described in the PDI Work Plan.

2.2 Pre-Design Sediment Removal Investigations

In accordance with the SOW, to address the reported presence of elevated PCBs in sediments, the performance standards require removal of a maximum of 400 in-situ cy of Silver Lake sediment from an area in the general vicinity of existing outfall 01A (Figure 3). Although existing sediment PCB data provided a general understanding of the concentrations and extent of PCBs in sediment near outfall 01A, additional pre-design investigation activities were proposed to better define the vertical and horizontal extent of PCBs in this area and thus to determine the limits of the sediment removal in this area.

2.2.1 Summary of Pre-Design Investigation Activities

Based on the presence of elevated PCB concentrations in sediment previously collected in the vicinity of Outfall 01A [(a single sample collected in 1992 showed a concentration of 21,000 milligrams/kilogram (mg/kg) at NO2(92)], a sediment sampling program was developed to better define the vertical and horizontal extent of PCBs in sediment near Outfall 01A for use in selecting the limits of a sediment removal (up to a maximum of 400 in-situ cy) in this area. On April 29, 2003, sediment investigation activities were performed at seven sediment sampling locations around the perimeter of N02(92) and from the location of N02(92) itself (with the pre-design sample designated NO2(03)-01), as shown on Figure 3. Samples were collected from the 0- to 1- and 1- to 3-foot depth increment at each location and analyzed for PCBs.

The pre-design sediment removal sample locations, frequencies, depths, and analytes were consistent with the activities proposed in the PDI Work Plan. Sampling logs are presented in Appendix B. Collected samples were analyzed for Aroclor-specific PCBs using EPA Method 8082.

2.2.2 Summary of Available Data

The historical sediment PCB data collected in the vicinity of outfall 01A, as well as recent pre-design sample results, are summarized on Figure 3, with the 2003 data provided in Table 1. Sediment PCB concentrations for the 0 to 1 foot interval ranged from 51 to 625 mg/kg, with an average of 322 mg/kg. Sediment PCB concentrations for the 1 to 3 foot interval ranged from 103 to 36,000 mg/kg, with an average of 10,500 mg/kg.

Based on all of the available PCB data, it is anticipated that removal can be performed within the outfall area to a depth of approximately 3 feet resulting in the removal of approximately 400 cy of sediment. Further, this removal will encompass the sample locations with higher PCB concentrations. The limits and corresponding depth of removal will be further evaluated in the forthcoming Conceptual RD/RA Work Plan.

2.2.3 Data Quality Assessment

For the pre-design sediment sampling activities performed by GE, quality control samples (i.e., matrix spike/matrix spike duplicates, field duplicates, and field blanks) were collected in accordance with the FSP/QAPP. The FSP/QAPP also presents the quality control criteria and corrective action procedures to be followed for each analytical and field-generated quality control sample. Overall project quality assurance was provided by following the procedures for sample collection and analysis, corrective action, and data reporting and validation specified in the FSP/QAPP.

All of the GE pre-design PCB analytical data collected as a result of the performance of sediment removal investigation activities have undergone data validation in accordance with Section 7.5 of the FSP/QAPP. The results of this assessment for GE's recent pre-design samples are summarized in a data validation report presented in Appendix C. In summary, for a total of 17 PCB sediment samples, individual Aroclor-1221 and Aroclor-1248 results reported by the laboratory were qualified as non-detect as the data validation indicated that the sample data did not match aroclor patterns that were established through the analysis of target aroclor standards. Additionally, two duplicate sediment PCB results were qualified as estimated (J) as the field duplicate results exceeded the acceptable relative percent difference. The qualified results are noted in Table 1.

Overall, as indicated in that report, 100.0% of the pre-design data collected by GE are considered to be usable, as qualified. Thus, the GE pre-design sediment PCB data set meets the data quality objectives set forth in the PDI Work Plan and the FSP/QAPP.

2.2.4 Assessment of Potential Data Needs

The available sediment PCB data are sufficient to define the boundaries of a potential removal action. Based on review of the Performance Standards set forth in the SOW pertaining to the removal of Silver Lake sediments, there does not appear to be a need for additional pre-design investigations to support sediment removal activities. As a result, additional pre-design investigations are not proposed at this time.

2.3 Capping-Related Investigations

The SOW requires the installation of a cap over the entire bottom of the lake to achieve the design standards set forth in Attachment K to the SOW. The conceptual design of the cap includes an isolation layer consisting of silty sand (TOC 0.5%) with a presumptive thickness of 10 inches if geotextile is placed between the sediments and the cap (or 12 inches without a geotextile). Additionally, a layer of armor stone is included for protection along the shoreline. Various capping-related pre-design investigations were identified in the PDI Work Plan to verify several of the design assumptions and parameters associated with the conceptual design.

Specific capping-related investigations were identified in the PDI Work Plan to: 1) support design of the isolation layer design; 2) support armor layer design; and 3) evaluate cap constructability. Details pertaining to each of these design considerations are further discussed below in Sections 2.3.1, 2.3.2, and 2.3.3.

2.3.1 Isolation Layer Design

A sediment cap isolation layer (as part of an overall capping system) provides a long-term reduction of PCB flux (i.e., migration) from the sediment into the water column. The ability of the cap isolation layer to control the migration of PCBs can be modeled through a series of equations that predict the chemical flux into and through the cap. Two general types of PCB mass transport can occur: advective and diffusive. In the absence of groundwater discharge through the bottom of the lake, the PCB concentration gradient between the pore water and the overlying water will control diffusion of PCBs upward through the cap. If the hydraulic conditions in the area indicate active discharge of groundwater, the movement of PCBs in pore water from the sediments to the lake may be driven by advective transport.

Chemical flux models were used in the isolation layer basis of design. In developing the chemical flux model to assess cap effectiveness, 11 major variables must be measured, estimated, or assumed. These variables are:

Cap Material Variables

- Thickness
- Cap material TOC
- Porosity
- Bulk density

PCB-Related Variables

- Partitioning coefficient to particulate organic carbon
- Partitioning coefficient to dissolved organic carbon

Site Characteristic Variables

- Sediment PCB concentration
- Sediment TOC
- Bioturbation depth
- Pore water PCB and dissolved organic carbon (DOC) concentration
- Groundwater velocity

With regard to the cap material variables, the uncertainty for some of the cap-related variables can be controlled by specifying appropriate isolation material to be used in constructing the cap. With regard to the PCB-related variables, partitioning characteristics of PCBs are generally available through existing databases (many generated as a result of EPA studies) and provide reasonable estimates for design.

Concerning site characteristic variables, a sufficient amount of historical data exist to provide reasonable estimates of sediment PCB and TOC concentrations. However, for three of the site characteristic isolation layer design variables -- bioturbation depth, sediment pore water DOC, and groundwater velocity -- additional data collection was warranted to support RD/RA activities. Thus, the PDI Work Plan proposed additional investigations to: (1) better define the depth to which bioturbation can be expected in the isolation layer, to allow appropriate adjustments (if any) to be made to the isolation layer thickness; (2) better understand sediment pore water DOC within lake sediments; and (3) collect more accurate site-specific data pertaining to groundwater seepage velocity. As a result, activities related to bioturbation, pore water characterization, and groundwater seepage velocity were performed and are further discussed below in Sections 2.3.1.1, 2.3.1.2, and 2.3.1.3, respectively.

2.3.1.1 Bioturbation

Bioturbation refers to processing, mixing, and/or resuspension of sediments by aquatic organisms (including benthic invertebrates and other bottom-dwelling organisms) while burrowing, feeding, spawning, and/or undertaking other physiological activities. If some of the potential effective thickness of the cap isolation layer is lost due to mixing in the bioturbation zone, an increase in the cap isolation material thickness may be warranted to provide physical and chemical separation sufficient to achieve the design standards set forth in Attachment K to the SOW.

Previous research was conducted by BBL to determine an effective capping thickness for Silver Lake (BBL, 1999). Based on the results of this study, the isolation layer thickness for the cap was increased by 4 inches (if geotextile is placed between the sediments and the cap) to 6 inches (if geotextile is not placed) to account for uncertainties associated with bioturbation. Subsequently, pre-design investigation activities were performed to confirm or modify these design parameters and to generate data to support the presumptive thickness of the isolation layer within Silver Lake. Specifically, to gather additional data to further evaluate bioturbation, pre-design activities consisted of a benthic community survey and sediment radiochemical analysis. The laboratory results of the benthic survey were used to characterize the existing benthic community of the lake and literature was then used to determine burrowing characteristics. Sediment radiochemical analyses using Beryllium-7 was conducted as an alternative approach to determining bioturbation depths (based on interpretation of depositional patterns). A summary of these activities and their findings is provided below.

2.3.1.1.1 Summary of Pre-Design Investigation Activities

2.3.1.1.1.1 Benthic Community Survey

To evaluate the possible effects of benthic macroinvertebrates on the disruption or mixing of a cap surface, a benthic community survey was conducted between June 4 and 5, 2003 at twelve random sediment locations (as shown in Figure 4) within Silver Lake. As part of the survey, samples of surficial substrate materials were collected using a petite ponar dredge. Triplicate samples were collected from each of the twelve areas. Consistent with the standard operating procedure provided in the PDI Work Plan, these materials were sieved through a standard #30 sieve to separate organisms from the sediment material. Sieve contents were preserved using 70% ethanol and shipped to Chadwick & Associates, a taxonomic laboratory, for enumeration and identification to lowest practical taxonomic level. Physical characterization of recovered materials and water quality measurements were also assessed to supplement findings.

2.3.1.1.1.2 Sediment Radiochemical Analysis

In addition to the benthic community survey, sediment radiochemical analyses using Beryllium-7 were conducted to provide an alternative approach to determining bioturbation depths. Beryllium-7 is a naturally occurring radioisotope that is present in atmospheric deposition and because of its relatively short half-life (53 days), Beryllium-7 is an effective indicator of materials in contact with the atmosphere within the last year. The deepest detectable Beryllium-7 activity is interpreted as the surficial mixing depth. In addition, although not part of the original investigation approach, analysis results for another radioisotope – Cesium-137 – were also reported by the laboratory. Cesium-137 is a radioactive by-product of atmospheric nuclear weapons testing and can be used as an event marker in sediment profiles. Cesium-137 is ideally suited for radiotracing sediment movements, because of its long half-life (approximately 30 years), low self-absorption effects, and high affinity to sediment particulates (Charles and Hites, 1987). The presence of Cesium-137 was also used to infer potential bioturbation depth as discussed further below.

During the sediment radiochemical study, shallow sediment cores were collected from Silver Lake at six of the twelve randomly selected benthic sample locations using 4-inch diameter Lexan tubes. The sample locations were selected to provide spatial coverage of the lake (core locations 1 through 6 in Figure 4). Following collection, the six cores were stored upright for several hours to allow materials to settle. The overlying water was decanted by drilling holes and then cutting the Lexan tubes approximately 4 to 6 inches above the sediment water interface. The core material was then extracted by pushing the sediments upward. As the material was extruded, the upper 6-inches of each core were segmented into six 1-inch depth increments and placed into shallow wide-mouth glass jars for shipment to Mass Spec Services of Orangeburg, New York for radiochemical analysis.

2.3.1.1.2 Summary of Available Data

2.3.1.1.2.1 Benthic Community Survey

Population survey results for the benthic macroinvertebrates are presented in Table 2. Two classes of benthic organisms were identified: midges (Diptera) and worms (Oligochaeta). Within these two classes, three families of midges (Ceratopogoninae, Chaoboridae, and Chironomidae) and one family of worms (Tubificidae) were identified. Several different genus and species for the families were also identified.

Total abundance ranged from 3 to 85 organisms per sample, and the average abundance for all sample locations was approximately 34 organisms (Table 2). Diversity ranged from 1 to 8 taxa per sample; with an average of 5 taxa per sample.

The structure and abundance of the macroinvertebrate assemblage can be affected by a diverse group of environmental factors, including direct and indirect interactions with depth, water quality, substrate type, sedimentation, erosion, chemical constituents, food availability, and predator abundance (Stroud Water Research Center, 2001). Within Silver Lake, substrate conditions were similar for most locations. Typically, fine to coarse sands, silts, and clays were overlain with black, very fine organics and detritus materials. Water depths were variable, and ranged from approximately 3 to 25 feet across the site. A summary of the water quality data is presented in Table 3. At greater water depths (i.e., >20 feet), water temperature decreased three-fold, specific conductance increased three-fold, and turbidity increased by a factor of 15.

A literature review was conducted to interpret the results of the benthic community survey in terms of the possible extent of bioturbation for the particular species observed in Silver Lake. Several literature sources were used that describe the role of benthic organisms on migration of radiochemicals within the sediment, and specific burrowing behaviors of families and species of benthic organisms. The results of this research as compared to the site benthic community assemblage are detailed below.

Available literature pertaining to organisms encountered in Silver Lake suggests that the majority of bioturbation is expected to occur to a depth of 6 to 10 centimeters (cm), although they may occasionally occur at greater depths. The intensity and depth to which bioturbation occurs in the sediment column are highly site-specific, but usually less than 10 cm (Clarke, et. al., 2001). Studies by Matisoff et al. (1985) for subsurface deposit feeders (i.e., Tubificid oligochaete worms) showed bioturbation depths for worm species Limnodrilus and Tubifex to occur in the top 2 to 8 cm. Studies by Ford (1962) indicated that 98% of the benthic organisms occurred in the top 5 cm. Within this study, burrowing depths for the family of biting midges, Ceratopogoninae, were shown to occur up to 15 cm. Studies by Charbonneau and Hare (1998) showed the midge genus, Procladius, to burrow to depths of less than 3 cm. Based on the review of literature, none of the taxa observed in the Silver Lake survey are known to exhibit deep burrowing behaviors. In addition, given the relatively limited abundance and diversity of benthic organisms sampled within the surficial substrate, the effect of benthic organism mixing in the current system is expected to be minimal.

2.3.1.1.2.2 Sediment Radiochemical Analysis

Results of the beryllium-7 analyses are presented in Table 4. Beryllium-7 was detected in only one of the six cores (Core 5, in the 0 to 1 inch layer). Beryllium-7 was not detectable in any of the other core samples. Lack of detectable levels of beryllium-7 in the upper one inch segment of five of the six cores may be related to loss during sample collection (the upper surface layer of the sediment samples consist of very fine materials with low solids content). However, no beryllium-7 was noted in the deeper 1-inch cores, indicating a general lack of bioturbation within the upper 6-inches of sediment. Based on the limited detection of beryllium-7, bioturbation in the Silver Lake appears too limited to the upper 1-inch of sediment.

In addition to the beryllium-7 report, though not requested as part of the original Work Plan, analysis of cesium-137 was included in the lab report. Cesium-137 was detected in all cores, although not necessarily in all segments of the cores. A pronounced concentration difference in cesium concentrations was generally noted in surficial core intervals (i.e., 0- to 1-inch, 1- to 2-inch, and 2- to 3-inch depth intervals) compared to those below 2 to 3 inches (with one possible exception, Core 4); indicating mixing is limited to three inches or less. Results of the cesium-137 analyses are presented in Table 4.

The relative lack of sediment mixing based on the radiochemistry data from the pre-design sediment cores are in general agreement with observation of PCB and cesium-137 data available from the four prior sediment cores collected to assess sediment deposition rates in Silver Lake in 1994 (presented on Figure 2-4 of the PDI Work Plan). While the data collection was not intended for a determination of mixing depth, cesium-137 data from the upper 3 inches and in the 6- to 7-inch depth segment generally showed a similar pronounced concentration difference, and indicate that mixing depths appear to be conservatively limited to the upper three inches.

2.3.1.1.3 Assessment of Potential Data Needs

Based on the existing data related to bioturbation potential, the conceptual isolation layer design thickness provided in the SOW (i.e., four inches of isolation layer material with a geotextile to six inches of isolation layer material without a geotextile) appears appropriate to account for potential bioturbation effects. As a result, additional pre-design investigation activities are not proposed.

2.3.1.2 Pore Water Characterization

The initial step in any potential pathway for the long-term migration of PCBs through a cap into the overlying water would be the desorption of the PCBs from the sediment to the surrounding pore water (interstitial water). It is the pore water PCB concentration that directly serves as the supply for PCB loading to the cap, either through pore water advection as a result of groundwater discharge to the lake, or through diffusion as a result of the concentration gradient established between the sediment pore water and the water of the cap and ultimately the overlying Silver Lake waters.

Due to the slow rate of groundwater movement into Silver Lake, the contact time between the sediment and pore water can be sufficient for the concentration of PCBs in the pore water and sediment to approach thermodynamic equilibrium. Pore water, therefore, can be extracted (in-situ or ex-situ) and analyzed to indicate the concentration and/or partitioning of contaminants within the sediment matrix.

The partitioning of the PCBs between the solid and liquid phase is dependent on the relative sorptivity of the PCBs, given site-specific conditions. Characteristics of the chemical, sediment, and pore water all contribute to determining the distribution between the phases and the equilibrium concentration. For a highly hydrophobic organic compound such as PCBs, the partitioning is largely determined by TOC content present in the sediment matrix and DOC content of the pore water. The case-specific distribution coefficient can be mathematically represented by:

$$K_d = \frac{K_{oc} f_{oc}}{1 + (C_{doc} K_{doc})}$$

where: K_d = distribution coefficient
K_{oc} = partitioning coefficient to organic carbon
K_{doc} = partitioning coefficient to dissolved organic carbon
f_{oc} = fraction of TOC in the sediment
C_{doc} = pore water PCB concentration associated with DOC

The presence of DOC decreases the distribution coefficient, and thereby increases the concentration of PCBs in the pore water. The potential impact on PCB migration through the cap, in addition to increasing the initial pore water PCB concentration within the sediment bed, is that increased DOC concentrations will decrease the retardation coefficient associated with the cap/pore water interactions and increase PCB transport through the cap.

Prior to the pre-design investigation, Silver Lake pore water had not been collected for chemical analysis. As a result, in the conceptual design (Attachment K to the SOW), an initial estimated sediment pore water PCB concentration was calculated using a highly conservative assumption regarding the DOC concentration of the pore water. Specifically, a conservatively high estimated value of 50 milligrams/liter (mg/L) for the pore water DOC (based on Thurman, 1985) was used. Other inputs in the calculation were based on existing data from Silver Lake sediments, including the spatially averaged TOC and PCB concentrations (9% and 330 mg/kg, respectively), (excluding the removal area near N02[92]). Another assumption made in the initial cap evaluation was that K_{doc} was equal to 0.1 x K_{oc}. An extensive evaluation of the published relationships between K_{doc} and K_{oc} for hydrophobic organic compounds supports this value as representing a reasonable and conservative assumption (Barnes and others, 2001). It was also consistent with observations of PCB sorption characteristics in the Housatonic River (Russell and others, 2001). Using these values, an initial bed sediment pore water PCB concentration of 1.97×10^{-2} milligrams per liter (mg/L) was computed.

In order to obtain site-specific pore water DOC data within the Silver Lake sediments, to confirm or modify the cap design, a pore water characterization study was proposed as part of the pre-design investigation. Additionally, measuring the pore water PCB concentrations provided a means to test assumptions regarding partitioning characteristics exhibited at Silver Lake. In addition, sequential batch leach tests (SBLTs) were proposed by EPA as part of the pre-design investigation to determine whether there was a change in pore water concentrations/PCB partitioning with repeated mixing and pore water extraction.

2.3.1.2.1 Summary of Pre-Design Investigation Activities

Sediment cores for the pore water study were collected from 10 locations within Silver Lake. Measurements of PCB and TOC in sediment, as well as PCB and DOC in pore water were obtained. The TOC analysis was performed as three (occasionally four) replicate analyses, with the average of these replicates used in this analysis. Results of these analyses provide a range for the TOC to be used in the verification/modification of the cap effectiveness model. Additionally, results of the associated pore water and sediment PCB and pore water DOC analyses provide a check on the partitioning values used in the preliminary cap modeling.

The 10 locations were identified prior to sampling -- four in areas of suspected groundwater discharge to the lake (eastern portion of the lake), and three each in areas of suspected groundwater recharge from the lake (western portion of the lake) and in transitional areas (center of the lake). The locations were selected to represent a range in anticipated PCB concentrations, sediment characteristics, water depths, and possible groundwater flow regime. At the time of core collection, locations were identified by GPS survey. The sampling locations are depicted on Figure 5. From each location, three cores were collected and composited to provide sufficient volume of material. Core collection procedures were consistent with the FSP/QAPP. Upon retrieval of each core, the cores were photographed and visual descriptions noted. Prior to processing, the cores were maintained at approximately the ambient sediment bed temperature at the time of collection. The cores were maintained vertically during all handling, transportation, and storage steps to minimize disruption. Also, the cores were processed within one working day after sample collection.

Due to concerns regarding mixing with overlying surface water and other boundary related conditions at the water sediment interface, the top 5 cm of the core was extruded for sediment PCB and TOC analysis but not pore water analysis.

An IEC Centra GP8R centrifuge was used for the extraction of pore water. The procedures used for the extraction of pore water were detailed in the PDI Work Plan.

As a check on the pore water, partitioning and distribution coefficients developed as a result of the analysis of pore water concentrations, three of the 10 sediment samples used in the pore water tests were retained for further analysis by SBLTs. The SBLTs were performed on one sample collected from each of the three zones (i.e., suspected discharge, transition, and recharge). The sample locations selected for SBLT analysis are shown on Figure 5. The SBLTs involved sequential measurements of pore water PCBs and DOC through repeated addition of distilled deionized water and centrifugation. The procedures for the performance of SBLTs were detailed in the PDI Work Plan.

2.3.1.2.2 Summary of Available Data

Sediment TOC results were available for the 0 to 5 cm and 5 to 30 cm segments of each of the 10 cores. The TOC values are presented in Table 5. Surface TOC values, as represented by the 0 to 5 cm samples, ranged from 0.41 to 10.0 percent. The 0.41 percent at location SL03 may be non-representative of the Lake as a whole, and may instead result from the deposition of coarser materials within the delta-like deposit at the outfall area. It should also be noted that the materials present in this area will be subject to removal. Excluding the TOC at SL03, the minimum TOC was 5.9 percent in the 0 to 5cm depth, and TOC concentrations averaged 8.3 percent at the surface. TOC values in the 5 to 30 cm depth were generally greater than in the corresponding surface samples, ranging from 5 to 17 percent (excluding a value of 0.52 percent at SL03), and averaging 12.1 percent. These results are generally consistent with the value of 9 percent used in the preliminary cap design modeling based on existing data from Silver Lake sediments.

Sediment total PCB concentrations were obtained for the 0 to 5 cm and 5 to 30 cm segments of each of the 10 cores. The PCB concentrations are also presented in Table 5. Surface concentrations (0 to 5 cm) averaged 120.2 mg/kg and ranged from 10.4 to 363 mg/kg. PCB concentrations in the 5 to 30 cm layer were greater than the corresponding surface sample, averaging 1,037 mg/kg, ranging from 12.7 to 7,240 mg/kg. PCB concentrations were generally higher at the eastern end of the Lake (locations SL01 through SL05).

Pore water DOC and PCB concentration results were obtained for the 5 to 30 cm layer of each of the sediment cores. These results are presented in Table 6. Pore water DOC concentrations ranged from 18.1 to 38.6 mg/L, averaging 25.4 mg/L. This average is approximately half the 50 mg/L DOC concentration assumed for the preliminary cap modeling. DOC concentration appeared slightly higher at the east end of the Lake, but, as shown on Figure 6, there was not a statistically significant relation between sediment TOC and corresponding pore water DOC.

Pore water PCB concentrations ranged from 1.1×10^{-3} to 1.49×10^{-1} mg/L, and averaged 5.3×10^{-2} mg/L. Most of the difference between the observed average 5.3×10^{-2} mg/L and the value that was calculated for the conceptual design (1.97×10^{-2} mg/L) can be accounted for by the two highest values. The two highest concentrations occurred at SL03 (which was located near the outfall, had very low sediment TOC, and will be subject to removal) and at SL04 (where the highest sediment PCB concentration, 7,240 mg/kg, was observed). As with the sediment PCB concentrations, the highest pore water PCB concentrations were generally observed in the eastern half of the lake.

Additionally, the porewater PCB concentrations observed at SL09 (0.0113 mg/L) appears anomalously high considering a number of factors. With a relatively low sediment PCB concentration of 90.3 mg/kg, a pore water DOC concentration of 21.2 mg/L and a sediment TOC of 13 percent, the reported pore water PCB result is a factor of five higher than would have been anticipated based on partitioning equilibrium. Further evidence of the suspected anomalously high pore water PCB concentration for this sample is provided by the SBLT results (discussed in more detail later in this section). The results of SL09 pore water PCB concentrations were inconsistent with the general pattern observed during the SBLT at the other two cores (i.e., an increase in dissolved PCB concentrations during leach test 1 compared to initial pore water PCB concentrations, then a return to initial pore water PCB concentrations for subsequent leach tests). Further, the pore water PCB concentration associated with the second, third, and fourth SBLTs for SL09 are an order of magnitude lower than the initial concentration. Additionally, the pore water DOC from SL09 generally follows the expected pattern for the other areas.

Based upon the observed PCB concentration in sediments and pore water, an apparent partitioning coefficient can be computed for each core location. This apparent partitioning coefficient includes the effects of dissolved organic carbon on the three phase partition present in pore water and is represented as the ratio of the sediment concentration to the pore water concentration as follows:

$$K_A = \frac{C_{sed}}{C_{pw}}$$

where: K_A = apparent partitioning coefficient
C_{sed} = sediment PCB concentration
C_{pw} = total pore water PCB concentration

K_A values observed at Silver Lake ranged from 5,800 to 127,000 L/kg, averaging 45,400 L/kg. The two lowest values were observed at SL03 where organic carbon content is extremely low, and at SL09 which had an anomalously high PCB concentration, as noted earlier. Excluding these two values, the average K_A would be 55,000 L/kg.

To account for the influence of organic carbon on the sediments, the apparent partitioning coefficient was then adjusted to create an organic carbon apparent partitioning coefficient (K_{Aoc}) which is calculated as follows:

$$K_{Aoc} = \frac{C_{sed} / f_{oc}}{C_{pw}}$$

This adjustment reduces the variability and allows for the partitioning coefficient to be expressed in more common terms (i.e., based on organic carbon). Results ranged from 210,000 to 735,000 L/kg, with an average of 473,000 L/kg (expressed on a Log10 basis 5.32 to 5.97, averaging 5.60). The observed K_{Aoc} values for each core and those that would have been predicted by relations and assumptions present in the conceptual cap design modeling as a function of dissolved organic carbon and sediment TOC, are compared in Figures 7 and 8, respectively. Using both the 9 percent TOC and 50 mg/L DOC concentration, the Log10 value calculated for K_{Aoc} for the initial conceptual design model was 5.29. As can be observed on these figures, the partitioning relations used in the conceptual cap modeling are representative of those actually observed in Silver Lake, with the exception of SL09 (that has a questionable pore water PCB concentration) and SL03 (that has a low sediment TOC value).

Another related means to assess the general extent to which the relations used in the conceptual cap design modeling represent actual processes in Silver Lake, is to compare the measured pore water concentrations with those that would be calculated using the modeling relations. The calculated pore water for each location was determined using the following relations and results shown in Figure 9.

$$C_{dis} = \frac{C_{sed}}{K_{oc} f_{oc}}$$

$$C_{doc} = C_{dis} \times \left(M_{doc} K_{doc} \right)$$

$$C_{pw} = C_{dis} + C_{doc} = C_{dis} \times \left(1 + M_{doc} K_{doc} \right)$$

where: C_{dis} = dissolved pore water PCB concentration
M_{doc} = mass of DOC in pore water

In general, with the exception of SL09 the calculated pore water concentrations compare well with the measured pore water concentrations. As shown in Figure 9, the model slightly over-predicted the pore water concentration at three locations (SL02, SL03, and SL05) and slightly under-predicted the pore water concentration at the remaining seven locations (SL01, SL04, SL06, SL07, SL08, SL09, and SL10). As discussed previously, the analytical result for pore water PCB concentration (0.0113 mg/L) obtained from the SL09 sediments appears to be inconsistent with other observations.

The initial conceptual modeling assumed a log K_{oc} value of 6.43, based on literature review and values previously used for modeling PCB transport in the study area. A log K_{doc} value of 5.43 was assumed based upon a 0.1 adjustment factor to the K_{oc} value. When comparing the two parameters, a higher degree certainty for the assumed value of K_{oc} seems probable, therefore the effect of adjustments to the K_{doc} (or adjustment ratio of 0.1) was evaluated. Given that the apparent partitioning coefficient (K_A) that has been observed, and using 6.43 as a K_{oc}, it follows that the range of possible K_{doc} values can be estimated as follows:

$$K_A = \frac{C_{sed}}{C_{pw}} = \frac{C_{sed}}{C_{dis} \times (1 + M_{doc} K_{doc})}$$

$$K_A = \frac{C_{sed}}{\frac{C_{sed}}{K_{oc} f_{oc}} \times (1 + M_{doc} K_{doc})}$$

$$K_A = \frac{K_{oc} f_{oc}}{(1 + M_{doc} K_{doc})}$$

Further, letting $Z = K_{doc}/K_{oc}$

$$K_{doc} = ZK_{oc}$$

$$K_A = \frac{K_{oc} f_{oc}}{(1 + M_{doc} Z K_{oc})}$$

rearranging

$$K_{oc} = K_A \big/ (f_{oc} - K_A M_{doc} Z)$$

or

$$Z = \frac{f_{oc}}{K_A M_{doc}} - \frac{1}{K_{oc} M_{doc}}$$

The maximum asymptotic value of Z (the ratio of K_{doc} to K_{oc}), is therefore:

$$Z_{\max} = \frac{f_{oc}}{K_A M_{doc}}$$

The maximum value of Z is plotted in Figure 10. The initial conceptual cap model used an equivalent value of 0.1. Six of the Z values shown in Figure 10 exceed 0.1. Evaluating the results as presented in Figure 10, the ratio of K_{doc} to K_{oc} was increased from 0.1 to 0.16, resulting in a revised log K_{doc} value of 5.63. The effect of the revised K_{doc} values on the comparison of observed and computed is shown on Figure 9. Effects of uncertainty in the K_{oc} value are presented on Figure 11.

With regard to modeling cap performance, the other factor increasing K_{doc} will affect, other than increasing pore water dissolved PCB concentrations, is a slight reduction in cap retardation coefficient. Figure 12 presents the computed cap retardation coefficient using constant values log K_{oc} of 6.43, log K_{doc} of 5.63 and an assumed cap TOC of 0.5 percent, with the core location specific DOC. These retardation coefficient values, ranging from 3,800 to 7,600, are generally still consistent with the 4,600 resulting from partitioning relations presented in the preliminary modeling. These cap PCB retardation coefficient values (using K_{oc}=6.43 and log K_{doc}=5.63) are generally significantly lower (more conservative) than those computed by an alternative method using the observed apparent partitioning coefficient (K_A) from each of the individual 10 locations (also shown in Figure 12).

SBLTs were performed on sediment cores from three (SL02, SL06, and SL09) of the ten sampling locations used in the evaluation of pore water. The SBLTs consisted of sequentially leaching the sediments with distilled water to make a fine grained slurry, mixing the slurry for 24-hours then centrifuging. The supernatant was then filtered and the filtrate analyzed for pore water DOC and PCB. More water was added to the sediment and the procedure repeated four times.

Patterns in DOC concentrations, pore water PCB concentrations and the relative ratio of these concentrations were observed. Results from the SBLT analysis for DOC and PCBs are presented in Table 7. The results show a general pattern of an increase in DOC during the first leach test compared to the initial measurements, followed by decreasing concentrations which approach, or are below the initial measurements (Figure 13). However, even the highest DOC concentrations during the first leach tests were below the 50 mg/L estimate used in the conceptual cap design. This increase during the first leach test may be the result of agitation of the test procedures creating an increase in colloidal material (particles smaller than a micron), elevating the initial measurement of dissolved phase leaching. SBLT results from the St. Louis River/Interlake/Duluth Tar site in Minnesota demonstrated that many of these colloids would not have formed without the agitation of the SBLT procedure and would not be available for transport under in-situ conditions (Service Engineering and others, 2002).

With the exception of the questionable pore water PCB concentration reported for SL09, a pattern similar to that observed for DOC is also observed in pore water PCB concentrations (Figure 14). In each core, pore water PCB concentrations appear to approximately double during the first leach test, then return to concentrations approximately equal to those found in the initial pore water sample. When the dissolved PCB concentration is normalized to the DOC concentration, the pattern is similar but the increase in concentration relative to the initial pore water is dampened (Figure 15).

2.3.1.2.3 Assessment of Potential Data Needs

The information collected during the pore water characterization study is sufficient to proceed with cap design and a result, collection of additional data is not proposed. Further, the results of the pre-design investigation have reasonably verified the conceptual model and assumptions, indicating in general, that the assumptions were conservative. Therefore, a change to the modeling assumptions or re-running the model is not proposed at this time.

2.3.1.3 Groundwater Seepage Velocity through the Cap

The velocity of groundwater seepage into the lake is an important component to understand for the design of an adequate cap isolation layer. To determine the velocity of groundwater seepage into the lake, the hydrology of Silver Lake, and the geologic stratigraphy and the hydrogeologic properties of the water-bearing sediments and soil materials adjacent to and below the lake must be defined. Pre-design investigation activities were performed to evaluate the velocity of groundwater flowing into and out of the lake to support the design of the cap isolation layer. Several methods were used in the pre-design investigations to quantify groundwater infiltration, including installing piezometers and monitoring wells, placing seepage meters, and assessment through developing a water budget. Specifically, measurements of groundwater gradients and hydraulic conductivity were obtained in wells and piezometers to allow calculation of the inflow rate to the whole lake, seepage meters were installed in the lake bottom sediments to provide a direct localized measurement of seepage into the lake, and a water budget was developed to calculate groundwater discharge into the lake based on the net difference from measured inflows and outflows and other losses. Groundwater seepage rates estimated using these three methods were then compared, using a weight-of-evidence approach, to the groundwater seepage estimate that was used for the initial conceptual design [2.74 liters per square meter per day (L/m^2/day)] to provide a comprehensive assessment of groundwater infiltration to the lake, in order to specify groundwater seepage velocity for cap design.

2.3.1.3.1 Summary of Pre-Design Investigation Activities

2.3.1.3.1.1 Groundwater Gradients

To estimate the velocity of groundwater seepage into the lake via groundwater gradient measurement, additional monitoring wells and piezometers were installed around and within the lake and monitored on an approximate monthly basis, hydraulic conductivity tests were performed, and a review of the geology, hydraulic properties of the soil, and hydraulic gradients adjacent to and below the lake was completed. These activities are summarized below.

Well/Piezometer Installation and Development

To supplement the existing groundwater monitoring network, six new shallow/deep monitoring well pairs (SLGW-1S/SLGW-1D through SLGW-6S/SLGW-6D) were installed along the northern, western, and southern Silver Lake shorelines (Figure 16). The monitoring wells were installed in accordance with the FSP/QAPP, using standard hollow-stem auger drilling techniques. Continuous soil sampling for geologic characterization was performed while drilling each deep well and the information obtained was utilized to determine the construction specifications for both wells in each pair. The wells were constructed with 2-inch diameter schedule 40 polyvinyl chloride (PVC) riser and well screens. The shallow wells were installed with 10-foot well screens that straddle the water table, and the deep wells were screened with 5-foot well screens set at a depth of approximately 20 to 25 feet below the water table. The sand pack surrounding each well screen was tremied into the annulus adjacent to the well screen, and a bentonite seal was placed above the sand pack. Cement-bentonite grout was then tremied into any remaining annular space above the bentonite seal to ground surface. The construction specifications for each new monitoring well are summarized in Table 8 and soil boring logs/well construction schematics are provided in Appendix B.

The locations of three well pairs were modified from those illustrated in the PDI Work Plan. Well pair SLGW-1S/SLGW-1D was moved approximately 150 feet eastward due to physical access limitations along the north side of the lake. GE was unable to obtain permission from the property owners to install well pairs SLGW-5S/SLGW-5D and SLGW-6S/SLGW-6D at their proposed locations. With EPA approval, the locations of these two well pairs were shifted to adjacent parcels where GE had obtained property access. Each well pair was moved approximately 200 feet eastward from their respective proposed locations.

In addition to the new shoreline monitoring wells, ten piezometers (SLPZ-01 through SLPZ-10) were installed into the lake bottom. As shown on Figure 16, six of these piezometers were located near shoreline monitoring wells, while the remaining four piezometers were spaced in the middle of the lake. The lake piezometers were constructed of 2-inch diameter steel risers and well screens and were driven into the sediment using direct-push drilling techniques from a barge-mounted drill rig. Each piezometer was constructed with a 5-foot screen, and the midpoint of the screen was approximately 17 to 28 feet (20 feet average) below the lake bottom. The construction specifications for each lake piezometer are summarized in Table 8.

To provide increased stability, especially in the portion of the piezometer between the water surface and lake bottom, the piezometers were constructed with steel screens and risers instead of PVC. Because the stratigraphy below the lake was already being defined as part of the sediment geotechnical boring program, the steel well points were pushed directly into the sediment without sampling.

Following installation, each of the new monitoring wells and lake piezometers was developed to improve hydraulic connection with the water-bearing materials. The monitoring wells were developed by surging the entire saturated portion of the well screen with a surge block and removing water with a positive displacement pump (for monitoring wells) or manually using inertia-pump (WaTerra™) tubing equipped with a foot valve (for lake piezometers).

Hydraulic Conductivity Testing

Rising-head slug tests were performed at the six new monitoring well pairs (SLGW-1S/SLGW-1D through SLGW-6S/SLGW-6D) and the ten lake piezometers (SLPZ-01 through SLPZ-10) between August 25 and August 29, 2003. Hydraulic conductivity values were then calculated by applying the Bower-Rice solution for unconfined aquifers and using AQTESOLV™ software (Bouwer and Rice, 1976; Bouwer, 1989). The results of the hydraulic conductivity tests performed during this investigation are summarized below in Section 2.3.1.3.2.1.

Water Level Monitoring

Groundwater and lake elevation measurements were collected monthly throughout the pre-design activities at the following previously-existing monitoring wells and the new monitoring wells and lake piezometers:

Shallow/Water Table Monitoring Wells	Deep Monitoring Wells	Lake Piezometers
SLGW-1S	SLGW-1D	SLPZ-01
SLGW-2S	SLGW-2D	SLPZ-02
SLGW-3S	SLGW-3D	SLPZ-03
SLGW-4S	SLGW-4D	SLPZ-04
SLGW-5S	SLGW-5D	SLPZ-05
SLGW-6S	SLGW-6D	SLPZ-06
RF-3	RF-3D	SLPZ-07
95-15		SLPZ-08
95-17		SLPZ-09
E-7		SLPZ-10
GMA1-10		
GMA1-12		
MW-6R		
RF-2		

The locations of these wells are shown on Figure 17 and well construction specifications are summarized in Table 8. The water-level data collected at the wells listed are summarized in Section 2.3.1.3.2.1 below. In addition to the monthly water-level monitoring activities performed at the wells identified above, additional monitoring was performed at certain wells near Silver Lake as part of the Plant Site GMA 1 groundwater quality and NAPL monitoring programs. Information obtained during those monitoring events was also utilized, as appropriate, in the preparation of this report.

Silver Lake water levels were also measured approximately monthly using a staff gauge located in the southeast portion of the lake and at each lake piezometer. As noted previously, the water levels in Silver Lake are controlled by an outfall located in the southwest portion of the lake. The outfall has an overflow weir at an elevation of 976.1 feet above mean sea level (amsl). The measured water-level data for Silver Lake ranged from 975.60 to 976.23 feet amsl, with an average of 975.93 feet amsl. Since 1995, water levels in Silver Lake have been monitored on a periodic basis and have shown a similar range of elevations.

2.3.1.3.1.2 Seepage Meters

On May 15, 2003, five seepage meters were installed in the lake bottom in approximately 5 feet of water to allow direct measurement of seepage rates into the lake. The seepage meters were used to monitor the volume of water flowing through a known surface area of the sediment bed and into the lake. The seepage meters were placed in the sediments for a known period of time; the net water accumulated (or lost) in a seepage meter provides a direct measure of groundwater seepage into (or out of) the lake over the footprint of the seepage meter. The most commonly used seepage meter is known as a Lee Meter. The typical Lee Meter, initially proposed in the pre-design investigation, was modified so that monitoring by boat was facilitated. Additionally, each meter was equipped with a separate vent to allow the release of trapped air from the meter. Instead of being directly attached to the inverted section of a 55-gallon drum, the collection bag was maintained in a separate weighted box which could be raised to the surface to retrieve the collection bag. The collection bag was attached to the drum by a length of tubing sufficient to allow the weighted box with collection bag to be raised to the surface. The collection bag was weighed each monitoring period to determine the net change in volume (assuming 1 ml = 1 gram), and then replaced in the weighted box and lowered to the sediment bed without removing the contents of the bag. The final weight for one monitoring period became the initial weight for the next.

Each seepage meter, constructed from an end of a 55-gallon drum, covered approximately 0.26 square meters. To compute a rate of specific discharge in units of L/m^2/day, the following equation is used:

$$Q(L/m^2/day) = \frac{(\Delta grams * .001)}{days * 0.26m^2}$$

where: Q = specific discharge

? *grams* = the change in mass of the water in the seepage meter collection bag over the time period (in days)

It was anticipated that the proposed seepage meters would be initially monitored weekly for the first month and the monitoring frequency modified depending on results, for a period of up to 6 months. Due to the low volumetric flow rates between the sediment bed and the water, the monitoring interval was modified to approximately monthly after the first several readings. Several of the seepage meters were paired with lake piezometers to directly compare calculated versus measured seepage rates. The seepage meter monitoring locations are depicted on Figure 18.

2.3.1.3.1.3 Water Budget

The third method of determining a groundwater seepage rate was through the development of a water budget. Development of a water budget requires quantification and balance of all inflows and outflows to the lake. Inflow sources include overland runoff, stormwater outfalls, treated stormwater discharges, direct precipitation, and groundwater infiltration. Water losses may occur from outflow, evaporation, and groundwater recharge. The water budget is represented by the following equations.

$$Q_{IN} = Q_{OUT} + \Delta S \quad (1)$$
$$Q_{IN} = P + Q_{GWR} + Q_{SO} + Q_{DD} \quad (2)$$
$$Q_{OUT} = Q_O + Q_{GWD} + E \quad (3)$$

where:
Q_{IN} = Total inflow
Q_{OUT} = Total outflow
ΔS = Change in storage
P = Precipitation on the lake surface
Q_{GWR} = Groundwater discharge to Silver Lake
Q_{GWD} = Groundwater discharge from Silver Lake
Q_O = Outflow from Silver Lake to the Housatonic River
Q_{SO} = Stormwater outfall discharge
Q_{DD} = Direct drainage from areas around the lake
E = Evaporation from the lake

The water budget measurements for the pre-design investigation were conducted during dry weather, targeting 5-day periods with no precipitation following 2 or 3 preceding days also with no precipitation. Because flow measurements were not taken during or after rain events, the Q_{DD} and P terms in equation 2 are assumed to be zero and are excluded from further consideration.

As a result, the water budget for Silver Lake included measurement of:

- significant lake inflows during dry weather;
- the lake outflow to the Housatonic River during dry weather;
- evaporation at GE's nearby weather monitoring station;
- lake storage volume based on stage records; and
- meteorological conditions including precipitation, temperature, humidity and wind speed.

A site visit was first conducted to identify potential inflow and outflow measurement locations for Silver Lake. The lake shoreline was walked and photographs and notes were taken regarding all potential inflow locations. The only surface water outflow from the lake; Outfall C, is the pipe to the Housatonic River (see Figures 19 and 20). In spite of the recent rain event that occurred the day before and during part of the first day of the site visit, only two inflows were observed to be flowing. Outfall A, a box culvert which transitions to a natural channel, clearly provides the largest dry weather inflow to Silver Lake (Figures 19 and 20). A smaller inflow was observed at Outfall B (Figure 19), a corrugated metal pipe, that initially appeared as a small spring (Figure 21). Upon digging away the sediment around the source of the flow, it became apparent that the flow originated from a large silted-in culvert with approximately an inch of space conveying flow (Figure 21).

Following identification of the outfall measurement locations, subsequent discharge measurements for the water budget sampling were obtained at Outfalls A and B (inflow) and Outfall C (outflow) using the velocity-area method with velocities measured using a hand-held electromagnetic velocimeter (March-McBirney Flo-Mate 2000). Measurements were also collected at a transect 80 feet downstream from Outfall A (Station A + 80') in the channel between the outfall and Silver Lake. Though the data for Outfalls A and A + 80 feet represent the same flow, Outfall A was chosen for inclusion in final calculations. The table below provides a description of each outfall and the flow measurement locations.

Summary of Silver Lake Outfalls

Outfall ID	Conveyance	Dimension (width/diameter) (ft)	Flow Type	Flow Duration	Depths (ft)
A	Box Culvert	3.5	Inflow	Continuous	0.05 - 1.0
A + 80	Channel	16	Inflow	Continuous	0.8 - 2.2
B	CMP	1.5	Inflow	Continuous	0.26 - 1.0
C	Channel	8.0	Outflow	Continuous	0.4 - 1.3

Meteorological data were measured during the water budget study at the GE weather station. The weather station is located approximately 1,800 feet east of the east shore of Silver Lake, near buildings 64G and 64T. Meteorological data is recorded every fifteen minutes, twenty four hours a day and includes, among others; precipitation, wind speed and direction, and evaporation rates. The weather station is active year round, and the current installation has been in service since approximately 1993.

Additional weather data for temperature and humidity (that was not available from the GE weather station) was obtained from the National Weather Service (NWS) for the station at the Pittsfield Municipal Airport. The weather station at the airport is approximately three miles from the west end of Silver Lake at an approximate elevation of 1,200 feet. Temperature and humidity data were gathered from this site and inserted into the estimation of evaporation from the lake surface.

The lake storage volume and related surface area were computed following a bathymetric survey completed by Ocean Surveys Incorporated (OSI) in June of 2003. This calculation provided a direct function for lake storage volume and lake surface area based on the water surface elevation. OSI provided survey information which aided in developing a bottom surface profile featuring two foot contours. Lake surface elevations were recorded at two locations. An automated monitoring location located near the southeastern shore of the lake, was used to record the daily change in the surface water elevation. The automated lake level data was used in concert with periodic water surface elevation measurements manually recorded at a piezometer (SLPZ-06) installed near the middle of the lake. These lake level monitoring locations are both shown on Figure 19.

As outlined in the PDI Work Plan, water budget measurements were intended to be recorded in sets of five dry weather days immediately after two to three days of no rain. During the summer/fall of 2003 following the start of PDI activities, there were only two such 5-day periods. This investigation was able to capture flow measurements for one of those periods in mid-September. Unfortunately, due to an equipment malfunction in the automated lake level monitor, lake levels were not recorded and water budget calculations could not be completed for this September period. Water budget analyses were completed for one three day period with no precipitation preceded by one day of no precipitation. Though this does not precisely fit the criteria set forth in the PDI Work Plan, it is the best available data and is believed to provide a reasonable estimation of dry-weather base-flow to the lake.

2.3.1.3.2 Summary of Available Data

2.3.1.3.2.1 Groundwater Gradients

Stratigraphy

The data from the geotechnical soil borings and monitoring wells installed during the pre-design investigation, together with prior data from investigations conducted within the Plant Site 1 GMA, support a general assessment of subsurface conditions in the area beneath and surrounding Silver Lake. Three geologic cross-sections have been prepared for transects illustrated on Figure 22. Cross-section A-A' (Figure 23A) shows a view from west to east across the lake, while cross-sections B-B' and C-C' (Figure 23B) represent sections from north to south across the western and eastern portions of the lake, respectively. The unconsolidated hydrogeologic units present near Silver Lake are briefly described below.

The shallow soils adjacent to Silver Lake generally consist of topsoil, recent alluvial sediments, and/or fill materials. These shallow deposits are typically present in the upper 10 feet of the subsurface, but extend to depths of up to approximately 20 feet below grade in some areas. The alluvial sediments consist primarily of fine-to-coarse sand containing approximately 20 percent silt and between 10 and 20 percent fine-to-medium gravel. These sands and sandy gravels are well-sorted and were deposited as glacial outwash and/or in association with more recent depositional processes. The nature of the fill materials is variable, but generally consists of re-worked sand, silt, and gravel, with minor amounts of general construction/demolition debris (glass, cinders, brick, wood, concrete, slag, asphalt, and metal) that were previously placed within some of the properties adjacent to Silver Lake.

Organic-rich silt deposits containing peat and marl are present beneath the surficial units, typically at depths corresponding to the bottom elevations of the lake. These materials were encountered at thicknesses ranging from 10- to 30-feet in the vicinity of Silver Lake and are the initial unit encountered across the majority of the lake bottom.

A generally coarsening-downward sequence of silty fine-to-medium sand that grades into coarse sand and gravel is present beneath the organic silt units. Most of the borings drilled during the pre-design investigation ended in the silty sand portion of this sequence, which was found to be up to 10 feet thick where penetrated. The silty sand forms a transitional contact with the underlying coarser sands and gravels, and contains several alternating layers of each.

Till, typically consisting of dense silt containing varying amounts of clay, sand, and gravel, represents the lower-most unconsolidated unit in the vicinity of Silver Lake. Till was not encountered in the borings installed during this pre-design investigation, but based on the geologic information obtained during other investigations around Silver Lake, the depth to till ranges up to over 50 feet below grade (more than 20 feet below the lake bottom).

Hydraulic Conductivity

The collected data (including complete grain size analysis results in Appendix D)
and calculations are presented in Appendix E, and the results are summarized in Table 9. This table also includes results from a few nearby wells that were tested during previous investigations (RF-3, RF-4, and GMA1-3). Hydraulic conductivity values ranged from 3.98×10^{-03} to 1.59×10^{-02} centimeter per second (cm/sec) for the shallow wells, 7.56×10^{-04} to 6.99×10^{-02} cm/sec for the deep wells, and 2.01×10^{-7} to 3.55×10^{-4} cm/sec for the lake piezometers. Hydraulic conductivity values could not be calculated reliably from wells

SLGW-5S or RF-3D because the water levels in these wells recovered too rapidly. Monitoring well SLGW-5S is screened in fill material, approximately 10 to 20 feet from the south shoreline of Silver Lake. Monitoring well RF-3D is screened in sand and gravel.

The hydraulic conductivity values for the lake sediments are significantly lower than for the soils surrounding the lake. As a result, the grain-size data from geotechnical lake borings were used to provide an order-of-magnitude check of hydraulic conductivity data obtained from the lake piezometers. Grain-size data from the sediments geotechnical testing program, which are presented in Table 24, were used to calculate hydraulic conductivity using the United States Bureau of Reclamation (USBR) method, as described by Vukovic and Soro (1992). The USBR formula is given in the form:

$$K = 0.36\,(d_{20})^{2.3}$$

where K is the hydraulic conductivity in cm/sec and d_{20} is the “20% passing” particle size in millimeters (mm) (i.e., 20% of the sample was smaller than the specified grain size). These calculation results are summarized in Table 9.

The hydraulic conductivities estimated using slug-tests for the piezometers ranged from 2.01×10^{-7} cm/sec to 3.55×10^{-4} cm/sec with a geometric mean of 1.86×10^{-6} cm/sec. The hydraulic conductivities calculated using the USBR method for samples in the same geologic stratum (SLGT03-02 5.3 to 5.8 feet, and SLGT03-02 10 to 12 feet) indicated similar results of 5.67×10^{-7} cm/sec and 8.04×10^{-6} cm/sec, providing an order of magnitude check of the piezometer slug test results. Using either set of conductivity numbers, results from both methods indicate that the unconsolidated materials beneath Silver Lake are several orders of magnitude less permeable than the unconsolidated materials surrounding the lake. These data suggest that groundwater/surface-water interaction at the lake bottom is likely limited by the low permeability of the geologic materials that underlie the lake.

Groundwater Elevations and Hydraulic Gradients

Groundwater elevations north of the lake range from approximately 976 to 983 feet amsl, while east and west of the lake they range from 976 to 977 feet amsl, and south of the lake they range from 975 to 976 feet amsl. The level of Silver Lake is generally maintained at approximately 976 feet amsl. Figures 24A and 24B represent groundwater elevation contour maps for the shallow and deep zones prepared using data collected in the fall of 2003. The complete groundwater elevation data set generated during the pre-design investigation is provided in Appendix F.

As shown on Figures 24A and 24B, the hydraulic gradient data collected during the pre-design investigation indicate a horizontal component of groundwater flow toward the lake from the north (magnitude approximately 0.020 feet per foot) and away from the lake to the south (magnitude approximately 0.0056 feet per foot). Horizontal hydraulic gradient directions east and west of the lake are variable and more subdued, but generally suggest the potential for groundwater discharge to the lake. The fall 2003 data are consistent with groundwater elevation data measured as part of the GMA 1 Baseline Monitoring Program (winter 2001, spring 2002, summer 2002, and fall 2002).

Based on the monitoring data obtained from the shallow/deep well pairs and from comparisons of groundwater levels in the piezometers with lake levels, the vertical component of the hydraulic gradient around and beneath the lake is variable. The vertical gradient data that were calculated using the water levels measured on October 30, 2003 are believed to be the most reliable because the water levels in the piezometers recovered very slowly following installation and development. Thus, some of the prior water level measurements at the piezometers may not have represented static conditions. Table 10 lists the calculated vertical gradients during each monitoring event at the paired wells located along the lake perimeter. Vertical gradients calculated for the October 30, 2003 round of water levels from lake piezometers, as well as gradients for the well pairs surrounding the lake for the same date, are shown on Figure 25. This figure indicates that vertical hydraulic gradients were generally upward (toward the lake); only SLPZ-09 exhibited a downward gradient and at SLPZ-05 there was no upward or downward gradient. The available vertical gradient data for the well pairs that surround the lake (Table 10) generally support the data trends shown on the figure except at the two well pairs located south (downgradient) of the lake, SLGW-5 and SLGW-6. The data for these locations show that the average vertical gradient during the period of available data (collected approximately monthly during the latter half of 2003) was downward. Based on this observation, it is reasonable to infer that during seasonally drier periods of the year (the fall season of 2003 was unusually "wet"), that downward gradients would be evident at several other lake piezometers, particularly those located in the southern portion of the lake.

While the data discussed above suggest the potential for groundwater flow into the lake, and localized flow out of the lake through the lakebed, the magnitude of the flow into and out of the lake bottom is likely limited by the low permeability of the unconsolidated deposits beneath the lake. It is possible that, due to the low permeability of the lakebed deposits, a large fraction of the horizontal flow observed in the area north and south of the lake by-passes the lake, rather than discharging into or out of it.

Seepage of water through the lakebed was therefore evaluated based on vertical groundwater flow calculations using the hydraulic conductivity and hydraulic gradient data measured at the lake piezometers, and described in the previous subsection. To provide an estimate of the range of water flow expected through the lakebed, Darcy's Law was used as follows:

$$Q = K\,A\,i$$

where: Q = the flow rate
A = the area across which seepage occurs
i = the vertical component of the hydraulic gradient.

As applied herein, a negative value of i indicates a downward gradient. The slug tests performed at the lake piezometers provided an estimate of the hydraulic conductivity, with a geometric mean of 1.9×10^{-6} cm/sec. As shown on Figure 25, the maximum (upward), minimum (strongest downward), and average vertical gradients for the lake piezometers are 0.123, -0.021, and 0.037, respectively. Using these values of K and i in the above equation, the maximum seepage into and out of a unit area of lakebed was calculated, as well as the average seepage of water through a unit area of lakebed. The calculations are summarized on Table 11. For the October 30, 2003 data set, the maximum seepage into the lake per unit area was estimated to be 0.2 liters per square meter per day (L/m^2/day), the maximum seepage out of the lake per unit area was estimated to be -0.03 L/m^2/day, and the average seepage was estimated to be 0.06 L/m^2/day. These values are comparable to those measured using seepage meters installed into the lakebed, as discussed in Section 2.3.1.3.2.2 (range of 0.44, -0.14 L/m^2/day, and average of 0.001 L/m^2/day) and is significantly below the 2.74 L/m^2/day assumed in the conceptual design.

2.3.1.3.2.2 Seepage Meters

Results of the seepage meter monitoring are presented in Table 12. After screening the data based on field observations and operating difficulties, it was determined that 38 individual sets of seepage measurements could be used. The computed groundwater seepage rates ranged from -0.14 to 0.44 L/m^2/day, with an overall time-weighted average of 0.001 L/m^2/day. Nearly half of the measurements (17 of 38) indicated lake water movement into the sediment pore water/groundwater system (negative discharge in Table 12) and each meter location had periods of upward and downward movement. The time weighted average seepage rate for each location was slightly positive (upward), with four of the five meters averaging between 0.00021 and 0.00077 L/m^2/day. The remaining meter (#5 located in the southeastern corner of the lake) had the highest average specific discharge, but may have been unduly influenced by the initial reading of 0.44 L/m^2/day, the highest observed during the study period. Excluding that initial measurement, meter #5 averaged a downward seepage rate (-0.00037 L/m^2/day) for the remainder of the monitoring period. Regardless, all seepage measurements were significantly below the 2.74 L/m^2/day assumed in the conceptual design.

2.3.1.3.2.3 Water Budget

During the August 19 through 21 water budget monitoring period, data to complete flow calculations for the three identified Silver Lake outfalls were collected twice daily. Recorded values are shown for each outfall in Appendix G. Flow data was derived from knowledge of the selected outfall geometries, and depth and water velocities collected at each outfall. Where possible, each outfall was divided into thirds, and depth and water velocity were measured near the middle of each section. Outfall B was significantly constricted by sediment and debris. Following removal of the debris, the area of flow was small enough such that one measurement location was sufficient for the whole outfall. Similarly, for the period of record in August, Outfall C was partially blocked by fallen trees and floating debris. During this blockage only one section of the channel had discernible flow and thus only one measurement was recorded for this outfall in August.

The flow for each section is calculated as the product of water depth, width of the section, and the measured water velocity using the following equation:

$$Q = w\ d\ v$$

where:

Q = flow (cfs)
w = section width (ft)
d = water depth (ft)
v = water velocity (ft/s)

The resulting flows from each section of the outfall were summed and a representative total flow was determined. Data from the specific periods of analysis and resulting flows for each outfall are displayed in Table 13.

Meteorological data were derived from two sources: the GE weather station, and the NWS daily records for the station at the Pittsfield Municipal Airport in Pittsfield, Massachusetts. Combined, the two sources provide: temperature; precipitation; wind speed and direction; and humidity data for the completion of the estimate of daily evaporation rates for Silver Lake. Data recorded and used in this calculation are found in Appendix H. Figure 26 displays the daily measurement of precipitation, temperature, wind speed and humidity as recorded for Silver Lake during the study period.

Evaporation estimates for Silver Lake were computed empirically using a Class-A evaporation pan installed with the GE weather station. Data compiled from the GE weather station and the NWS-Pittsfield station allow for computation of a pan coefficient which relates the actual potential for evaporation to the measured evaporation in the Class-A pan. The pan coefficient is a function of humidity and wind velocity, as well as the placement of the pan and the surrounding environments (Bedient & Huber, 1992.) Using this method the evaporation can be estimated using the following formula (Ponce, 1989):

$$PET = K_p E_p$$

where: PET = daily potential evaporation

K_p = calculated pan coefficient

E_p = measured daily evaporation in pan

The pan coefficient is a daily calculation based on a number of assumptions as well as environmental data. In an effort to create conservative estimates for the evaporation pan used in this calculation, it was assumed, based on the layout of the GE weather station, that the pan was surrounded by grassy and vegetated areas with fetch lengths in the vicinity of 100 meters. Additionally, the relative humidity (a function of measured temperature and dew point), and the measured wind speed, are required to complete the calculation of the evaporation coefficient. The calculated coefficient, in turn, adjusts the measured evaporation to complete the estimate for lake surface evaporation. A complete list of all the meteorological data collected is available in Appendix H, while the data used in completing the evaporation estimate are displayed in Table 14. The final evaporation coefficient is determined using the following function:

$$K_p = 0.108 - (0.0286\,W) + [0.0422\,\ln(F)] + [0.1434\,\ln(RH)] - [0.000631\,(\ln(F))^2)\,(\ln(RH))]$$

where: K_p = the calculated evaporation coefficient

W = measured wind speed

F = assumed fetch length

RH = calculated relative humidity

The storage volume of the lake is a function of the bathymetry of the lake bottom and the depth of water in the lake. The OSI survey completed in 2003 provided bathymetric information sufficient to create stage/storage and stage/surface area relationships. Topographic drawings were completed using AutoCAD and the bathymetric data as furnished, such that the surface area and the volume of the lake could be calculated in 2 foot increments starting from the lake bottom. The surface area was calculated using AutoCAD and is comprised of the area contained within each 2 foot increment. To determine the stage/storage ratio, the volume of each 2 foot increment (the surface area times a two foot thickness) was calculated and summed to the elevation of interest as shown below:

$$V_i = \sum_{0}^{i}\left[\left(\frac{A_i + A_{i+1}}{2}\right)\cdot D\right]$$

where: V_i = lake storage at depth interval i (ft^3)

A_i = the lake surface area at depth interval i (ft^2)

D = the thickness or depth of each interval (ft)

Figure 27 displays a graph of the stage/storage and stage/surface area relationships, as well as a table of calculated storage and surface area for each two-foot interval. Storage and surface area for intermediate depths were interpolated from the table shown in Figure 27.

The final water budget calculation is a sum of all its components, including both positive and negative contributions. In the summation, only the groundwater term is unknown and therefore the results are used to approximate the groundwater flow to or from the lake. To establish convention, this analysis considered the value of all components (except the change in storage), to be positive, while the change in storage can be positive or negative. The calculation process is explained in detail below.

Having removed precipitation and direct runoff to the lake from the calculation, equations (1), (2), and (3) are rewritten here:

$$Q_{IN} = Q_{OUT} + \Delta S \quad (1)$$
$$Q_{IN} = Q_{GWR} + Q_{SO} \quad (2)$$
$$Q_{OUT} = Q_O + Q_{GWD} + E \quad (3)$$

These equations were combined and rearranged to solve for the net groundwater flow to Silver Lake:

$$Q_{GWR} - Q_{GWD} = Q_O + E - Q_{SO} + \Delta S$$

Substituting the specific Silver Lake terms in for the general terms above, the final calculation for net groundwater flow to the lake takes the following form:

$$Q_{GW} = Q_C + E - (Q_A + Q_B) + \Delta S$$

where: Q_{GW} = net groundwater flow

Q_C = flow out of the lake from Outfall C

Q_A = flow into the lake in Outfall A

Q_B = flow into the lake in Outfall B

ΔS = Change in storage

Each of the inputs to the water budget calculation, and the resultant estimate for groundwater flow for the August 19-21 period of record is shown in Table 15. As shown in Table 15, the average groundwater flow for the period of record using the water budget calculation was -0.46 cfs downward (out of the lake). Dividing this flow by the surface area of the lake (to conservatively approximate the sediment surface area) results in an estimated seepage of -21 L/m^2/day. The absolute value of this seepage estimate is higher than the value used in the conceptual design 2.74 L/m^2/day. However, the design assumptions (which assume a net inward flow) are more conservative than the conditions observed on August 19 through 21 which indicate that during dry weather conditions the net flow of groundwater is downward (out of the lake).

2.3.1.3.3 Summary and Additional Data Needs

In summary, as discussed above, several methods were used in the pre-design investigation to quantify groundwater seepage, including groundwater gradient measurements, placing seepage meters, and developing a water budget. Seepage meters and piezometers provide direct in-situ measurements of groundwater seepage into or out of Silver Lake. During the pre-design investigation, several rounds of data were obtained with fairly limited and interpretable variability noted both spatially and between sampling rounds. By comparison, only one round of data was obtained for calculation of groundwater seepage rates by the water budget method which is a net-difference calculation technique. The results obtained from the seepage meters and piezometers/monitoring wells are considered more reliable for calculations of groundwater seepage rates.

The rate of potential groundwater seepage that was estimated using seepage meters and groundwater gradients was low (average values of 0.001 and 0.06 L/m^2/day, respectively). These values are significantly below the 2.74 L/m^2/day assumed in the conceptual design. In fact, all of the individual measurements were at least a factor of six less than the rate assumed in the conceptual design. This would indicate that limiting long-term advective transport of dissolved PCBs to the overlying water column can be adequately accommodated by capping. The least weight is placed on the water budget results since it is a net-difference-calculation method for what appears to be a relatively small groundwater component; and minor differences in the estimates of flow into and out of the lake can have a large effect on the estimated groundwater discharge. Based on the water budget method, however, the estimated seepage rate (-21 L/m^2/day) was downward for the period of time recorded and therefore will not be factored into the cap design.

It is believed that the pre-design investigation provided sufficient information to support the design assumption of 2.74 L/m^2/day for the groundwater seepage is a conservative estimation of seepage. However, to further confirm this and provide additional data on seasonal hydraulic gradients it is proposed that one or more additional complete rounds of water levels be performed in Spring 2004.

2.3.2 Armor Layer Design

The performance standards established in the SOW require that GE include an overlying armoring layer of stone incorporated along the shoreline as necessary to prevent erosion of the isolation layer due to wind-induced wave action. In the areas of man-made discharges along the shoreline (i.e., storm water pipe outfalls), armor stone must also be considered to prevent the erosion or physical displacement of sediment capping materials resulting from surface water discharges from/to the outfalls. The conceptual design for the armor layer was presented in the SOW which included a 0.4 foot layer of 10-pound quarry stone extending into the lake to a mean water depth of 5.3 feet along the west and east shores and a 0.4 foot layer of 1-pound quarry stone extending into the lake to a mean water depth of 2.5 feet along the north and south shores. The PDI Work Plan identified various pre-design investigation activities to verify or modify the conceptual design, if necessary, including the physical conditions around the outfalls, the bank/sediment bed slope along the shoreline, and wind speed and direction.

Details pertaining to the pre-design investigation activities performed related to armor layer design are further discussed below.

2.3.2.1 Summary of Pre-Design Investigation Activities

The data needs that were identified in the PDI Work Plan related to verification or modification of the armor stone design for the outfalls and the shoreline areas included: the physical conditions around the outfalls, bank/sediment bed slope along the shoreline, and wind speed and direction. The need for shoreline armor at

Silver Lake is dependent on two factors: erosion potential from wind generated waves, and scour potential due to storm drain outfalls. Each of these pre-design activities performed is further discussed below.

In addition, EPA recently requested that the impacts of ice formation on the armor system be evaluated. Discussions related to potential impacts from ice formation were presented in Attachment K to the SOW. As stated therein, additional protection from ice damage was not included in the conceptual design as wave action was expected to be the most significant design criteria. However, in response to EPA's request, the potential impacts from ice formation will be further evaluated. To perform this evaluation, information related to the number of freezing days in the Silver Lake area was obtained as further discussed below.

2.3.2.1.1 Bank/Sediment Bed Slope

A bathymetric map was prepared for Silver Lake using a small vessel-mounted Differential Global Positioning System (DGPS) with fathometer and laptop computer, supplemented with conventional topographic survey techniques applied in the shallow shoreline areas and outfalls of the lake. A description of these activities and results of the survey are presented in Section 2.3.3.1.

The bank/sediment bed slope was obtained (using the bathymetric map), in conjunction with other input parameters, and will be used to verify or modify the conceptual design related to the extent, thickness, and size of armor stone needed to prevent erosion of the isolation layer due to wind-induced wave action. Proper design of the armor layer at the stormwater outfalls is also necessary to prevent scour of the isolation layer and underlying sediments due to surface water discharge to/from the lake.

2.3.2.1.2 Wind Speed and Direction

Prior to data/analysis collection, a site visit was conducted on May 20, 2003 by the design engineer to document existing shoreline conditions, as well as to note existing topography and fetch patterns. Wind speed and direction information was then obtained from several sources including: Albany County Airport (NY), Hartford Bradley International Airport (CT), and the GE weather station (located at the East Street Area 2 site at the GE facility). The National Oceanic Atmospheric Administration (NOAA) website (under the National Climatic Data Center, Data Inventories) provides 19 years of "fastest mile peak daily wind speed" that is the fastest speed (in miles per hour) at which wind travels 1 mile measured during a 24-hour period data for both the Albany County Airport and the Hartford Bradley International Airport from 1965 to 1983. Additional data was also obtained from the GE weather station from the period of September 2001 to May 2003.

2.3.2.1.3 Outfall Scour

Discharge data were collected to develop the design for scour protection at the outfall pipes that discharge into Silver Lake during peak discharge periods. For the purposes of pre-design investigation activities, a peak discharge period was defined to be an event with more than 0.25-inches of rainfall over a three-hour duration. It was initially planned that 11 outfalls would be monitored for high flow events. However, based on a site visit by the field engineer, three outfalls (outfalls F, G, H) were noted as no longer existing. It was also determined during the monitoring that only outfalls A, B, D, E, and 004 had measurable discharge. Note that location C is the lake outlet to the Housatonic River. Figure 2 depicts the outfall locations.

Data collection (relative to high flow monitoring) was conducted on July 22, 2003 by a two-person field crew using a hand-held velocimeter. Measurements were conducted throughout the discharge period, and consisted of four measurements at each outfall location during the storm event. The field technicians noted the discharge velocity and water depth in the pipe. A desk-top high flow analysis was also conducted based on pipe hydraulics and the resulting outfall discharge rates were predicted.

Additionally, BBL on behalf of GE, met with the City of Pittsfield's engineer (Public Works and Utilities, City of Pittsfield) to discuss obtaining historical storm water discharge records for city drains that flow into Silver Lake. It was indicated that historical discharge records do not exist for Silver Lake. However, plan sheets and profiles of the storm water system in the vicinity of the lake were obtained.

2.3.2.1.4 Ice Formation

To further evaluate potential impacts due to ice formation, weather information was obtained from Albany County Airport between the years of 1984 to 2003 to estimate the number of freezing days in the Silver Lake area. This data will be used during design in conjunction with standard technical guidance (such as U. S. Army Corps of Engineers' *Ice Action on Riprap* (USACE 1996); and U. S. Army Corps of Engineers' *Ice Engineering* (USACE 2002)) to evaluate the effects of ice formation.

2.3.2.2 Summary of Available Data

2.3.2.2.1 Wind Speed and Direction

The wind speed data used to develop the conceptual design for the shoreline armor layer at Silver Lake was previously obtained from the *Ambient Air Monitoring for PCB Study* (Zorex, 1992). During this study, wind speed and direction were periodically recorded over a two-year period at an on-site weather station located at the East Street Area 2 Site at the GE facility. Additional data was obtained from the GE weather station from September 2001 to May 2003 and from the Albany and Connecticut airports from 1965 to 1983.

The maximum sustained wind speed data from the GE weather station for the period of September 2001 to May 2003 was 25 mph in the northwest direction. However, data from the nearest weather station, Albany County Airport, shows a maximum wind speed of 57 mph, while the Hartford/Bradley International Airport shows a maximum wind speed of 64 mph (from 1965 to 1983). Since the higher maximum wind speeds were obtained from the airport data and these databases provide 18 years of record, these data sources will be used to calculate maximum wave height.

As a result, to evaluate the wind conditions within the Pittsfield area, an analysis of digital wind records from Albany County Airport and Hartford/Bradley International Airport was performed. The data shown in Tables 16 and 17 provides an annual summary of the extreme wind speeds (defined as the highest recorded wind speeds of sufficient duration to travel one mile during the daylong recording period) for each location. For example, a wind speed of 50 miles per hour would require a duration of 72 seconds to travel a distance of one mile. A wind rose was created for both airports as shown on Figures 28A and 28B. A comparison of records from the two airports indicates that the predominant wind directions are from the northwest and the south, with maximum wind speeds of 57 mph (for Albany County Airport) and 64 mph (for Hartford/Bradley International Airport).

To determine the return frequency of various extreme wind events, an extremal analysis of the data set was also performed based on a Gumbel distribution. This technique required a curve-fit of the statistical distributions derived from the annual extreme wind speed information. Distributions were developed for the 5-, 10-, 15-, 25-, 50- and 100-year return periods in each of the primary wind directions for (N, NE, E, SE, S, SW, W, and NW). The results of this analysis are presented in Tables 18 and 19. Since the primary purpose for developing wind conditions is to assess the local wave climate, fastest mile wind speed was converted to one-hour wind speed for input to the U.S. Army Corps of Engineers Automated Coastal Engineering System (ACES). These revised extremal wind conditions are shown in Tables 20 and 21.

This information will be used to design the shoreline protection system based on wind impacts.

2.3.2.2.2 Ice Formation

Using the data obtained from Albany County Airport, cumulative freezing-degree days (i.e., days where the mean average temperature was 32 degrees F or below) were determined for the period of record and presented in Table 22. This information will be used during design to determine the ice impacts and any necessary mitigation.

2.3.2.2.3 Outfall Scour

The maximum discharge velocities obtained from the July 22, 2003 high flow monitoring event are summarized below. Outfall locations are illustrated on Figure 2.

Outfall ID	Maximum Outfall Velocity (ft/s)
A	6.3
B	0.03
E	0.01
D	0.06
004	0.08

A more detailed summary of each outfall measurement is provided in Table 23. This table includes the time of recording, date of recording, type of culvert, and measured water depth and velocity.

To supplement the high-flow field data, desk-top calculations were performed using the Manning equation to determine to the maximum velocity (V_{max}) that may occur based on the size of the pipe as follows:

$$V = \frac{k}{n} R^{\frac{2}{3}} \sqrt{S}$$ Manning Equation

$$R = \frac{A}{P}$$ Hydraulic Radius

$$P = \frac{qd}{2}$$ Wetted Perimeter

where: k = Dimensionless number of 1.49 for English Units
n = Manning Coefficient (0.13 for concrete pipe, 0.022 for corrugated metal)
R = Hydraulic radius of flow cross section
S = Slope of channel bottom
P = Wetted Perimeter
V = Average velocity of the water
y = Water depth
q = Angle representing how full the culvert is in radians
d = Culvert diameter
[Note: V_{max} occurs when y/d=0.81 (FHA, 1998)]

The results of these calculations are summarized in the following table:

Maximum Calculated Velocities for Outfalls

Outfall ID**	Pipe Diameter (inches)	Water Depth (ft)	Channel Slope (ft/ft)	Wetted Perimeter (ft)	Pipe Area (ft^2)	Hydraulic Radius (ft)	Pipe Slope (ft/ft)	Manning Coefficient	Outfall Velocity (ft/s)
A	42	2.8	0.0129	7.8	9.38	1.21	0.0129	0.013	14.8
B, E	16	1.1	0.0125*	3.1	1.36	0.44	0.0125	0.022	4.4
D	10	0.7	0.0125	1.9	0.53	0.28	0.0125	0.014	5.1
004	20	1.4	0.0125*	3.9	2.18	0.56	0.0125	0.012	9.5

* Assumed Pipe Slope
** Pipe A is concrete, Pipes B and E are corrugated metal, Pipe D is terracotta and Pipe 004 is steel.

The calculated outfall velocity data presented above are greater than the maximum velocities measured during the July 22, 2003 high-flow measurement event and, as a result, these calculated velocities will be used during design for scour protection.

Scour protection for these outfalls will be designed once additional details are known (i.e. size of pipe to be used, exact drainage area, and type of pipe that will be used). Additionally, during recent discussions with EPA it was noted that the City intends to relocate/modify one or more stormwater outfalls discharging to Silver Lake which may affect the design of the outfall scour protection.

2.3.2.3 Assessment of Potential Data Needs

Concerning wind data, there are no further data needs to aid in the armor stone design. Data collected during the pre-design investigation will be used to develop statistical relationships between wind speed and wave heights, and in turn will be used to verify the design for the shore protection system.

With respect to the evaluation of potential ice impacts, ice formation potential and historical trends will be discussed with the city engineer and other local personnel.

Theoretical maximum outfall discharge velocities have been determined and this information will be used for armor stone design. Additional data needs related to the outfalls include surveying of invert entrance (where possible) to verify the slope of the pipe for calculating the theoretical maximum outfall discharge velocities. Also, the city engineer will be contacted to better understand the relocation of the city storm drains or obtain available design drawings.

2.3.3 Cap Constructability Design Considerations

The Performance Standards for sediments established in the SOW require that GE achieve the final design cap thickness over the entire bottom of the lake. To design a cap configuration and identify cap placement techniques that will achieve this Performance Standard, the PDI Work Plan proposed characterization of the current bathymetry and geotechnical characteristics of the Silver Lake sediments. An accurate bathymetric map of the lake bottom was an important component of the Silver Lake cap design. The bathymetric base map was also used to help locate sample locations for geotechnical testing and will be used to complete the armor layer design, determine cap material volumes, monitor cap thickness both during and following placement, identify obstructions that may interfere with certain cap materials (i.e., geotextiles), modify/design the tie-ins for outfalls to Silver Lake, and help develop/assess various cap placement techniques. A thorough understanding of the geotechnical characteristics of the existing Silver Lake sediments is also necessary for the cap design. In areas of Silver Lake where the slopes are steep or the surficial sediments are loosely consolidated, additions or modifications to the isolation layer design may be necessary (e.g., the use of geotextile, addition of more isolation layer material). The geotechnical characteristics of the existing bottom sediments are also important when assessing/selecting appropriate cap placement techniques throughout the lake.

Details pertaining to the pre-design investigation activities performed related to bathymetry and geotechnical characteristics are further discussed below.

2.3.3.1 Lake Bottom Surface Profiling

2.3.3.1.1 Summary of Pre-Design Investigation Activities

As mentioned above, a bathymetric map was prepared for Silver Lake using a small vessel-mounted DGPS with fathometer and laptop computer, supplemented with conventional topographic survey techniques applied in the shallow shoreline areas and outfalls of the lake.

The survey was conducted by a qualified contractor along 34 north-to-south, bank-to-bank transects across the lake and 7 east-to-west transects at each end of the lake. Perpendicular tie lines were also included as required to maintain accuracy. Transects were spaced at approximately 50-feet intervals. To maintain horizontal and vertical control for this work, the onboard DGPS receives signal corrections from a shore-based unit (accuracy typically less than 0.5 meters).

The horizontal positioning data was transmitted in real time to a shoreline-based tracking system that is capable of displaying significant features such as target transects for data collection, and the position of the signal in relation to those features. This enabled the helmsman to maneuver the signal vessel to follow each transect laterally across the lake, and collect water-depth data using a digital depth sounder, or equivalent system. The water-depth data was used to calculate an elevation of the lakebed. These elevations are referenced to the site datum.

For the shallow shoreline areas and outfalls of the lake, which are inaccessible by the survey vessel, conventional topographic survey methods were employed and combined with the data collected from the survey vessel to make a complete bathymetric map.

Additionally, a side-scan sonar survey was conducted by obtaining sonar imagery along longitudinal survey lines parallel to the long-side of the lake (i.e., east-to-west). A sufficient number of survey lines were added so that bank-to-bank coverage was obtained. The surveys were conducted using a high-resolution side-scan sonar system or equivalent. The data was processed and interpreted to graphically represent the physical characteristics of the lakebed (e.g., remnant structures/obstructions, type of sediment, etc.). The side-scan sonar data was compiled to generate a mosaic of the lake bottom in order to identify specific features that need to be considered during the design phase.

2.3.3.1.2 Assessment of Existing Data

The bathymetric map is shown on Figure 29. Information from this figure will be used for design as well as construction of the cap. The side-scan sonar data and identified targets are shown on Figure 30. As shown on Figure 29, several remnant structures were identified that may be present on the bottom of Silver Lake.

2.3.3.1.3 Assessment of Potential Data Needs

Based upon compilation and review of the data that has been collected, it has been determined that the existing data needs related to lake bottom surface profiling have been fulfilled and there are no further data needs at this time. During design, consideration will be given to the potential for remnant structures to interfere or alter the cap design and placement activities.

2.3.3.2 Geotechnical Lake Bottom Properties

2.3.3.2.1 Summary of Pre-Design Investigation Activities

The pre-design geotechnical investigation activities were performed between July 21 and August 6, 2003. The investigation involved: collecting sub-aqueous strata (sediment and soil) samples at 25 locations within Silver Lake, gathering visual observations and conducting in-situ geotechnical testing during the sampling event and subsequent laboratory testing at an off-site facility. The purpose of this investigation was to further characterize the sub-aqueous strata including compiling geotechnical engineering properties to understand potential strata behavior in response to various remedial activities (cap configurations).

According to the bathymetric survey, the sub-aqueous surface generally slopes down at a 10 percent grade for 15 to 25 vertical feet and then levels off. Sampling was conducted in representative areas of the lake including near shore, side slope and central areas. The sub-aqueous strata profile was observed by advancing split-spoon samplers and Shelby tubes in 25 locations generally to a depth of 14 feet, two locations were advanced to a depth of 28 and 32 feet. Geotechnical sample locations and bathymetric information is presented on Figure 31.

Each core was visually characterized throughout the recovered core length using the Unified Soil Classification System (USCS). Cores were segmented into discrete depth increments for geotechnical testing. Geotechnical testing of sub-aqueous strata included: Standard Penetration Testing (SPT), Torvane, and Pocket Penetrometer testing (conducted in the field) and an array of laboratory testing including: permeability, wash sieve, hydrometer, Atterberg limits, moisture content, Shelby tube unit weight, specific gravity, loss on ignition, one dimensional consolidation and unconsolidated undrained triaxial shear.

The geotechnical testing program was similar to that described in the PDI Work Plan, with the addition of more detailed testing of the sediment materials (i.e., permeability, Torvane, and Pocket Penetrometer testing). These tests were included to gather additional information so that more accurate flux and strength parameters could be assessed. In addition, sampling was conducted to depths greater than originally anticipated. Relatively soft sediments were encountered to depths greater than expected, as such, sampling depths were increased to account for these conditions.

2.3.3.2.2 Summary of Available Data

Results of the sampling indicate that the sub-aqueous stratum is variable but can be generalized into three layers. From the sub-aqueous surface down, layer 1 consists of 0 to 6 feet of soft silt (sediment), layer 2 consists of 2 to 26 feet of soft silt and marl, and layer 3 consists of 26 to 32 feet of sand and silt. Additionally, a fine-to-coarse sand with gravel was identified from 0 to 6 feet below the sub-aqueous surface along a portion of the northern shoreline (borings SLGT03-08, SLGT03-09, and SLGT03-10).

The surface layer (layer 1) was characterized as soft black silt identified as having a sludge-like consistency. Field and laboratory results indicate that the majority of this layer consists of MH soils, which are inorganic silts with fine sand having a high plasticity. The intermediate layer (layer 2) was characterized as soft silt and marl of an olive or brown color. Field and laboratory results indicate that this layer consists of ML and MH soils, which are inorganic silts with fine sand having a low to high plasticity. The bottom layer (layer 3) was characterized as sand and silt, and was identified in the two locations in which sampling were conducted below 14 feet. Field and laboratory results indicate that this layer can be represented as SM soils which are sand silt mixes.

Representative geotechnical engineering values have been derived from the field and laboratory test results and from guidance from geotechnical literature. For purposes of design, the three generalized sub-aqueous strata layers will be represented with the engineering properties presented in the Table below. The complete geotechnical program results are presented in Table 24. Complete grain size analysis results are included in Appendix D.

Representative Geotechnical/Engineering Properties

Geotechnical Parameter	Layer 1	Layer 2	Layer 3
USCS Classification	MH	ML/MH	SM
Liquid Limit	69	220	--
Plastic Limit	59	100	--
Organic Content	16%	23%	5%
Moisture Content	120%	300%	40%
Dry Unit Weight	35 pcf	20 pcf	110 pcf
Shear Strength	40 psf	55 psf	500 psf
Permeability	1E-06 cm/s	6E-09 cm/s	5E-05 cm/s
Compression Index	1.5	5.0	0.05
Specific Gravity	2.35	2.37	2.74
SPT	0	0	12

Geotechnical engineering properties described in the table above will be used to relate indexing and potential behavior of the three strata layers. These properties relate to index, strength, compressibility, behavior during shear, and permeability of the three strata layers. A general description of these properties and testing results are presented below.

- Index of the strata is determined by USCS classification, organic content, liquid limits and plastic limits. Specific indexing of each layer has previously been discussed.

- Strength of the strata is determined by shear strength and SPT results. Generally the three layers have relatively low strength characteristics for their respective classifications.

- Compressibility of the strata is determined by the compressibility index, specific gravity, moisture content and unit weight results. These properties will be used to model consolidation of the strata as the result of various capping scenarios. Due to relatively high compressibility indices of layer 1 and 2, consolidation is anticipated to be somewhat high.

- Strata behavior in shear failure is determined by a relationship between liquid limit, plastic limit and moisture content results. During shear failure, layer 1 is expected to act as a viscous liquid, layer 2 is expected to act as a somewhat viscous liquid and layer 3 is subject to act as typical sand.

- Permeability properties are used for flux calculations and also used to gauge time-rate consolidation. Layer 1 generally exhibit characteristics of a low permeability silt, while layer 2 exhibits characteristics of impervious clay and Layer 3 generally exhibit characteristics of pervious sand.

2.3.3.2.3 Assessment of Potential Data Needs

The geotechnical testing activities have provided a significant amount of information that will be used for design of the capping system and the collection of additional pre-design geotechnical data is not believed necessary. The sub-aqueous strata exhibited characteristics of low shear-strength (40 to 50 psf) and high compression index (1.5 to 5). In order to further evaluate available cap placement techniques and potential stresses on the lake bottom, a pilot study is proposed as discussed in Section 3.

2.4 Pre-Design Bank Habitat Investigations

The PDI Work Plan additionally proposed conducting a riparian habitat assessment of the banks to document the current vegetative community and potential wildlife usage adjacent to Silver Lake. The objective of the bank habitat characterization was to determine the existing functions and wildlife value of the shoreline areas, and to document existing habitats for restoration and/or enhancement purposes. The performance standards and other requirements for natural resource restoration/enhancement are set forth in detail in Attachment I to the SOW. For this assessment, the riparian habitat of Silver Lake was considered as the vegetative community covering the lake's bank slope from the edge of the water to the crest of the slope.

The bank habitat investigation activities are further discussed below.

2.4.1 Summary of Pre-Design Investigation Activities

To document the existing vegetative communities and potential wildlife usage of habitats adjacent to Silver Lake, bank habitat characterization activities were performed on June 3, 2003 along the shoreline of Silver Lake. Random sample plots were selected along the shoreline at approximately equal distances around the perimeter of the lake to establish plots that were representative of the existing communities. A total of 11 sample plots were inventoried along the shoreline, as depicted on Figure 32. One-square-meter sample plots were used at locations containing only herbaceous vegetation (i.e., no mature trees or shrubs). For locations containing herbaceous vegetation and mature trees and/or shrubs, a line transect of random length was run along the top of the bank, and vegetation between this transect and the edge of water was inventoried. Trees and shrubs were enumerated (i.e., stem counts) and a visual estimate of groundcover (i.e., herbaceous vegetation) was determined within each sample plot. Total percent groundcover was determined for each sample plot and relative percent cover of dominant herbaceous species was determined as a percentage of total cover. Potential wildlife usage was evaluated through direct observations of wildlife and wildlife signs (e.g., tracks, dens, nests, scat, if any), as well as knowledge of habitat requirements for wildlife species typical for the area.

2.4.2 Summary of Available Data

The banks of Silver Lake are generally narrow and range in width from approximately 5 to 25 feet. The majority of the shoreline transitions from aquatic and semi-aquatic vegetation near the edge of water to upland vegetation along the higher bank elevations. Ten of the 11 sample plots have been classified as transitional shoreline areas (i.e., mixture of aquatic, semi-aquatic, and upland habitats), with the remaining sample plot (Plot #9) classified as shallow emergent marsh. There are three relatively small wetland areas along the lake shoreline: the westernmost end of the lake (adjacent to Plot #2); the northernmost point of the lake near an inlet (between Plots #6 and #7); and the southeast corner of the lake (adjacent to Plot #9).

Table 25 shows results of the vegetation survey and lists the dominant species present within each sample plot. Vegetation within these sample plots was generally similar and consisted of emergent aquatic vegetation (e.g., purple loosestrife, bulrush) along the water's edge, which transitioned into semi-aquatic vegetation (e.g., horsetail) and upland vegetation (e.g., bitter cress) with increasing bank elevation. A majority of these sample plots were characterized by the presence of shrubs (e.g., tartarian honeysuckle, red-osier dogwood) and mature trees (e.g., sugar maple, American elm, basswood) with fairly dense canopies. Shrub and tree density differed slightly within these plots, as indicated by the stem count data presented in Table 25. Herbaceous vegetation along the upper bank elevations is generally characteristic of that found in successional old-field habitats.

Silver Lake is located within the City of Pittsfield, and surrounding land use can be characterized as industrial to the east and north, and commercial/residential to the south and west. The entire lake is surrounded by urban landscapes, possibly limiting the extent to which Silver Lake is used by local fauna. During field activities for the bank habitat characterization several wildlife species were observed including; Canada geese, a kingfisher, and various songbirds (e.g., grackle, sparrow, cowbird). No other observations of wildlife use (e.g., dens, tracks, nests, scat) were noted during these field activities.

The most likely wildlife use of Silver Lake (including the shoreline) is by granivorous, insectivorous, and frugivorous birds that may use the mature trees surrounding the lake for foraging, perching, nesting, and/or cover. Silver Lake is not likely used on a regular basis by wading piscivorous birds (e.g., herons) or semi-aquatic mammals (e.g., raccoon) due to surrounding land use and adjacent human activity. Additionally, the presence of roadways surrounding the lake may also serve as a travel barrier to local fauna, especially terrestrial wildlife.

2.4.3 Assessment of Potential Data Needs

Based on review of the Performance Standards set for in Attachment I to the SOW, additional pre-design investigations related to the natural resource restoration/enhancement activities do not appear necessary. As a result, additional pre-design investigations are not proposed at this time.

2.5 Supplemental USEPA Data Collection

EPA collected additional sediment samples at seven locations during August of 2003, during the piezometer installation for GE's pre-design investigation activities. The seven sediment locations are shown on Figure 33. The EPA samples represented sediments from the 0 to 0.5 ft (0 to 15cm) interval. These samples were analyzed for PCB, total petroleum hydrocarbon (TPH), and Appendix IX semi-volatile organic carbons and metals. Results are presented in a table provided by EPA, and included as Table 26 of this report.

Sediment PCB concentrations ranged from 36 to 910 mg/kg with an average of 210 mg/kg. Sediment TPH concentrations ranged from 1,220 to 77,400 mg/kg with an average of 16,300 mg/kg. As shown in Table 26, various Appendix IX semi-volatile organic carbons and metals were also detected, however, these were observed to be within the range of historical sample results (historical data presented in PDI Work Plan).

In recent discussions with EPA, EPA raised concern over the potential for increased PCB flux as a result of the presence of elevated TPH. As a result, the TPH data were compared to the results of the pore water characterization to determine whether the higher PCB pore water concentrations were associated with areas of higher TPH concentrations. Figure 33 provides an overlay of the TPH sample locations and results along with the pore water sample locations. Using this overlay, and comparing the TPH results to the pore water results, it appears that pore water samples from areas of higher TPH concentrations do not have corresponding higher pore water DOC and PCB concentrations. In fact, when comparing the highest TPH results to the closest sediment/pore water sampling locations, the pore water PCB concentrations are generally less than anticipated based on the conceptual cap modeling evaluation. Specifically, all of the pore water samples where the model over-predicted the observed pore water concentration (i.e., the sampling locations which plot approximately an order of magnitude off the 1 to 1 line in Figure 10) were located near the EPA sample locations with the highest TPH results.

In summary, it appears that the presence of TPH in the sediments does not increase the potential PCB flux from the sediments (and may actually serve to reduce PCB flux). However, additional evaluations related to the presence of TPH and its effect on the cap is proposed as discussed in Section 3.

3. Proposed Supplemental Pre-Design Activities and Schedule

As described in Section 2, pre-design investigation activities identified in the PDI Work Plan have been performed. These activities have fulfilled many of the data needs for design of the Silver Lake capping system. However, certain additional data needs have been identified to further support design activities as well as to evaluate potential cap placement methods. These activities include additional specific investigation activities as well as the performance of a pilot study to evaluate cap placement methods. In summary, the following additional activities (with an approximate schedule for performance and cross-references to the section where these additional activities were initially discussed) have been identified:

- perform one or more additional complete rounds of water levels to further assess hydraulic gradient conditions and groundwater seepage rates (spring 2004) (Section 2.3.1.3.3);
- discuss ice formation potential and historical trends with the city engineer and other local personnel (winter/spring 2004) (Section 2.3.2.3);
- survey invert entrance (where possible) so that the slope of the pipe can be verified for calculating the theoretical maximum outfall discharge velocities (summer 2004) (Section 2.3.2.3);
- contact the city engineer to better understand the relocation of the city storm drains (spring 2004) (Section 2.3.2.3);
- design and implement a pilot study to evaluate different sediment placement techniques and to field test sub-aqueous sediment behavior in response to cap placement (Section 2.3.3.2.3); and
- collect additional data related to the presence of TPH and its potential effects on the cap before and during implementation of the pilot study (Section 2.5).

Several of the above activities are continuations of the pre-design investigation activities that have been implemented and as such, their performance will be coordinated and scheduled with EPA approximately 2 weeks prior to their implementation. However, two of the above activities are related to the performance of a field-scale pilot study. Details of the pilot study are currently being developed, however; it is anticipated that the pilot study will generally consist of a program that will evaluate various cap placement methods both with and without the use of a geotextile, placement of cap materials in both side-slope and flat-bottom areas, and evaluation of pore pressure dissipation, consolidation, strength, slope stability, and TPH presence and effects. For these activities GE proposes developing a Work Plan for EPA approval that more fully describes the identified data needs and proposes the pilot study to gain a better understanding of certain design parameters needed to support RD/RA activities. It is anticipated that this Work Plan will be provided to EPA no later than 3 months following EPA approval of this report. The Work Plan describing the proposed investigation will include a schedule for implementation of the pilot study. Within 6 months of completion of the pilot study, if it is concluded that the available data are sufficient to support RD/RA activities for sediments, a Conceptual RD/RA Work Plan (that incorporate the results of the pilot study) will be submitted to EPA for approval.

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Tables

BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

TABLE 1
PCB SEDIMENT SAMPLING RESULTS

PRE-DESIGN INVESTIGATION FOR THE SILVER LAKE AREA
GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS
(Results are presented in dry weight milligrams per kilogram, mg/kg)

Sample ID	Depth(Feet)	Date Collected	Aroclor-1016	Aroclor-1221	Aroclor-1232	Aroclor-1242	Aroclor-1248	Aroclor-1254	Aroclor-1260	Total PCBs
N02(03)-01	0-1	4/29/2003	ND(18) [ND(5.8)]	ND(18)* [ND(5.8)]*	ND(18) [ND(5.8)]	ND(18) [ND(5.8)]	ND(18)* [ND(5.8)]*	470 AFJ [210 AFJ]	79 AGJ [44 AGJ]	549J [254J]
	1-3	4/29/2003	ND(6.0)	ND(6.0)*	ND(6.0)	ND(6.0)	ND(6.0)*	78 AF	25 AG	103
N02(03)-02	0-1	4/29/2003	ND(20)	ND(20)*	ND(20)	ND(20)	ND(20)*	540 AF	85 AG	625
	1-3	4/29/2003	ND(720)	ND(720)	ND(720)	ND(720)	ND(720)*	17000 AF	ND(720)	17000
N02(03)-03	0-1	4/29/2003	ND(7.5)	ND(7.5)*	ND(7.5)	ND(7.5)	ND(7.5)*	ND(7.5)	51 AG	51
	1-3	4/29/2003	ND(13)	ND(13)*	ND(13)	ND(13)	ND(13)*	ND(13)	150 AG	150
N02(03)-04	0-1	4/29/2003	ND(16)	ND(16)	ND(16)	ND(16)	ND(16)*	330 AF	190 AG	520
	1-3	4/29/2003	ND(860)	ND(860)	ND(860)	ND(860)	ND(860)*	36000 AF	ND(860)	36000
N02(03)-05	0-1	4/29/2003	ND(21)	ND(21)	ND(21)	ND(21)	ND(21)*	330 AF	170 AG	500
	1-3	4/29/2003	ND(960)	ND(960)	ND(960)	ND(960)	ND(960)*	21000 AF	ND(960)	2100
N02(03)-06	0-1	4/29/2003	ND(6.3)	ND(6.3)*	ND(6.3)	ND(6.3)	ND(6.3)*	150 AF	47 AG	197
	1-3	4/29/2003	ND(11)	ND(11)*	ND(11)	ND(11)	ND(11)*	300 AF	60 AG	360
N02(03)-07	0-1	4/29/2003	ND(16)	ND(16)*	ND(16)	ND(16)	ND(16)*	ND(16)	210 AG	210
	1-3	4/29/2003	ND(870)	ND(870)	ND(870)	ND(870)	ND(870)*	22000 AF	ND(870)	22000
N02(03)-08	0-1	4/29/2003	ND(6.5)	ND(6.5)*	ND(6.5)	ND(6.5)	ND(6.5)*	49 AF	23 AG	72
	1-3	4/29/2003	ND(200)	ND(200)	ND(200)	ND(200)	ND(200)*	5200 AF	1100 AG	6300

Notes:
1. Samples were collected by Blasland, Bouck & Lee, Inc. and submitted to Northeast Analytical Services, Inc. for analysis of PCBs.
2. ND - Analyte was not detected. The number in parentheses is the associated detection limit.
3. Field duplicate sample results are presented in brackets.
4. AF - Aroclor 1254 is being reported as the best Aroclor match. The sample exhibits an altered PCB pattern.
5. AG - Aroclor 1260 is being reported as the best Aroclor match. The sample exhibits an altered PCB pattern.

J - Analyte was positively identified but the associated numerical value is an estimated concentration only.

* Individual Aroclor-1221 and Aroclor-1248 results reported by the laboratory were qualified as non-detect as the data validation indicated that the sample data did not match aroclor patterns that were established through the analysis of target aroclor standards. .

TABLE 2
BENTHIC COMMUNITY SAMPLE RESULTS

PRE-DESIGN INVESTIGATION REPORT FOR SILVER LAKE SEDIMENTS
GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS

	Sample (mg/sample)											
Taxa	SL-BIO-01	SL-BIO-02	SL-BIO-03	SL-BIO-04	SL-BIO-05	SL-BIO-06	SL-BIO-07	SL-BIO-08	SL-BIO-09	SL-BIO-10	SL-BIO-11	SL-BIO-12
Diptera	17.4	2.8	1.8	129.2	26.7	65.1	3.5	0.8	3.3	13.1	2.3	81.7
Oligochaeta	27.9	19	1.9	nr	65.1	4.9	1.4	34.6	16.2	35.4	10.8	NR
Total Mass (mg/sample)	45.3	21.8	3.7	129.2	91.8	70	4.9	35.4	19.5	48.5	13.1	81.7

	Sample (count/sample)											
Taxa	SL-BIO-01	SL-BIO-02	SL-BIO-03	SL-BIO-04	SL-BIO-05	SL-BIO-06	SL-BIO-07	SL-BIO-08	SL-BIO-09	SL-BIO-10	SL-BIO-11	SL-BIO-12
Diptera	28	4	3	53	23	16	1	6	7	2	8	32
Oligochaeta	19	27	4	0	62	10	2	25	20	37	14	0
Total (count/sample)	47	31	7	53	85	26	3	31	27	39	22	32

NR- not reported.

TABLE 3
BENTHIC MACROINVERTEBRATE SURVEY WATER QUALITY DATA

PRE-DESIGN INVESTIGATION REPORT FOR SILVER LAKE SEDIMENTS
GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS

Water Quality Parameter[1]	Site / Sample Date	SLBIO-01 6/4/03	SLBIO-02 6/4/03	SLBIO-03 6/4/03	SLBIO-04 6/4/03	SLBIO-05 6/4/03	SLBIO-06 6/4/03	SLBIO-07 6/5/03	SLBIO-08 6/5/03	SLBIO-09 6/5/03	SLBIO-10 6/5/03	SLBIO-11 6/5/03	SLBIO-12 6/5/03
TEMPERATURE (°C)		17.3	16.9	16.8	5.9	17.4	16.3	16.8	16.9	10.0	11.3	16.7	5.6
CONDUCTIVITY (mS/cm)		0.523	0.522	0.523	1.35	0.530	0.532	0.529	0.522	0.626	0.624	0.520	1.52
DISSOLVED OXYGEN (mg/L)		9.65	9.85	10.2	2.6	10.6	10.9	10.4	9.56	6.4	5.92	10.3	1.47
pH		7.53	8.35	8.41	7.67	8.38	8.38	8.31	7.74	7.77	8.17	8.30	7.67
TURBIDITY (NTU)		2.8	3.8	4.7	69	2.6	5.4	3.7	5.6	39	21	6.5	50
WATER DEPTH		2.8	9.0	4.2	24.8	3.1	7.4	9.4	7.2	16.0	14.5	9.2	>25

Notes:
[1] Water quality measurements were taken with a Horiba Model U-22, within 1-meter of the bottom surface.

°C = Degrees Celsius
mS/cm = Microsiemens per centimeter
mg/L = Milligrams per liter
pH = Standard units
NTU = Nephelometric turbidity units

TABLE 4
RADIOCHEMICAL SAMPLING RESULTS

PRE-DESIGN INVESTIGATION REPORT FOR SILVER LAKE SEDIMENTS
GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS

Core ID	Depth in.	Collected	Radioactivity concentrations (pCi/g dry)	
			Be-7	Cs-137
SL-BE7-01	0 - 1	6/4/2003 10:35	< 0.841	0.479 ± 0.070
	1 - 2		< 0.688	0.598 ± 0.115
	2 - 3		< 0.755	0.234 ± 0.106
	3 - 4		< 0.400	< 0.085
	4 - 5		< 0.700	< 0.072
	5 - 6		< 0.587	< 0.057
SL-BE7-02	0 - 1	6/4/2003 11:10	< 0.833	2.070 ± 0.106
	1 - 2		< 0.566	1.217 ± 0.098
	2 - 3		< 0.850	0.422 ± 0.089
	3 - 4		< 0.565	< 0.072
	4 - 5		< 0.624	< 0.062
	5 - 6		< 0.686	
SL-BE7-03	0 - 1	6/4/2003 11:45	< 0.764	1.264 ± 0.129
	1 - 2		< 0.737	1.025 ± 0.106
	2 - 3		< 0.529	0.686 ± 0.094
	3 - 4		< 0.626	0.216 ± 0.065
	4 - 5		< 0.408	0.087 ± 0.060
	5 - 6		< 0.360	0.051 ± 0.037
SL-BE7-04	0 - 1	6/4/2003 12:25	< 0.592	0.609 ± 0.086
	1 - 2		< 0.562	0.390 ± 0.083
	2 - 3		< 0.530	0.562 ± 0.069
	3 - 4		< 0.652	0.730 ± 0.098
	4 - 5		< 0.363	0.938 ± 0.065
	5 - 6		< 0.605	1.249 ± 0.090
SL-BE7-05	0 - 1	6/4/2003 14:15	1.183 ± 0.535	0.163 ± 0.050
	1 - 2		< 0.527	0.225 ± 0.074
	2 - 3		< 0.582	0.310 ± 0.063
	3 - 4		< 0.366	1.084 ± 0.068
	4 - 5		< 0.402	1.292 ± 0.077
	5 - 6		< 0.511	1.485 ± 0.074
SL-BE7-06	0 - 1	6/4/2003 14:45	< 0.209	< 0.025
	1 - 2		< 0.181	0.144 ± 0.029
	2 - 3		< 0.355	0.159 ± 0.030
	3 - 4		< 0.313	0.549 ± 0.049
	4 - 5		< 0.232	0.584 ± 0.037
	5 - 6		< 0.370	0.681 ± 0.055

TABLE 5
SEDIMENT SAMPLE DATA - TOC AND PCBs

PRE-DESIGN INVESTIGATION FOR THE SILVER LAKE AREA
GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS
(Results are presented in dry weight milligrams per kilogram, mg/kg)

Parameter — Sample ID: / Date Collected:	SL01-0005-SD 08/05/03	SL01-0530-SD 08/05/03	SL02-0005-SD 08/05/03	SL02-0530-SD 08/05/03	SL03-0005-SD 08/05/03	SL03-0530-SD 08/05/03	SL04-0005-SD 08/05/03	SL04-0530-SD 08/05/03	SL05-0005-SD 08/05/03	SL05-0530-SD 08/05/03
PCBs										
Congener Total PCBs	216	4250 [1450]	141	435	363	864	216	7240	85.9	5130
Total Organic Carbon										
TOC - Replicate 1	88000	130000 [140000]	100000	150000	2100	5300	100000	170000	83000	140000
TOC - Replicate 2	69000	130000 [140000]	80000	150000	1500	7800	100000	180000	83000	120000
TOC - Replicate 3	90000	130000 [160000]	130000	160000	10000	5600	110000	160000	86000	140000
TOC - Replicate 4	NA	NA	NA	NA	2200	NA	NA	NA	NA	NA
TOC - Average	82000	130000 [150000]	100000	150000	4100	6200	100000	170000	84000	140000
TOC - % RSD	14	2.2 [6.8]	23	5.4	100	22	4.7	5.7	2.3	9.7

Parameter — Sample ID: / Date Collected:	SL06-0005-SD 08/05/03	SL06-0530-SD 08/05/03	SL07-0005-SD 08/05/03	SL07-0530-SD 08/05/03	SL08-0005-SD 08/05/03	SL08-0530-SD 08/05/03	SL09-0005-SD 08/05/03	SL09-0530-SD 08/05/03	SL10-0005-SD 08/05/03	SL10-0530-SD 08/05/03
PCBs										
Congener Total PCBs	49.7	119	10.4	12.7	36	1460	43.6	90.3	40.1	1350
Total Organic Carbon										
TOC - Replicate 1	62000	120000	60000	62000	80000	140000	85000	98000	88000	130000
TOC - Replicate 2	81000	120000	69000	44000	66000	79000	85000	80000	87000	94000
TOC - Replicate 3	77000	120000	48000	43000	74000	150000	93000	100000	80000	96000
TOC - Replicate 4	NA	NA	NA	NA	NA	110000	NA	NA	NA	NA
TOC - Average	73000	120000	59000	50000	73000	120000	88000	94000	85000	110000
TOC - % RSD	14	4.0	18	22	9.8	27	5.1	13	5.3	17

Notes:
1. Samples were collected by Blasland, Bouck & Lee, Inc., and were submitted to Northeast Analytical, Inc. for analysis of congener PCBs and total organic carbon (TOC).
2. Field duplicate sample results are presented in brackets.
3. % RSD - Percent relative standard deviation.
4. NA - Not Analyzed - TOC Replicate 4 is only analyzed and reported by laboratory when the % RSD of Replicate 1 thru Replicate 3 is greater than 25%.
5. Numbers in Sample ID represent depth at which samples were taken (i.e., "0005" represents samples taken from 0 to 5 cm below the sediment surface and "0530" represents samples taken from 5 to 30 cm below the sediment surface).

TABLE 6
PORE WATER DATA SUMMARY - DOC AND PCBs

PRE-DESIGN INVESTIGATION FOR THE SILVER LAKE AREA
GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS
(Results are presented in milligrams per liter, mg/L)

Sample ID	Date Collected	Matrix	Dissolved Organic Carbon	Congener Total PCBs
SL01-0530-PW	8/5/2003	Pore Water	27.2	0.0971
SL02-0530-PW	8/5/2003	Pore Water	38.6	0.00399
SL03-0530-PW	8/5/2003	Pore Water	24.2	0.149
SL04-0530-PW	8/5/2003	Pore Water	20.2	0.147 [0.142]
SL05-0530-PW	8/5/2003	Pore Water	31.7	0.0404
SL06-0530-PW	8/5/2003	Pore Water	18.4	0.00253
SL07-0530-PW	8/5/2003	Pore Water	36.2	0.00115
SL08-0530-PW	8/5/2003	Pore Water	18.1	0.0351
SL09-0530-PW	8/5/2003	Pore Water	21.2	0.0113
SL10-0530-PW	8/5/2003	Pore Water	17.9 [19.1]	0.0551

Notes:
1. Samples were collected by Blasland, Bouck & Lee, Inc., and were submitted to Northeast Analytical, Inc. for analysis of congener PCBs and dissolved organic carbon.
2. Field duplicate sample results are presented in brackets.
3. Numbers in Sample ID represent depth at which samples were taken (i.e., "0530" represents samples taken from 5 to 30 cm below the sediment surface).

TABLE 7
SBLT DATA SUMMARY - DOC AND PCBs

PRE-DESIGN INVESTIGATION FOR THE SILVER LAKE AREA
GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS
(Results are presented in milligrams per liter, mg/L)

Sample ID	Date Collected	Matrix	Dissolved Organic Carbon	Congener Total PCBs
SL02-0530-LI	8/8/2003	Leachate	42.6	0.00737 [0.00664]
SL02-0530-L2	8/11/2003	Leachate	31.8 [40.4]	0.00387
SL02-0530-L3	8/12/2003	Leachate	26.9	0.00392
SL02-0530-L4	8/13/2003	Leachate	19.1	0.00274
SL06-0530-LI	8/8/2003	Leachate	43.0	0.0109
SL06-0530-L2	8/11/2003	Leachate	39.5	0.00292
SL06-0530-L3	8/12/2003	Leachate	34.7	0.0032
SL06-0530-L4	8/13/2003	Leachate	35.4	0.00456
SL09-0530-LI	8/8/2003	Leachate	33.8	0.00312
SL09-0530-L2	8/11/2003	Leachate	32.6	0.00119
SL09-0530-L3	8/12/2003	Leachate	24.9	0.00145
SL09-0530-L4	8/13/2003	Leachate	22.5	0.00121

Notes:

1. Samples were collected by Blasland, Bouck & Lee, Inc., and were submitted to Northeast Analytical, Inc. for analysis of congener PCBs and dissolved organic carbon (DOC).
2. Field duplicate sample results are presented in brackets.
3. Numbers in Sample ID represent depth at which samples were taken (i.e., "0530" represents samples taken from 5 to 30 cm below the sediment surface).

TABLE 8
MONITORING WELL/PIEZOMETER CONSTRUCTION DATA

PRE-DESIGN INVESTIGATION REPORT FOR SILVER LAKE SEDIMENTS
GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS

Well ID	Removal Action Area	Well Diameter (inches)	Ground Elevation (Feet AMSL)	Measuring Point Elevation (Feet AMSL)	Depth to Top of Screen (feet BGS)	Screen Length (Feet)	Top of Screen Elevation (Feet AMSL)	Base of Screen Elevation (Feet AMSL)	Survey Coordinates	
									Northing	Easting
Monitoring Wells										
95-15	30s Complex	0.75	986.58	986.38	7	10	979.6	969.6	534224.8500	131091.6800
GMA1-10	30s Complex	2	985.14	984.86	5.21	15	979.9	964.9	533752.3000	131312.7000
GMA1-12	30s Complex	2	989.30	992.26	9.38	10	979.9	969.9	534218.0000	131263.1000
RF-02	30s Complex	4	983.42	982.43	3	15	980.4	965.4	533507.3000	131111.2000
RF-03	30s Complex	4	985.60	985.40	3	15	982.6	967.6	533872.3000	131153.9000
RF-03D	30s Complex	2	985.54	985.31	30.6	5	954.9	949.9	533879.3000	131154.6000
RF-16	30s Complex	4	988.15	987.91	7	15	981.2	966.2	534255.3000	130931.5300
95-17	40s Complex	0.75	1,007.61	1,007.67	20	10	987.6	977.6	534485.6100	130681.4300
E-07	Lyman Street	2	983.33	982.87	4.6	15	978.7	963.7	533185.2150	131010.8460
MW-6R	Lyman Street	2	985.47	985.14	4	10	981.5	971.5	532826.5000	130329.5000
SLGW-1S	Silver Lake	2	981.20	982.94	4	10	977.2	967.2	534100.5000	130531.1000
SLGW-1D	Silver Lake	2	981.20	983.13	30	5	951.2	946.2	534103.0000	130536.1000
SLGW-2S	Silver Lake	2	983.50	985.39	4	10	979.5	969.5	533726.6000	129785.5000
SLGW-2D	Silver Lake	2	983.60	985.10	30	5	953.6	948.6	533727.5000	129779.0000
SLGW-3S	Silver Lake	2	977.60	980.21	1.5	10	976.1	966.1	533477.6000	129331.1000
SLGW-3D	Silver Lake	2	977.20	979.14	26	5	951.2	946.2	533471.8000	129332.9000
SLGW-4S	Silver Lake	2	982.00	984.02	4	10	978.0	968.0	533117.2000	129348.3000
SLGW-4D	Silver Lake	2	981.80	983.51	30	5	951.8	946.8	533121.9000	129350.5000
SLGW-5S	Silver Lake	2	979.78	979.12	2	10	977.8	967.8	533003.7000	130023.5000
SLGW-5D	Silver Lake	2	979.64	979.30	29	5	950.6	945.6	533005.6000	130016.3000
SLGW-6S	Silver Lake	2	982.20	981.66	4	10	978.2	968.2	533308.0000	131017.3000
SLGW-6D	Silver Lake	2	982.16	981.63	30	5	952.2	947.2	533313.7000	131019.3000
Lake Piezometers										
SLPZ-1	Silver Lake	2	969.3	981.5	14.1	5.3	955.2	949.9	533987.7393	130750.9986
SLPZ-2	Silver Lake	2	965.7	982.1	15.5	5.3	950.2	944.9	533913.3040	130387.3687
SLPZ-3	Silver Lake	2	951.1	981.6	20.7	5.3	930.4	925.1	533512.4503	130214.3404
SLPZ-4	Silver Lake	2	960.7	977.6	14.6	5.3	946.1	940.8	533591.5514	129686.7372
SLPZ-5	Silver Lake	2	955.7	981.4	16.4	5.3	939.3	934.0	533321.6561	129630.2848
SLPZ-6	Silver Lake	2	956.8	980.8	24.6	5.3	932.2	926.9	533382.3868	129950.8773
SLPZ-7	Silver Lake	2	963.3	979.6	15.3	5.3	948.0	942.7	533055.2129	129869.1965
SLPZ-8	Silver Lake	2	967.2	981.2	12.5	5.3	954.7	949.4	533311.0821	130405.3679
SLPZ-9	Silver Lake	2	947.2	981.2	23.8	5.3	923.4	918.1	533603.9431	130510.7382
SLPZ-10	Silver Lake	2	970.3	981.4	15.2	5.3	955.1	949.8	533334.7510	130818.5205
Surface Water Staff Gauge										
Silver Lake Gauge	Staff Gauge	N/A	N/A		N/A	N/A	N/A	N/A		

Notes:
1) N/A : Not Applicable.

TABLE 9
HYDRAULIC CONDUCTIVITY SUMMARY

GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS
PRE-DESIGN INVESTIGATION FOR THE SILVER LAKE AREA

Well/Boring ID	Date/Depth	D_{20} Value (mm)	Hydraulic Conductivity (cm/s)	Hydraulic Conductivity (ft/min)	Hydraulic Conductivity (ft/day)
RF-4	8/16/2001		1.242E-03	2.445E-03	3.522
GMA1-3	8/15/2001	N/A	1.150E-04	2.264E-04	0.326
RF-3	8/15/2001	N/A	2.818E-02	5.549E-02	79.900
SLGW-1S	8/25/2003	N/A	3.977E-03	7.831E-03	11.276
SLGW-1D	8/25/2003	N/A	1.300E-02	2.560E-02	36.860
SLGW-2S	8/26/2003	N/A	9.662E-03	1.902E-02	27.395
SLGW-2D	8/26/2003	N/A	2.093E-03	4.121E-03	5.934
SLGW-3S	8/28/2003	N/A	1.416E-02	2.788E-02	40.149
SLGW-3D	8/28/2003	N/A	6.160E-02	1.213E-01	174.658
SLGW-4S	8/28/2003	N/A	5.409E-03	1.065E-02	15.336
SLGW-4D	8/28/2003	N/A	6.998E-02	1.378E-01	198.418
SLGW-5S	8/27/2003	N/A	N/A	N/A	N/A
SLGW-5D	8/27/2003	N/A	7.564E-04	1.489E-03	2.145
SLGW-6S	8/29/2003	N/A	1.587E-02	3.125E-02	44.997
SLGW-6D	8/29/2003	N/A	9.141E-03	1.800E-02	25.918
SLPZ-1	8/27/2003	N/A	2.006E-07	3.950E-07	0.001
SLPZ-2	8/27/2003	N/A	1.365E-06	2.688E-06	0.004
SLPZ-3	8/26/2003	N/A	9.16E-06	1.804E-05	0.026
SLPZ-4	8/26/2003	N/A	2.322E-07	4.572E-07	0.001
SLPZ-5	8/25/2003	N/A	8.801E-07	1.733E-06	0.002
SLPZ-6	8/25/2003	N/A	8.808E-07	1.734E-06	0.002
SLPZ-7	8/25/2003	N/A	7.66E-07	1.508E-06	0.002
SLPZ-8	8/28/2003	N/A	3.550E-04	6.990E-04	1.007
SLPZ-9	8/28/2003	N/A	2.265E-06	4.460E-06	0.006
SLPZ-10	8/28/2003	N/A	1.786E-06	3.517E-06	0.005
SLGT03-01	1.4-1.8	0.005	1.84E-06	3.616E-06	0.005
SLGT03-02	1.3-1.8	0.01	9.04E-06	1.781E-05	0.026
SLGT03-02	5.3-5.8	0.0095	8.04E-06	1.582E-05	0.023
SLGT03-02	10-12	0.003	5.67E-07	1.117E-06	0.002
SLGT03-02	26-28	0.0095	8.04E-06	1.582E-05	0.023
SLGT03-03	2-4	0.008	5.41E-06	1.066E-05	0.015
SLGT03-06	0-2	0.002	2.23E-07	4.395E-07	0.001
SLGT03-08	0-2	0.15	4.58E-03	9.027E-03	12.999
SLGT03-09	0.5-2.5	0.11	2.25E-03	4.423E-03	6.370
SLGT03-09	2.5-4.5	0.15	4.58E-03	9.027E-03	12.999
SLGT03-10	0-2	0.25	1.48E-02	2.923E-02	42.089
SLGT03-10	2-4	0.4	4.38E-02	8.616E-02	124.065
SLGT03-12	30-32	0.02	4.45E-05	8.768E-05	0.126
SLGT03-13	0-2	0.005	1.84E-06	3.616E-06	0.005
SLGT03-14	3.3-3.8	0.001	4.53E-08	8.924E-08	0.000
SLGT03-16	0-2	0.0065	3.36E-06	6.611E-06	0.010
SLGT03-16	5.4-5.8	0.006	2.79E-06	5.499E-06	0.008
SLGT03-17	1.4-1.8	0.0045	1.44E-06	2.838E-06	0.004
SLGT03-20	1.4-1.8	0.002	2.23E-07	4.395E-07	0.001
SLGT03-20	2-4	0.0015	1.15E-07	2.268E-07	0.000
SLGT03-23	3.4-3.8	0.004	1.10E-06	2.164E-06	0.003
SLGT03-25	1.4-1.8	0.009	7.10E-06	1.397E-05	0.020

TABLE 10
VERTICAL GRADIENT DATA FOR SELECTED MONITORING WELLS

PRE-DESIGN INVESTIGATION REPORT FOR SILVER LAKE SEDIMENTS
GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS

Date of Shallow GW Measurement	Shallow Well Name	Shallow Groundwater Elevation	Date of Deep GW Measurement	Deep Well Name	Deep Groundwater Elevation	Vertical Gradient (feet)		Approximate Location	Average Vertical Gradient (feet)	
7/8/2003	RF-03	975.78	7/8/03	RF-03D	977.61	1.830	UPWARD	East of Lake (30s Complex)	1.825	UPWARD
8/7/2003	RF-03	976.02	8/7/03	RF-03D	977.66	1.640	UPWARD			
9/2/2003	RF-03	975.89	9/2/03	RF-03D	977.89	2.000	UPWARD			
10/16/2003	RF-03	976.56	10/16/03	RF-03D	978.39	1.830	UPWARD			
6/12/2003	SLGW-1S	976.01	6/12/03	SLGW-1D	978.67	2.660	UPWARD	North of Lake (East of Center)	2.646	UPWARD
7/8/2003	SLGW-1S	975.79	7/8/03	SLGW-1D	978.39	2.600	UPWARD			
8/6/2003	SLGW-1S	976.09	8/6/03	SLGW-1D	978.35	2.260	UPWARD			
8/25/2003	SLGW-1S	975.87	8/25/03	SLGW-1D	978.70	2.830	UPWARD			
9/3/2003	SLGW-1S	976.03	9/3/03	SLGW-1D	978.60	2.570	UPWARD			
10/30/2003	SLGW-1S	976.66	10/30/03	SLGW-1D	979.31	2.650	UPWARD			
12/12/2003	SLGW-1S	976.40	12/12/03	SLGW-1D	979.35	2.950	UPWARD			
6/11/2003	SLGW-2S	977.41	6/12/03	SLGW-2D	977.80	0.390	UPWARD	North of Lake (West of Center)	0.336	UPWARD
7/8/2003	SLGW-2S	977.08	7/8/03	SLGW-2D	977.42	0.340	UPWARD			
8/6/2003	SLGW-2S	977.13	8/6/03	SLGW-2D	977.38	0.250	UPWARD			
8/26/2003	SLGW-2S	977.29	8/26/03	SLGW-2D	977.63	0.340	UPWARD			
9/3/2003	SLGW-2S	977.22	9/3/03	SLGW-2D	977.54	0.320	UPWARD			
10/30/2003	SLGW-2S	978.05	10/30/03	SLGW-2D	978.27	0.220	UPWARD			
12/12/2003	SLGW-2S	977.84	12/12/03	SLGW-2D	978.33	0.490	UPWARD			
7/8/2003	SLGW-3S	975.75	7/8/03	SLGW-3D	977.44	1.690	UPWARD	Northwest Corner of Lake	1.332	UPWARD
8/6/2003	SLGW-3S	976.10	8/6/03	SLGW-3D	975.03	-1.070	DOWNWARD			
8/28/2003	SLGW-3S	975.77	8/28/03	SLGW-3D	977.68	1.910	UPWARD			
9/3/2003	SLGW-3S	976.10	9/3/03	SLGW-3D	977.68	1.580	UPWARD			
10/30/2003	SLGW-3S	976.80	10/30/03	SLGW-3D	978.45	1.650	UPWARD			
12/12/2003	SLGW-3S	976.60	12/12/03	SLGW-3D	978.83	2.230	UPWARD			
6/12/2003	SLGW-4S	975.98	6/13/03	SLGW-4D	977.56	1.580	UPWARD	West of Lake (Esther Terrace)	1.330	UPWARD
7/11/2003	SLGW-4S	975.75	7/11/03	SLGW-4D	977.10	1.350	UPWARD			
8/6/2003	SLGW-4S	976.18	8/6/03	SLGW-4D	977.01	0.830	UPWARD			
8/28/2003	SLGW-4S	975.73	8/28/03	SLGW-4D	977.31	1.580	UPWARD			
9/3/2003	SLGW-4S	976.02	9/3/03	SLGW-4D	977.28	1.260	UPWARD			
10/30/2003	SLGW-4S	976.97	10/30/03	SLGW-4D	977.92	0.950	UPWARD			
12/12/2003	SLGW-4S	976.53	12/12/03	SLGW-4D	978.29	1.760	UPWARD			
7/8/2003	SLGW-5S	975.78	7/8/2003	SLGW-5D	975.75	-0.030	DOWNWARD	South of Lake (West of Center)	-0.027	DOWNWARD
7/16/2003	SLGW-5S	975.81	7/16/2003	SLGW-5D	975.80	-0.0100	DOWNWARD			
8/6/2003	SLGW-5S	976.01	8/6/2003	SLGW-5D	975.89	-0.120	DOWNWARD			
8/27/2003	SLGW-5S	975.72	8/27/2003	SLGW-5D	975.72	0.000	--			
9/3/2003	SLGW-5S	975.97	9/3/2003	SLGW-5D	975.94	-0.030	DOWNWARD			
10/30/2003	SLGW-5S	976.45	10/30/2003	SLGW-5D	976.48	0.030	UPWARD			
7/11/2003	SLGW-6S	975.75	7/11/2003	SLGW-6D	975.42	-0.330	DOWNWARD	Southeast Corner of Lake	-0.311	DOWNWARD
7/15/2003	SLGW-6S	975.71	7/15/2003	SLGW-6D	975.12	-0.590	DOWNWARD			
8/6/2003	SLGW-6S	976.12	8/6/2003	SLGW-6D	975.48	-0.640	DOWNWARD			
8/29/2003	SLGW-6S	976.03	8/29/2003	SLGW-6D	975.82	-0.210	DOWNWARD			
9/3/2003	SLGW-6S	976.20	9/3/2003	SLGW-6D	974.98	-1.220	DOWNWARD			
10/30/2003	SLGW-6S	977.21	10/30/2003	SLGW-6D	977.40	0.190	UPWARD			
12/12/2003	SLGW-6S	976.90	12/12/2003	SLGW-6D	977.52	0.620	UPWARD			

TABLE 10
VERTICAL GRADIENT DATA FOR SELECTED MONITORING WELLS

PRE-DESIGN INVESTIGATION REPORT FOR SILVER LAKE SEDIMENTS
GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS

Date of Lake Level Measurement	Lake Piezometer Name	Surface Water Elevation	Date of Groundwater Measurement	Lake Piezometer Name	Ground Water Elevation	Vertical Gradient (feet)		Approximate Location	Average Vertical Gradient (feet)	
8/6/2003	SLPZ-01	976.01	8/6/2003	SLPZ-01	975.80	-0.21	DOWNWARD	Northeast Corner of Lake	0.32	UPWARD
9/3/2003	SLPZ-01	976.06	9/3/2003	SLPZ-01	976.27	0.21	UPWARD			
9/8/2003	SLPZ-01	975.91	9/8/2003	SLPZ-01	976.64	0.73	UPWARD			
10/30/2003	SLPZ-01	976.70	10/30/2003	SLPZ-01	977.26	0.56	UPWARD			
8/6/2003	SLPZ-02	975.95	8/6/2003	SLPZ-02	977.74	1.79	UPWARD	lorth portion of Lake (East of Cente	1.92	UPWARD
9/3/2003	SLPZ-02	976.00	9/3/2003	SLPZ-02	977.64	1.64	UPWARD			
9/8/2003	SLPZ-02	975.80	9/8/2003	SLPZ-02	977.76	1.96	UPWARD			
10/30/2003	SLPZ-02	976.50	10/30/2003	SLPZ-02	978.80	2.30	UPWARD			
8/6/2003	SLPZ-03	975.95	8/6/2003	SLPZ-03	976.92	0.97	UPWARD	Center of Lake	1.51	UPWARD
9/3/2003	SLPZ-03	976.01	9/3/2003	SLPZ-03	977.46	1.45	UPWARD			
9/8/2003	SLPZ-03	975.84	9/8/2003	SLPZ-03	977.62	1.78	UPWARD			
10/30/2003	SLPZ-03	976.40	10/30/2003	SLPZ-03	978.25	1.85	UPWARD			
8/6/2003	SLPZ-04	975.95	8/6/2003	SLPZ-04	974.86	-1.09	DOWNWARD	orth portion of Lake (West of Cente	0.32	UPWARD
9/3/2003	SLPZ-04	975.94	9/3/2003	SLPZ-04	976.39	0.45	UPWARD			
9/8/2003	SLPZ-04	975.87	9/8/2003	SLPZ-04	976.90	1.03	UPWARD			
10/30/2003	SLPZ-04	976.40	10/30/2003	SLPZ-04	977.30	0.90	UPWARD			
8/6/2003	SLPZ-05	976.01	8/6/2003	SLPZ-05	968.99	-7.02	DOWNWARD	Western portion of Lake	-1.90	DOWNWARD
9/3/2003	SLPZ-05	975.98	9/3/2003	SLPZ-05	975.39	-0.59	DOWNWARD			
9/8/2003	SLPZ-05	975.82	9/8/2003	SLPZ-05	975.82	0.00	FLAT			
10/30/2003	SLPZ-05	976.50	10/30/2003	SLPZ-05	976.50	0.00	FLAT			
8/6/2003	SLPZ-06	975.95	8/6/2003	SLPZ-06	974.46	-1.49	DOWNWARD	West of Center of Lake	-0.22	DOWNWARD
9/3/2003	SLPZ-06	976.01	9/3/2003	SLPZ-06	975.92	-0.09	DOWNWARD			
9/8/2003	SLPZ-06	975.85	9/8/2003	SLPZ-06	976.23	0.38	UPWARD			
10/30/2003	SLPZ-06	976.40	10/30/2003	SLPZ-06	976.74	0.34	UPWARD			
8/6/2003	SLPZ-07	975.68	8/6/2003	SLPZ-07	974.94	-0.74	DOWNWARD	outh portion of Lake (West of Cente	-0.23	DOWNWARD
9/3/2003	SLPZ-07	976.00	9/3/2003	SLPZ-07	975.58	-0.42	DOWNWARD			
9/8/2003	SLPZ-07	976.04	9/8/2003	SLPZ-07	976.04	0.00	FLAT			
10/30/2003	SLPZ-07	976.50	10/30/2003	SLPZ-07	976.72	0.22	UPWARD			
8/6/2003	SLPZ-08	975.90	8/6/2003	SLPZ-08	975.59	-0.31	DOWNWARD	outh portion of Lake (East of Cente	0.29	UPWARD
9/3/2003	SLPZ-08	975.95	9/3/2003	SLPZ-08	976.13	0.18	UPWARD			
9/8/2003	SLPZ-08	975.80	9/8/2003	SLPZ-08	976.39	0.59	UPWARD			
10/30/2003	SLPZ-08	976.50	10/30/2003	SLPZ-08	977.20	0.70	UPWARD			
8/6/2003	SLPZ-09	975.89	8/6/2003	SLPZ-09	935.91	-39.98	DOWNWARD	East of Center of Lake	-2.76	DOWNWARD
9/3/2003	SLPZ-09	975.95	9/3/2003	SLPZ-09	970.14	-5.81	DOWNWARD			
9/8/2003	SLPZ-09	975.79	9/8/2003	SLPZ-09	971.65	-4.14	DOWNWARD			
10/30/2003	SLPZ-09	976.40	10/30/2003	SLPZ-09	975.82	-0.58	DOWNWARD			
8/6/2003	SLPZ-10	976.08	8/6/2003	SLPZ-10	975.59	-0.49	DOWNWARD	Southeast Corner of Lake	0.93	UPWARD
8/15/2003	SLPZ-10	976.54	8/15/2003	SLPZ-10	976.54	0.00	FLAT			
8/22/2003	SLPZ-10	975.87	8/22/2003	SLPZ-10	976.42	0.55	UPWARD			
8/28/2003	SLPZ-10	975.75	8/28/2003	SLPZ-10	976.31	0.56	UPWARD			
9/3/2003	SLPZ-10	976.14	9/3/2003	SLPZ-10	981.03	4.89	UPWARD			
9/8/2003	SLPZ-10	975.96	9/8/2003	SLPZ-10	976.47	0.51	UPWARD			
9/22/2003	SLPZ-10	975.46	9/22/2003	SLPZ-10	976.11	0.65	UPWARD			
10/30/2003	SLPZ-10	976.60	10/30/2003	SLPZ-10	977.38	0.78	UPWARD			

TABLE 11
ESTIMATED GROUNDWATER FLOW RATE INTO AND OUT OF SILVER LAKE

PRE-DESIGN INVESTIGATION REPORT FOR SILVER LAKE SEDIMENTS
GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS

Maximum Estimated Groundwater Flow into Silver Lake

K (cm/sec)	K (m/day)	i	Q ($L/m^2/day$)
1.9E-06	1.6E-03	0.123	0.20

Maximum Estimated Groundwater Flow Out of Silver Lake

K (cm/sec)	K (m/day)	i	Q ($L/m^2/day$)
1.9E-06	1.6E-03	-0.021	-0.03

Estimated Average Net Groundwater Flow Into Silver Lake

K (cm/sec)	K (m/day)	i_{avg}	Q ($L/m^2/day$)
1.9E-06	1.6E-03	0.037	0.06

Notes:

1) K value is geometric mean of slug test values from the SLPZ-series piezometers.
   - Note that this value (1.6E-3 m/day) compares well with the geometric mean of 1.1E-3 m/day calculated based on the grain size data from sub-lake soil samples using the USBR Method.
2) Vertical gradients based on head data measured at SLPZ-series piezometers on October 30, 2003 (Figure 17).
3) i = vertical hydraulic gradient (feet per foot); i_{avg} = average vertical hydraulic gradient for all SLPZ-series piezometers.
4) A negative value indicates flow out of the lake bed.

TABLE 12
SEEPAGE METER MONITORING DATA

PRE-DESIGN INVESTIGATION FOR THE SILVER LAKE AREA
GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS

Date	Reading	Time	Weight (g)	Flow Rate (L/m^2/day)	Notes:
SLA SL-SEEP-1_03219					
5/15/03	initial	10:40	812		
5/22/03	1	11:20	810	-0.001	
5/28/03	2	14:30	820	0.006	a
6/5/03	3	10:00	737	-0.041	
6/12/03	4	9:10	1148	0.227	
6/25/03	5	9:55	672	-0.140	
8/11/03	6	15:30	758	0.007	
9/22/03	7	10:42	501		d
10/30/03	8	11:15	310		d
11/12/03	9	13:50	570		g
			Time Wt. Avg.	0.00066	

Date	Reading	Time	Weight (g)	Flow Rate (L/m^2/day)	Notes:
SLA SL-SEEP-2_03219					
5/15/03	initial	12:18	907		
5/22/03	1	11:34	887	-0.011	
5/28/03	2	14:40	890	0.002	a
6/5/03	3	10:14	878	-0.006	
6/12/03	4	9:25	1092	0.118	
6/25/03	5	10:05	756	-0.099	
8/12/03	6	7:40	892	0.011	
9/22/03	7	11:00	764	-0.012	
10/30/03	8	10:15	744	-0.002	
11/12/03	9	14:30	862	0.034	
			Time Wt. Avg.	0.00021	

Date	Reading	Time	Weight (g)	Flow Rate (L/m^2/day)	Notes:
SLA SL-SEEP-3_03219					
5/15/03	initial	14:00	780		
5/22/03	1	11:50	807	0.015	
5/28/03	2	14:50	801	-0.004	a
6/5/03	3	10:28	666		b
6/12/03	4	9:31	840		c
6/25/03	5	-	-		c
8/12/03	6	7:50	860		
9/22/03	7	11:15	1426	0.053	e
10/30/03	8	10:30	274	-0.057	f
11/12/03	9	15:00	515	0.070	
			Time Wt. Avg.	0.00074	

TABLE 12
SEEPAGE METER MONITORING DATA

PRE-DESIGN INVESTIGATION FOR THE SILVER LAKE AREA
GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS

Date	Reading	Time	Weight (g)	Flow Rate (L/m²/day)	Notes:
SLA SL-SEEP-4_03219					
5/15/03	initial	15:07	988		
5/22/03	1	12:00	1006	0.010	
5/28/03	2	15:00	1020	0.009	a
6/5/03	3	10:36	1077	0.028	
6/12/03	4	9:41	1232	0.086	
6/25/03	5	10:10	868	-0.108	
8/12/03	6	8:00	1043	0.014	
9/22/03	7	11:30	765	-0.026	
10/30/03	8	10:45	446	-0.032	
11/12/03	9	15:30	988	0.158	
			Time Wt. Avg.	0.00077	

Date	Reading	Time	Weight (g)	Flow Rate (L/m²/day)	Notes:
SLA SL-SEEP-5_03219					
5/15/03	initial	15:48	1082		
5/22/03	1	12:10	1875	0.445	
5/22/03	retared	12:15	468		
5/28/03	2	15:10	446	-0.014	a
6/5/03	3	10:44	597	0.072	
6/12/03	4	9:55	672	0.041	
6/25/03	5	10:15	448	-0.066	
8/12/03	6	8:10	570	0.010	
9/22/03	7	11:40	470	-0.009	
10/30/03	8	11:00	869	0.040	
11/12/03	9	15:50	552	-0.092	
			Time Wt. Avg.	0.00235	

Notes:
(a) Small amount of gas in tubing, none in bag.
(b) Line disconnected from drum.
(c) Line disconnected from drum, valve in closed position.
(d) Upon arrival, valve detached from bag.
(e) Bag near full. Drianed and reset at 839g.
(f) Bag near empty.
(g) Reading likely inaccurate: gas vent disconnected, tubing wrapped around log.

TABLE 13
WATER BUDGET OUTFALL DISCHARGE SUMMARY

PRE-DESIGN INVESTIGATION FOR THE SILVER LAKE AREA
GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS

Outfall	Date	Time of Day	Outfall	Outfall Width (ft)	DATA COLLECTION LOCATION (1) 0+25% Depth (ft)	0+25% Velocity (f/s)	0+25% Discharge (cfs)	0+50% Depth (ft)	0+50% Velocity (f/s)	0+50% Discharge (cfs)	0+75% Depth (ft)	0+75% Velocity (f/s)	0+75% Discharge (cfs)	Total Discharge (cfs)
A	8/19/2003	8:00 AM	A	3.5	0.1	4.724	0.551	0.15	4.07	0.712	0.10	2.95	0.345	1.608
		1:30 PM		3.5	0.20	3.38	0.788	0.15	4.46	0.781	0.10	4.76	0.555	2.124
	8/20/2003	9:00 AM		3.5	0.2	3.34	0.779	0.2	3.24	0.756	0.15	3.55	0.621	2.157
		1:50 PM		3.5	0.2	1.35	0.315	0.18	1.21	0.254	0.16	1.83	0.342	0.911
	8/21/2003	9:00 AM		3.5	0.2	5.9	1.377	0.15	4.23	0.740	0.15	3.28	0.574	2.691
		2:00 PM		3.5	0.2	3.36	0.784	0.15	2.85	0.499	0.15	3.85	0.674	1.957
B	8/19/2003	8:30 AM	B	1.5	NM	NM	NA	0.50	0.20	0.049	NM	NM	NA	0.049
		1:45 PM		1.5	NM	NM	NA	0.55	0.10	0.027	NM	NM	NA	0.027
	8/20/2003	9:30 AM		1.5	NM	NM	NA	0.52	0.11	0.029	NM	NM	NA	0.029
		2:30 PM		1.5	NM	NM	NA	0.52	0.08	0.021	NM	NM	NA	0.021
	8/21/2003	9:30 AM		1.5	NM	NM	NA	0.5	0.06	0.015	NM	NM	NA	0.015
		2:30 PM		1.5	NM	NM	NA	0.5	0.01	0.003	NM	NM	NA	0.003
C	8/19/2003	8:45 AM	C	8	0.70	0.49	1.378	NM	NM	NA	NM	NM	NA	1.378
		2:00 PM		8	0.65	0.39	1.024	NM	NM	NA	NM	NM	NA	1.024
	8/20/2003	9:45 AM		8	0.68	0.5	1.360	NM	NM	NA	NM	NM	NA	1.360
		2:45 PM		8	0.66	0.54	1.426	NM	NM	NA	NM	NM	NA	1.426
	8/21/2003	9:45 AM		8	0.6	0.300	0.720	NM	NM	NA	NM	NM	NA	0.720
		2:45 PM		8	0.6	0.38	0.912	NM	NM	NA	NM	NM	NA	0.912

Notes:

1. Data collections points are located within the outfall channel at 25%, 50% and 75% of the total width of the outfall channel.
   Station locations are the distance from the left side of the outfall channel while looking in an upstream direction.
2. NM - No measurement taken.
3. NA - Calculation not available due to lack of data.

TABLE 14
WATER BUDGET EVAPORATION DATA

PRE-DESIGN INVESTIGATION FOR THE SILVER LAKE AREA
GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS

									Grass Fetch: 100 meters		
Date	Wind Speed[3] (m/s)	Temp.[3] (Deg C)	Dew Point[3] (Deg C)	E_s[3,4]	E[3,5]	RH[3,6] (%)	Evap. Rate[3] (mm/d)	Total Precip.[1] (in)	Evap. Coefficient	Adj. Evap. Rate (mm/d)	Adj. Evap. Rate (in/d)
08/19/03	1.28	20.56	16.17	36.47	29.18	80.01	5.33	0.00	0.84	4.46	0.18
08/20/03	1.18	21.11	16.22	37.38	29.28	78.32	5.08	0.00	0.84	4.24	0.17
08/21/03	1.03	21.67	17.78	38.28	31.89	83.30	5.08	0.00	0.85	4.31	0.17

Notes:

1. Data represents average daily values received from GE weatherstation near Silver Lake
2. Daily averages as reported by NOAA- Pittsfield, MA weather station
3. Calculated or converted using widely accepted formulas
4. $E_s = 6.11 \cdot 10\left(\frac{7.5 \cdot \text{Temp}}{237.5 + \text{Temp}}\right)$
5. $E = 6.11 \cdot 10\left(\frac{7.5 \cdot \text{Dew Point}}{237.5 + \text{Dew Point}}\right)$
6. $RH = 100\left(\frac{E}{E_s}\right)$

TABLE 15
WATER BUDGET CALCULATION SUMMARY

PRE-DESIGN INVESTIGATION REPORT FOR SILVER LAKE SEIMENTS
GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS
(Results are presented in cubic feet per second, cfs)

Date	ΔS	Q_A	Q_B	Q_C	E	GW
08/19/03	-1.15	1.53	0.11	1.20	0.20	-1.40
08/20/03	-0.53	1.12	0.07	1.39	0.19	-0.13
08/21/03	-0.37	0.47	0.03	0.82	0.20	0.15
Average	-0.68	1.04	0.07	1.14	0.20	-0.46

Notes:

Q_{GW} = net ground water flow to the lake

Q_C = flow into the lake from Outfall C

E = evaporation out of the lake

Q_A = flow out of the lake in Outfall A

Q_B = flow out of the lake in Outfall B

ΔS = the change in storage

TABLE 16
ANNUAL EXTREME WIND SPEED PER DIRECTION
ALBANY INTERNATIONAL AIRPORT

PRE-DESIGN INVESTIGATION REPORT FOR SILVER LAKE SEDIMENTS
GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS

Year	Wind Speed (mph)								
	North	Northeast	East	Southeast	South	Southwest	West	Northwest	All Directions
1965	37	25	22	32	30	31	36	40	40
1966	11	22	23	16	30	33	34	44	44
1967	28	28	16	24	30	33	30	45	45
1968	26	28	12	23	29	19	43	38	43
1969	11	24	22	6	28	36	42	30	42
1970	23	25	6	26	29	26	42	30	42
1971	24	22	11	30	25	26	49	57	57
1972	29	22	16	21	29	20	41	42	42
1973	26	19	7	24	38	25	34	34	38
1974	23	22	0	30	28	13	38	47	47
1975	20	19	16	20	32	21	34	36	36
1976	30	22	0	22	29	20	40	50	50
1977	33	16	16	20	29	21	35	44	44
1978	34	18	14	25	26	14	33	39	39
1979	22	21	15	17	29	44	42	38	44
1980	26	19	8	19	35	24	26	40	40
1981	31	16	14	12	32	26	40	42	42
1982	28	16	10	10	29	29	33	40	40
1983	18	23	10	16	21	30	26	29	30
Maximum All Directions	**37**	**28**	**23**	**32**	**38**	**44**	**49**	**57**	**57**

TABLE 17
ANNUAL EXTREME WIND SPEED PER DIRECTION
HARTFORD/BRADLEY INTERNATIONAL AIRPORT

PRE-DESIGN INVESTIGATION REPORT FOR SILVER LAKE SEDIMENTS
GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS

Year	Wind Speed (mph)								
	North	Northeast	East	Southeast	South	Southwest	West	Northwest	All Directions
1965	28	23	19	23	27	32	28	38	38
1966	26	24	17	25	28	25	34	36	36
1967	29	37	22	18	29	53	34	38	53
1968	29	30	15	24	31	28	32	40	40
1969	34	37	16	26	29	29	26	37	37
1970	28	21	18	17	28	29	36	42	42
1971	33	26	14	37	31	31	34	47	47
1972	26	33	17	22	29	31	42	49	49
1973	19	28	14	18	27	33	27	34	34
1974	23	30	17	26	30	29	34	42	42
1975	27	23	20	17	29	33	31	37	37
1976	20	21	30	18	35	29	31	42	42
1977	26	32	0	22	32	34	33	39	39
1978	38	26	9	26	38	49	34	42	49
1979	23	22	13	27	63	29	29	64	64
1980	29	30	17	29	28	42	29	38	42
1981	25	27	21	20	20	40	48	44	48
1982	19	25	17	21	24	30	38	36	38
1983	20	28	14	8	27	26	42	34	42
Maximum All Directions	**38**	**37**	**30**	**37**	**63**	**53**	**48**	**64**	**64**

TABLE 18
DESIGN WIND SPEED FOR DIFFERENT RETURN PERIODS
FASTEST MILE WIND SPEED
ALBANY INTERNATIONAL AIRPORT

PRE-DESIGN INVESTIGATION REPORT FOR SILVER LAKE SEDIMENTS
GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS

Return Period (Years)	Wind Speed (mph)							
	North	Northeast	East	Southeast	South	Southwest	West	Northwest
5	31	24	18	27	33	33	42	46
10	36	27	23	31	35	38	46	51
15	39	28	25	34	36	41	48	54
25	42	30	28	37	38	44	51	57
50	46	33	32	42	40	49	55	62
100	51	35	37	46	42	54	59	66

TABLE 19
DESIGN WIND SPEED FOR DIFFERENT RETURN PERIODS
FASTEST MILE WIND SPEED
HARTFORD/BRADLEY INTERNATIONAL AIRPORT

PRE-DESIGN INVESTIGATION REPORT FOR SILVER LAKE SEDIMENTS
GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS

Return Period (Years)	Wind Speed (mph)							
	North	Northeast	East	Southeast	South	Southwest	West	Northwest
5	31	32	21	28	38	40	39	47
10	35	35	25	32	44	45	43	52
15	36	37	28	34	48	48	45	54
25	39	39	30	37	52	51	47	58
50	42	42	34	41	57	56	51	62
100	45	45	38	44	63	61	54	66

TABLE 20
DESIGN WIND SPEED FOR DIFFERENT RETURN PERIODS
ONE-HOUR WIND SPEED
ALBANY INTERNATIONAL AIRPORT

GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS
PRE-DESIGN INVESTIGATION FOR THE SILVER LAKE AREA

Return Period (Years)	Wind Speed (mph)							
	North	Northeast	East	Southeast	South	Southwest	West	Northwest
5	26	21	16	23	28	28	35	38
10	30	23	20	26	30	32	38	42
15	33	24	22	29	30	34	39	44
25	35	26	24	31	32	36	42	46
50	38	28	27	35	33	40	45	50
100	42	30	31	38	35	44	48	53

TABLE 21
DESIGN WIND SPEED FOR DIFFERENT RETURN PERIODS
ONE-HOUR WIND SPEED
HARTFORD/BRADLEY INTERNATIONAL AIRPORT

GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS
PRE-DESIGN INVESTIGATION FOR THE SILVER LAKE AREA

Return Period (Years)	Wind Speed (mph)							
	North	Northeast	East	Southeast	South	Southwest	West	Northwest
5	26	27	19	24	32	33	33	39
10	30	30	22	27	36	37	36	42
15	30	31	24	29	39	39	37	44
25	33	33	26	31	42	42	39	47
50	35	35	29	34	46	45	42	50
100	37	37	32	36	50	49	44	53

TABLE 22
CUMULATIVE FREEZING-DEGREE DAYS
ALBANY INTERNATIONAL AIRPORT (1984-2003)

PRE-DESIGN INVESTIGATION REPORT FOR SILVER LAKE SEDIMENTS
GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS

Month	Average Number of Freezing-Degree Days	Maximum Number of Freezing-Degree Days
January	24	30
February	20	27
March	12	17
April	1	6
May	0	0
June	0	0
July	0	0
August	0	0
September	0	0
October	0	1
November	6	14
December	19	31

TABLE 23
HIGH FLOW MONITORING

PRE-DESIGN INVESTIGATION REPORT FOR SILVER LAKE SEDIMENTS
GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS

Outfall ID	Type of Channel	Channel Width (feet)	Date	Time of Day	DATA COLLECTION LOCATION [1] 0+25% 0+0.88' Depth (feet)	Velocity (ft/sec)	0+50% 0+1.75' Depth (feet)	Velocity (ft/sec)	0+75% 0+2.63' Depth (feet)	Velocity (ft/sec)
A	Box Culvert	3.5	7/22/2003	7:56 AM	0.20	5.85	0.20	5.55	0.30	4.55
				8:56 AM	0.20	6.30	0.20	5.87	0.20	4.03
				9:55 AM	0.20	4.80	0.20	3.40	0.30	3.35
				10:55 AM	0.20	5.54	0.20	5.20	0.30	2.90

Notes:

1. Data collections points are located within the outfall channel at 25%, 50% and 75% of the total width of the outfall channel. Station locations are the distance from the left side of the outfall channel while looking in an upstream direction.
2. ft/sec - feet per second

Outfall ID	Type of Channel	Channel Width (feet)	Date	Time of Day	DATA COLLECTION LOCATION [1] 0+25% 0+0.4' Depth (feet)	Velocity (ft/sec)	0+50% 0+0.8' Depth (feet)	Velocity (ft/sec)	0+75% 0+1.1' Depth (feet)	Velocity (ft/sec)
B	Circular Pipe	1.5	7/22/2003	7:59 AM	NM	NM	0.42	0.01	NM	NM
				9:01 AM	NM	NM	0.48	0.01	NM	NM
				9:58 AM	NM	NM	0.46	0.03	NM	NM
				10:59 AM	NM	NM	0.49	0.00	NM	NM

Notes:

1. Data collections points are located within the outfall channel at 25%, 50% and 75% of the total width of the outfall channel. Station locations are the distance from the left side of the outfall channel while looking in an upstream direction.
2. ft/sec - feet per second
3. NM - Not Measured (mid channel measurements were only obtained due to the width of the circular pipe).

TABLE 23
HIGH FLOW MONITORING

PRE-DESIGN INVESTIGATION REPORT FOR SILVER LAKE SEDIMENTS
GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS

Outfall ID	Type of Channel	Channel Width (feet)	Date	Time of Day	DATA COLLECTION LOCATION [1]					
					0+25% 0+2.0'		0+50% 0+4.0'		0+75% 0+6.0'	
					Depth (feet)	Velocity (ft/sec)	Depth (feet)	Velocity (ft/sec)	Depth (feet)	Velocity (ft/sec)
C	Rectangular	8	7/22/2003	8:19 AM	0.90	0.40	NM	NM	NM	NM
				9:29 AM	0.86	0.75	NM	NM	NM	NM
				NR	0.80	0.27	NM	NM	NM	NM
				11:15 AM	0.90	0.61	NM	NM	NM	NM

Notes:

1. Data collections points are located within the outfall channel at 25%, 50% and 75% of the total width of the outfall channel. Station locations are the distance from the left side of the outfall channel while looking in an upstream direction.
2. ft/sec - feet per second
3. NM - Not Measured (due to the trees and other debris within the channel, measurements were not obtained).
4. NR - Not Recorded

Outfall ID	Type of Channel	Channel Width (feet)	Date	Time of Day	DATA COLLECTION LOCATION [1]					
					0+25% 0+0.3'		0+50% 0+0.6'		0+75% 0+0.8'	
					Depth (feet)	Velocity (ft/sec)	Depth (feet)	Velocity (ft/sec)	Depth (feet)	Velocity (ft/sec)
D	Circular Pipe	1.1	7/22/2003	7:51 AM	NM	NM	1.00	0.06	NM	NM
				8:51 AM	NM	NM	0.98	0.06	NM	NM
				9:57 AM	NM	NM	0.96	0.02	NM	NM
				10:51 AM	NM	NM	0.97	0.01	NM	NM

Notes:

1. Data collections points are located within the outfall channel at 25%, 50% and 75% of the total width of the outfall channel. Station locations are the distance from the left side of the outfall channel while looking in an upstream direction.
2. ft/sec - feet per second
3. NM - Not Measured (mid channel measurements were only obtained due to the width of the circular pipe).

TABLE 23
HIGH FLOW MONITORING

PRE-DESIGN INVESTIGATION REPORT FOR SILVER LAKE SEDIMENTS
GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS

Outfall ID	Type of Channel	Channel Width (feet)	Date	Time of Day	DATA COLLECTION LOCATION [1] 0+25% 0+0.3' Depth (feet)	Velocity (ft/sec)	0+50% 0+0.7' Depth (feet)	Velocity (ft/sec)	0+75% 0+1.0' Depth (feet)	Velocity (ft/sec)
E	Circular Pipe	1.3	7/22/2003	7:56 AM	NM	NM	0.20	0.01	NM	NM
				8:56 AM	NM	NM	0.10	0.01	NM	NM
				9:55 AM	NM	NM	0.05	0.00	NM	NM
				10:55 AM	NM	NM	0.05	0.00	NM	NM

Notes:

1. Data collections points are located within the outfall channel at 25%, 50% and 75% of the total width of the outfall channel. Station locations are the distance from the left side of the outfall channel while looking in an upstream direction.
2. ft/sec - feet per second
3. NM - Not Measured (mid channel measurements were only obtained due to the width of the circular pipe).

Outfall ID	Type of Channel	Channel Width (feet)	Date	Time of Day	DATA COLLECTION LOCATION [1] 0+25% 0+0.95' Depth (feet)	Velocity (ft/sec)	0+50% 0+1.90' Depth (feet)	Velocity (ft/sec)	0+75% 0+2.85' Depth (feet)	Velocity (ft/sec)
01A	Box Culvert	3.8	7/22/2003	8:07 AM	NMF	NMF	NMF	NMF	NMF	NMF
				9:08 AM	NMF	NMF	NMF	NMF	NMF	NMF
				10:03 AM	NMF	NMF	NMF	NMF	NMF	NMF
				11:04 AM	NMF	NMF	NMF	NMF	NMF	NMF

Notes:

1. Data collections points are located within the outfall channel at 25%, 50% and 75% of the total width of the outfall channel. Station locations are the distance from the left side of the outfall channel while looking in an upstream direction.
2. ft/sec - feet per second
3. NMF- No Measurable Flow.

TABLE 23
HIGH FLOW MONITORING

PRE-DESIGN INVESTIGATION REPORT FOR SILVER LAKE SEDIMENTS
GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS

Outfall ID	Type of Channel	Channel Width (feet)	Date	Time of Day	DATA COLLECTION LOCATION [1] 0+25% 0+0.3' Depth (feet)	Velocity (ft/sec)	0+50% 0+0.5' Depth (feet)	Velocity (ft/sec)	0+75% 0+0.8' Depth (feet)	Velocity (ft/sec)
003	Circular Pipe	1	7/22/2003	8:07 AM	NM	NM	NMF	NMF	NM	NM
				9:11 AM	NM	NM	NMF	NMF	NM	NM
				10:09 AM	NM	NM	NMF	NMF	NM	NM
				11:08 AM	NM	NM	NMF	NMF	NM	NM

Notes:

1. Data collections points are located within the outfall channel at 25%, 50% and 75% of the total width of the outfall channel. Station locations are the distance from the left side of the outfall channel while looking in an upstream direction.
2. ft/sec - feet per second
3. NM - Not Measured (mid channel measurements were only obtained due to the width of the circular pipe).
4. NMF- No Measurable Flow.

Outfall ID	Type of Channel	Channel Width (feet)	Date	Time of Day	DATA COLLECTION LOCATION [1] 0+25% 0+0.4' Depth (feet)	Velocity (ft/sec)	0+50% 0+0.9' Depth (feet)	Velocity (ft/sec)	0+75% 0+1.3' Depth (feet)	Velocity (ft/sec)
004	Circular Pipe	1.7	7/22/2003	8:12 AM	NM	NM	0.50	0.08	NM	NM
				9:21 AM	NM	NM	0.50	0.01	NM	NM
				10:13 AM	NM	NM	0.55	0.05	NM	NM
				11:10 AM	NM	NM	0.60	0.01	NM	NM

Notes:

1. Data collections points are located within the outfall channel at 25%, 50% and 75% of the total width of the outfall channel. Station locations are the distance from the left side of the outfall channel while looking in an upstream direction.
2. ft/sec - feet per second
3. NM - Not Measured (mid channel measurements were only obtained due to the width of the circular pipe).

TABLE 24
GEOTECHNICAL TESTING RESULTS

PRE-DESIGN INVESTIGATION FOR THE SILVER LAKE AREA
GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS

Location	Sampling Interval	Moisture Content (ASTM D 2216)	Dry Unit Weight (PCF)	Organic Content (ASTM	Atterberg Limits (ASTM D 4318)	Grain-Size Analysis (ASTM 422)				USCS/USDA Classification	Standard Penetration Test (ASTM D XXXX) N Value	UU Triaxial (ASTM D 2850) Shear Strength (PSF)	Vane Shear		Torvane Undrained Shear PSF	Pocket Penentrometer Undrained Shear PSF	Permeability (ASTM D 5084) CM/SEC	Consolidation (ASTM D 2435) Cc	Specific Gravity (ASTM D 854)
						Gravel	Sand	Silt	Clay				Peak (PSF)	Remolded (PSF)					
SLGT03-01	0.0-1.0'		35.3		LL=61, PL=54, PI=7, MH										12	12			
	1.0-2.0'			12%			26%	64%	10%	MH, Silt Loam			0	0					
	2.0-4.0'		18.4										50	25	68	63			
	4.0-6.0'		17.4	14%	LL=103, PL=90, PI=13, MH								138	88	92	106			
	6.0-8.0'										WOR								
	8.0-10.0'										WOR								
	10.0-12.0'										WOR								
	12.0-14.0'										WOR								
SLGT03-02	0.0-1.0'		43.5												68	2			2.45
	1.0-2.0'			13%	Non-Plastic	1%	46%	49%	5%	ML, Sandy Loam		76	0	0					2.45
	2.0-4.0'		44.7									23	38	25	64	38	1.3E-06		
	4.0-6.0'		44.5	16%	Non-Plastic	1%	41%	52%	7%	ML, Sandy Loam		30	101	50	48	32		0.403	
	6.0-8.0'	106									WOR								
	8.0-10.0'	72									WOR								
	10.0-12.0'	267		13%	Non-Plastic		39%	51%	10%	ML, Loam	WOR								
	12.0-14.0'	254									WOR		88	25					
	17.0-20.0'	246		13%	Non-Plastic		29%	71%		ML	WOR		163	50					
	21.0-23.0'	216									WOH		264						
	26.0-28.0'	84		5%	Non-Plastic	11%	28%	53%	8%	ML, Silt Loam	19								2.75
SLGT03-03	0.0-1.0'		55.5		Non-Plastic	2%	65%	34%		SM					36	82			2.45
	1.0-2.0'	178		7%									13	0				0.055	
	2.0-4.0'	69	43.6	13%	LL=47, PL=46, PI=1, ML	1%	41%	49%	9%	ML, Loam			38	25	40	50		0.98	2.31
	4.0-6.0'	204	23.7	9%	Non-Plastic		35%	65%		ML			163	113	128	138		1.8	2.26
	6.0-8.0'										WOR								
	8.0-10.0'										WOR								
	10.0-12.0'										WOR								
	12.0-14.0'										WOR								
SLGT03-04	0.0-1.0'		24.2																
	1.0-2.0'			19%	LL=69, PL=69, PI=0, MH								0	0					
	2.0-4.0'												38	8	28	0			
	4.0-6.0'												96	20	44	38			
	6.0-8.0'										WOR								
	8.0-10.0'										WOR								
	10.0-12.0'										WOR								
	12.0-14.0'										WOR		96	20	44	38			
SLGT03-05	0.0-1.0'		29.9												32	0			
	1.0-2.0'												0	0					
	2.0-4.0'		34.5										63	25	96	76			
	4.0-6.0'												101	75	76	76			
	6.0-8.0'										WOR								
	8.0-10.0'										WOR								
	10.0-12.0'										WOR								
	12.0-14.0'	999									WOR								
SLGT03-06	0.0-1.0'		27.4				4%	76%	20%	MH, Silt Loam					10	0			
	1.0-2.0'			13%	LL=56, PL=48, PI=8, MH								13	13					
	2.0-4.0'		6.9										25	13	60	32			
	4.0-6.0'	1503	7.4	73%	LL=1413, PL=391, PI=1022, CH								88	63	60	32			
	6.0-8.0'										WOR								
	8.0-10.0'										WOR								
	10.0-12.0'										WOR								
	12.0-14.0'	999		42%	Assume ML		41%	59%		ML	WOR								
SLGT03-07	0.0-1.0'		44.5												40	25			
	1.0-2.0'												0	0					
	2.0-4.0'		16.4										50	13	56	63			
	4.0-6.0'																		
	6.0-8.0'										WOR								
	8.0-10.0'										WOR								
	10.0-12.0'										WOR								
	12.0-14.0'										WOR								

TABLE 24
GEOTECHNICAL TESTING RESULTS

PRE-DESIGN INVESTIGATION FOR THE SILVER LAKE AREA
GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS

Location	Sampling Interval	Moisture Content (ASTM D 2216)	Dry Unit Weight (PCF)	Organic Content (ASTM	Atterberg Limits (ASTM D 4318)	Grain-Size Analysis (ASTM 422)				USCS/USDA Classification	Standard Penetration Test (ASTM D XXXX) N Value	UU Triaxial (ASTM D 2850) Shear Strength (PSF)	Vane Shear		Torvane Undrained Shear PSF	Pocket Penentrometer Undrained Shear PSF	Permeability (ASTM D 5084) CM/SEC	Consolidation (ASTM D 2435) Cc	Specific Gravity (ASTM D 854)
						Gravel	Sand	Silt	Clay				Peak (PSF)	Remolded (PSF)					
SLGT03-08	0.0-2.0'		105.3	10%	Non-Plastic	19%	70%	10%	1%	SW-SM, Sand					136	44			
	2.0-4.0'		49.3	41%	Non-Plastic										88	125			
	4.0-6.0'										3								
	0.5-2.5'				Non-Plastic		85%	15%		SM									
	2.5-4.5'			51%	Non-Plastic		91%	9%		SP-SM									
SLGT03-09	0.0-1.0'																		
	1.0-2.0'																		
	0.5-2.5'	24		2%	Non-Plastic	11%	73%	15%		SM	9								
	2.5-4.5'	18		2%	Non-Plastic	7%	84%	9%		SP-SM	19								
SLGT03-10	0.0-1.0'	87	104.9		Assume ML	14%	85%	0%		SP									2.63
	1.0-2.0'			1%															
	2.0-4.0'		104.5	2%	Assume ML	11%	88%	1%		SP									
	4.0-6.0'										2								
SLGT03-11	0.0-1.0'		44.1										0	0					
	1.0-2.0'			13%	LL=41, PL=41, PI=0, ML								50	0					
	2.0-4.0'		16.1	13%									50	13					
	6.0-8.0'										WOR								
	8.0-10.0'										WOR								
	10.0-12.0'										WOR								
	12.0-14.0'										WOR								
SLGT03-12	0.0-1.0'		44.1																
	1.0-2.0'			13%	LL=41, PL=41, PI=0, ML														
	2.0-4.0'	114	35.8										38	25					
	4.0-6.0'	77	49.4												60	92			
	10.0-12.0'	755									WOR								
	12.0-14.0'												38	25					
	14.0-17.5'	747		29%	Assume ML		19%	81%		Assume ML	WOR		113	63					
	20.0-22.5'	384									WOR		214	88					
	25.0-27.5'	32									WOR		276	201					
	30.0-32.0'	31		0%	Non-Plastic		62%	33%	5%	SM, Sandy loam	7								2.74
SLGT03-13	0.0-1.0'	101	36.1		LL=56, PL=52, PI=4, MH		15%	74%	11%	MH, Silt Loam		0							
	1.0-2.0'			12%									0	0				1.056	
	2.0-4.0'	77	43.5	19%	LL=53, PL=52, PI=1, MH								63	25					
	4.0-6.0'	1068	4.0										75	50	28	56			
	6.0-8.0'										WOR								
	8.0-10.0'										WOR								
	10.0-12.0'										WOR								
	12.0-14.0'										WOR								

TABLE 24
GEOTECHNICAL TESTING RESULTS

PRE-DESIGN INVESTIGATION FOR THE SILVER LAKE AREA
GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS

Location	Sampling Interval	Moisture Content (ASTM D 2216)	Dry Unit Weight (PCF)	Organic Content (ASTM	Atterberg Limits (ASTM D 4318)	Grain-Size Analysis (ASTM 422)				USCS/USDA Classification	Standard Penetration Test (ASTM D XXXX) N Value	UU Triaxial (ASTM D 2850) Shear Strength (PSF)	Vane Shear		Torvane Undrained Shear PSF	Pocket Penentrometer Undrained Shear PSF	Permeability (ASTM D 5084) CM/SEC	Consolidation (ASTM D 2435) Cc	Specific Gravity (ASTM D 854)
						Gravel	Sand	Silt	Clay				Peak (PSF)	Remolded (PSF)					
SLGT03-14	0.0-1.0'																		
	1.0-2.0'												0	0					
	2.0-4.0'	180	28.7	12%	LL=83, PL=65, PI=18, MH		1%	69%	30%	MH, Silty Clay Loam		0	13	13	48	0	1.0E-06	1.074	
	4.0-6.0'		4.3	50%	LL=925, PL-262, PI= 663, CH	3%	75%	22%		SC		78	50	38	52	0		15.8	
	6.0-8.0'										WOR								
	8.0-10.0'	331		95%			38%	62%		Assume ML	WOR								
	10.0-12.0'										WOR								
	12.0-14.0'										WOR								
SLGT03-15	0.0-1.0'		22.9												24	0			
	1.0-2.0'			28%	LL=76, PL=72, PI=4, MH								0	0					
	2.0-4.0'		19.3										50	25	76	38			
	4.0-6.0'												113		128	250			
	6.0-8.0'										WOR								
	8.0-10.0'										WOR								
	10.0-12.0'										4								
	12.0-14.0'										7								
SLGT03-16	0.0-1.0'		28.6			2%	48%	41%	9%	SM, Loam					0	0			2.23
	1.0-2.0'			20%	LL=60, PL=54. PI=6, MH								0	0					
	2.0-4.0'		19.5										38	13	48	12			
	4.0-6.0'		23.6	9%	LL=101, PL=91, PI=10, MH		26%	68%	6%	MH, Silt Loam			88	50	100	62			
	6.0-8.0'										WOR								
	8.0-10.0'										WOR								
	10.0-12.0'										WOH								
	12.0-14.0'										WOH								
SLGT03-17	0.0-1.0'		24.6												0	0			
	1.0-2.0'			15%	LL=73, PL=65, PI=8, MH	1%	37%	52%	10%	MH, Loam			0	0					
	2.0-4.0'		13.6										0	0	32	0			
	4.0-6.0'		34.2	12%	LL=105, PL=89, PI=16, MH					MH			38	25	58	32			
	6.0-8.0'										WOR								
	8.0-10.0'										WOR								
	10.0-12.0'										WOR								
	12.0-14.0'										WOH								
SLGT03-18	0.0-1.0'		21.4												18	0			
	1.0-2.0'												0	0					
	2.0-4.0'		19.5										50	25	24	13			
	4.0-6.0'												75	45	40	32			
	6.0-8.0'										WOR								
	8.0-10.0'										WOR								
	10.0-12.0'										WOR								
	12.0-14.0'										WOR								
SLGT03-19	0.0-1.0'		30.2		LL-67, PL=61, PI=6, MH					MH					0	0			
	1.0-2.0'			15%									0	0					
	2.0-4.0'		23.1										13	13	8	0			
	4.0-6.0'												50	38	48	13			
	6.0-8.0'										WOR								
	8.0-10.0'										WOR								
	10.0-12.0'										WOR								
	12.0-14.0'										WOR								
SLGT03-20	0.0-1.0'		21.9										0	0					
	1.0-2.0'			20%	LL=69, PL=59, PI=10, MH		20%	60%	20%	MH, Silt Loam			13	0					
	2.0-4.0'		24.1	18%	LL=87, PL=65, PI=22, MH		5%	67%	28%	MH, Silty Clay Loam			13	0					
	4.0-6.0'		10.6																
	6.0-8.0'										WOR								
	8.0-10.0'										WOR								
	10.0-12.0'										WOR								
	12.0-14.0'										WOR								

TABLE 24
GEOTECHNICAL TESTING RESULTS

PRE-DESIGN INVESTIGATION FOR THE SILVER LAKE AREA
GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS

Location	Sampling Interval	Moisture Content (ASTM D 2216)	Dry Unit Weight (PCF)	Organic Content (ASTM	Atterberg Limits (ASTM D 4318)	Grain-Size Analysis (ASTM 422)				USCS/USDA Classification	Standard Penetration Test (ASTM D XXXX) N Value	UU Triaxial (ASTM D 2850) Shear Strength (PSF)	Vane Shear		Torvane Undrained Shear PSF	Pocket Penentrometer Undrained Shear PSF	Permeability (ASTM D 5084) CM/SEC	Consolidation (ASTM D 2435) Cc	Specific Gravity (ASTM D 854)
						Gravel	Sand	Silt	Clay				Peak (PSF)	Remolded (PSF)					
SLGT03-21	0.0-1.0'		19.2																
	1.0-2.0'			20%	LL=67, PL=61, PI=6, MH								0	0					
	2.0-4.0'												25	13					
	4.0-6.0'		4.2										70	25					
	6.0-8.0'										WOR								
	8.0-10.0'										WOR								
	10.0-12.0'										WOR								
	12.0-14.0'										WOR								
SLGT03-22	0.0-1.0'		24.4												28	0			
	1.0-2.0'			14%	LL=78, PL=65, PI=13, MH								0	0					
	2.0-4.0'		14.5										25	13	28	0			
	4.0-6.0'												63	25	72	50			
	6.0-8.0'										WOR								
	8.0-10.0'										WOR								
	10.0-12.0'										WOR								
	12.0-14.0'										WOR								
SLGT03-23	0.0-1.0'		11.4												3				
	1.0-2.0'												0	0					2.23
	2.0-4.0'		21.4	7%	LL=106, PL=54, PI=52, MH		3%	93%	4%	MH, Silt			13	13	8	6			2.43
	4.0-6.0'		20.2										75	25	10	14			2.41
	6.0-8.0'										WOR								
	8.0-10.0'										WOR								
	10.0-12.0'										WOR								
	12.0-14.0'										WOR								
SLGT03-24	0.0-1.0'		23.3	21%											20	0			
	1.0-2.0'				Non-Plastic		2%	74%	24%	ML, Silt Loam			0	0				1.06	
	2.0-4.0'		71.3										38	13	54	38		4.87	
	4.0-6.0'		6.9	39%	LL=890, PL=113, PI=777, CH		37%	63%		CH			106	43	52	19	6.6E-09	6.35	
	6.0-8.0'										WOR								
	8.0-10.0'										WOR								
	10.0-12.0'										WOR								
	12.0-14.0'										WOR								
SLGT03-25	0.0-1.0'		59.5												100	160			
	1.0-2.0'			4%	Non-Plastic	1%	33%	64%	3%	ML, Silt Loam			0	0					
	2.0-4.0'		8.9										38	25	128	188			
	4.0-6.0'		17.2	15%	LL=135, PL=123, PI=12, MH								239	63	68	60			
	6.0-8.0'										WOR								
	8.0-10.0'										WOR								
	10.0-12.0'										WOR								
	12.0-14.0'										WOH								

TABLE 25
SUMMARY OF BANK HABITAT CHARACTERIZATION

PRE-DESIGN INVESTIGATION REPORT FOR SILVER LAKE SEDIMENTS
GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS

Plot Number	Plot Size			Latitude/ Longitude	Dominant Vegetative Species			
	Length (ft)	Width (ft)	Area (ft^2)		Trees and Shrubs	Stem Count	Herbaceous	Relative Percent Cover
1	3.3	3.3	10.9	42° 26.986 N	Silver maple	1	Celandine	4
				73° 14.580 W			Jewelweed	5
							Bitter cress	8
							Ground ivy	15
							Teasel	2
							Grasses	5
							Cinquefoil	4
							Common blue violet	2
							Prickly lettuce	5
							Total Percent Groundcover:	50
2	13	10	130	42° 27.013 N	Box elder	3	Goldenrod	2
				73° 14.613 W	Red-osier dogwood	2	Grasses	2
					Silver maple	1	Bedstraw	2
					American elm	1	Raspberry	1
							Bitter cress	2
							Sedge	1
							Jewelweed	5
							Day lily	75
							Purple loosestrife	10
							Total Percent Groundcover:	100
3	33	10	330	42° 27.060 N	American elm	6	Grasses	15
				73° 14.592 W	Green ash	2	Bedstraw	8
					Basswood	7	Horsetail	35
					Red oak	1	Broad-leaved cattail	3
					Red-osier dogwood	3	Goldenrod	2
					Silver maple	3	Cypress spurge	30
					Tartarian honeysuckle	1	Purple loosestrife	5
					Flowering dogwood	1	Buttercup	1
							White clover	1
							Total Percent Groundcover:	100
4	33	10	330	42° 27.087 N	Tartarian honeysuckle	1	Goldenrod	1
				73° 14.520 W	Box elder	3	Horsetail	50
					Red-osier dogwood	7	Purple loosestrife	2
							Bedstraw	1
							Grasses	45
							Cow vetch	1
							Total Percent Groundcover:	100
5	33	12	396	42° 27.102 N	Box elder	10	Horsetail	40
				73° 14.445 W	Red-osier dogwood	2	Grasses	20
					Tartarian honeysuckle	5	Goldenrod	5
					Green ash	1	Bedstraw	15
							Wild grape	2
							Purple loosestrife	5
							Cypress spurge	12
							Redtop	1
							Total Percent Groundcover:	100
6	33	8	264	42° 27.143 N	Sugar maple	13	Purple loosestrife	10
				73° 14.373 W	Red-osier dogwood	5	Horsetail	35
					Tartarian honeysuckle	4	Bedstraw	35
					Speckled alder	1	Redtop	3
							Grasses	5
							Common strawberry	2
							Blue flag	5
							Goldenrod	5
							Total Percent Groundcover:	100
7	30	18	540	42° 27.150 N	Basswood	3	Narrow-leaved cattail	25
				73° 14.251 W	Sugar maple	2	Purple loosestrife	25
					Tartarian honeysuckle	8	Grasses	45
					Box elder	1	Goldenrod	2
					Red-osier dogwood	3	Horsetail	3
							Total Percent Groundcover:	100

TABLE 25
SUMMARY OF BANK HABITAT CHARACTERIZATION

PRE-DESIGN INVESTIGATION REPORT FOR SILVER LAKE SEDIMENTS
GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS

Plot Number	Plot Size			Latitude/ Longitude	Dominant Vegetative Species			
	Length (ft)	Width (ft)	Area (ft^2)		Trees and Shrubs	Stem Count	Herbaceous	Relative Percent Cover
8	33	10	330	42° 27.080 N	Sugar maple	3	Cypress spurge	5
				73° 14.238 W	Staghorn sumac	1	Goldenrod	3
					Basswood	2	Bedstraw	5
					Tartarian honeysuckle	5	Purple loosestrife	5
					Red-osier dogwood	1	Redtop	2
					Flowering dogwood	2	Grasses	5
							Bulrush	15
							Total Percent Groundcover:	40
9	3.3	3.3	10.9	42° 27.086 N			Bulrush	8
				73° 14.238 W			Purple loosestrife	50
							Narrow-leaved cattail	2
							Total Percent Groundcover:	60
10	25	8	200	42° 27.014 N	Box elder	13	Common blue violet	3
				73° 14.375 W	Tartarian honeysuckle	3	Bitter cress	5
							Ground ivy	5
							Cinquefoil	5
							Grasses	20
							Celandine	2
							Total Percent Groundcover:	40
11	25	5	125	42° 26.978 N	Eastern cottonwood	4	Wild grape	3
				73° 14.449 W	American elm	2	Cinquefoil	2
					Tartarian honeysuckle	3	Bedstraw	5
					Sugar maple	1	Grasses	30
							Total Percent Groundcover:	40

TABLE 26
EPA SEDIMENT SAMPLE ANALYTICAL RESULTS

PRE-DESIGN INVESTIGATION REPORT FOR SILVER LAKE SEDIMENTS
GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS

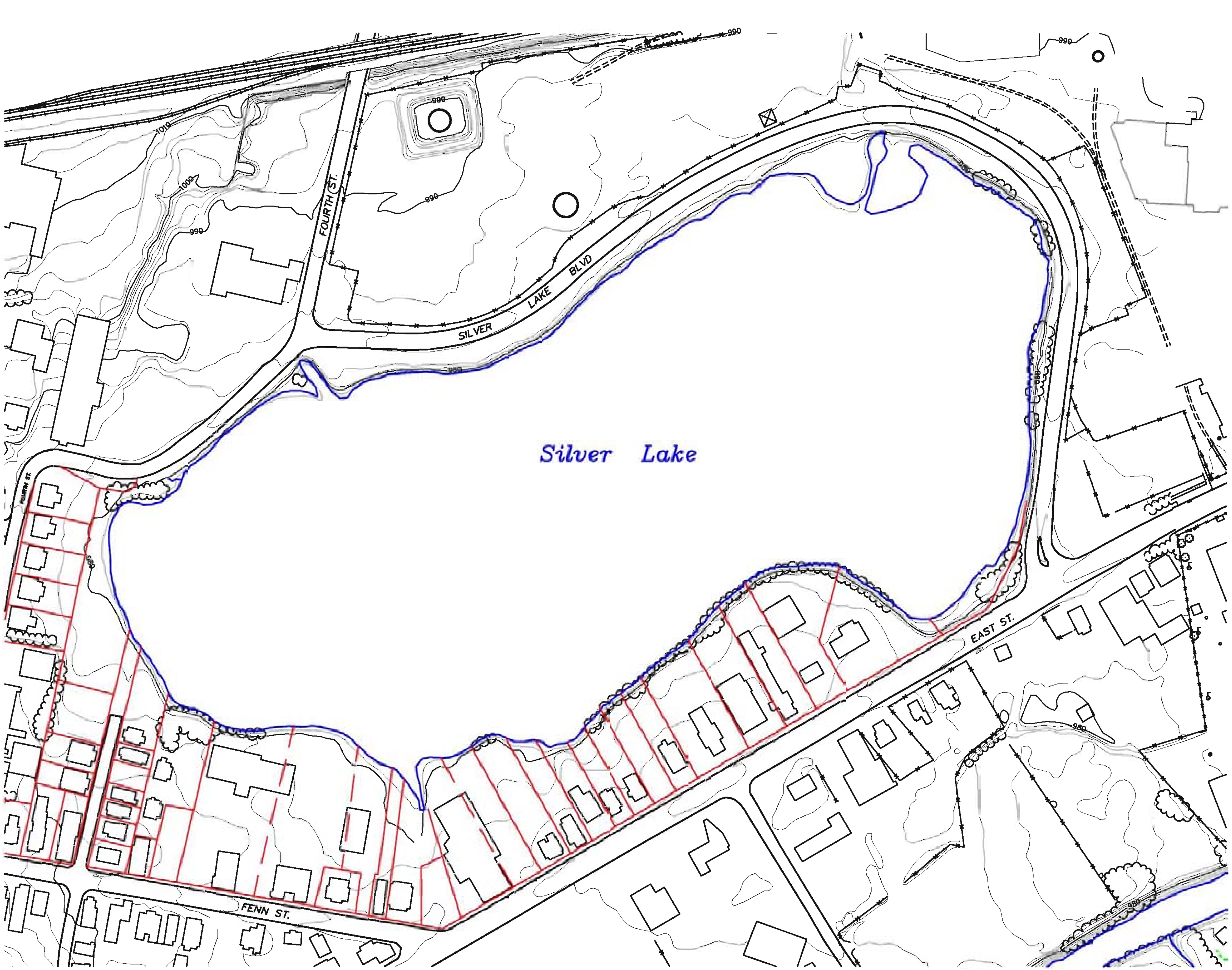
C-of-C ID	RFW0003052	RFW0003052	RFW0003052	RFW0003052	RFW0003052	RFW0003052	RFW0003052	RFW0003052
C-of-C Item	1	2	3	4	5	6	7	8
GE Location ID	SLGT03-25	SLGT03-23	SLPZ03-07	SLGT03-17	SLGT03-16	SLGT03-04 (close)	SLGT03-02	SLGT03-25
Field Sample ID	SL-SE001533-0-3G07	SL-SE001534-0-3G07	SL-SE001535-0-3G07	SL-SE001536-0-3G07	SL-SE001537-0-3G07	SL-SE001538-0-3G07	SL-SE001539-0-3G07	SL-SE001533-1-3G07
Date Collected	08/07/2003	08/07/2003	08/07/2003	08/07/2003	08/07/2003	08/07/2003	08/07/2003	08/07/2003
Depth	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5
Source	EPA_COE	EPA_COE	EPA_COE	EPA_COE	EPA_COE	EPA_COE	EPA_COE	EPA_COE
QC								Duplicate Sample
Analyte								
PCBS								
PCB, TOTAL (mg/kg)	36 J	190 J	47 J	82 J	130 J	910 J	96 J	45 J
AROCLOR-1242 (mg/kg)	2.5 J	60 J	5.3 J	7.8 J	16 J	44 U	32 J	3.4 J
AROCLOR-1254 (mg/kg)	12 J	40 J	17 J	24 J	33 J	430 J	29 J	16 J
AROCLOR-1260 (mg/kg)	21	93	25	50	82	480	35	26
ORGANIC								
PETROLEUM HYDROCARBON (mg/kg)	8670 J	10900 J	1220 J	3860 J	7270 J	77400	7430 J	2210 J
APP IX SEMIVOLATILES								
1,2,4-TRICHLOROBENZENE (mg/kg)	.08 J	.32 J	.088 J	.3 J	.18 J	1.5 J	3.6 U	.069 J
1,2-DICHLOROBENZENE (mg/kg)	1.2 U	1.6 U	.61 U	.079 J	.8 U	.29 J	3.6 U	1.2 U
1,3-DICHLOROBENZENE (mg/kg)	.1 J	.78 J	.11 J	.48 J	.42 J	1.1 J	3.6 U	.089 J
1,4-DICHLOROBENZENE (mg/kg)	.3 J	1.7	.33 J	1.2	1.4	5.5 J	.64 J	.25 J
2-CHLORONAPHTHALENE (mg/kg)	1.2 U	1.6 UJ	.61 U	1.2 U	.25 J	1.3 J	3.6 U	1.2 U
2-METHYLNAPHTHALENE (mg/kg)	.19 J	.19 J	.17 J	.47 J	.39 J	3.2 J	.3 J	.15 J
2-METHYLPHENOL (O-CRESOL) (mg/kg)	.13 J	.16 J	.13 J	.28 J	.27 J	1.2 J	.77 J	.095 J
4-METHYLPHENOL (mg/kg)	.22 J	.19 J	.12 J	.19 J	.21 J	.95 J	.64 J	.14 J
ACENAPHTHENE (mg/kg)	.36 J	1.6 U	.18 J	.38 J	.55 J	4.3 U	1.1 J	.32 J
ACENAPTHYLENE (mg/kg)	1.2 U	1.6 U	.072 J	1.2 U	.8 U	4.3 U	3.6 U	.078 J
ACETOPHENONE (mg/kg)	1.2 U	1.6 U	.61 U	.064 J	.056 J	4.3 U	3.6 U	1.2 U
ANILINE (mg/kg)	3.1 U	.085 J	1.5 U	.24 J	1 J	15 J	1.1 J	3 U
ANTHRACENE (mg/kg)	1 J	.52 J	.49 J	1.5 J	1.9 J	2.9 J	2.7 J	.93 J
BENZO(A)ANTHRACENE (mg/kg)	4.7	2.6 J	2.9	5.8	5.8	3.2 J	8.5 J	4 J
BENZO(A)PYRENE (mg/kg)	5.1	3.3	3.9	7	6.4	2.4 J	9.2	4.4
BENZO(B)FLUORANTHENE (mg/kg)	6.3	4.5 J	5.5	9	7.6	3.2 J	9.4	5.8
BENZO(GHI)PERYLENE (mg/kg)	3.5	2.4	3.1	5	4.7	1.8 J	5.6 J	3.1
BENZO(K)FLUORANTHENE (mg/kg)	4.9 J	3.6	3.6	8.1 J	6.6	2.5 J	8.3 J	4.9
BIS(2-ETHYLHEXYL) PHTHALATE (mg/kg)	1.7	1.8	3.4	4.1	4.8	3 J	5.2 J	1.6
BUTYLBENZYLPHTHALATE (mg/kg)	1.2 UJ	1.6 UJ	.4 J	.15 J	.8 UJ	4.3 UJ	3.6 U	.12 J
CHRYSENE (mg/kg)	6	4.1 J	4.3	8.8	8.5	4.5 J	11	5.3
DIBENZO(A,H)ANTHRACENE (mg/kg)	1 J	.74 J	.98 J	1.4 J	1.2 J	4.3 UJ	1.7 J	.97 J
DIBENZOFURAN (mg/kg)	.21 J	.12 J	.12 J	.27 J	.27 J	.63 J	.46 J	.18 J
DI-N-BUTYL PHTHALATE (mg/kg)	.22 J	1.6 UJ	.96 J	.86 J	1.8 J	4.3 UJ	1.7 J	.19 J
FLUORANTHENE (mg/kg)	10	5.8	5.5	16 J	16 J	9.7	20	9.3 J
FLUORENE (mg/kg)	.52 J	.25 J	.23 J	.77 J	.86 J	1.3 J	1.3 J	.45 J
INDENO(1,2,3-C,D)PYRENE (mg/kg)	2.9	1.9	2.5	4	3.8	1.5 J	4.7 J	2.5
NAPHTHALENE (mg/kg)	.56 J	.66 J	.47 J	1.3	.85 J	3.8 J	.59 J	.45 J
N-NITROSODIPHENYLAMINE (mg/kg)	.38 J	1.6 UJ	.32 J	1.4 J	1.6 J	5.4	.73 J	.3 J
O-TOLUIDINE (mg/kg)	1.2 U	1.6 U	.61 U	1.2 U	.8 U	1.5 J	3.6 U	1.2 U
PHENANTHRENE (mg/kg)	5.6	2.7	2.7	7.8 J	10 J	11	15	4.9 J
PHENOL (mg/kg)	1.1 J	1.2 J	1.2 J	2.6	3.7	24	6.1	.79 J
PYRENE (mg/kg)	10	6.3 J	7.2	14 J	14 J	8.5 J	19	8.6 J

TABLE 26
EPA SEDIMENT SAMPLE ANALYTICAL RESULTS

PRE-DESIGN INVESTIGATION REPORT FOR SILVER LAKE SEDIMENTS
GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS

C-of-C ID	RFW0003052	RFW0003052	RFW0003052	RFW0003052	RFW0003052	RFW0003052	RFW0003052	RFW0003052
C-of-C Item	1	2	3	4	5	6	7	8
GE Location ID	SLGT03-25	SLGT03-23	SLPZ03-07	SLGT03-17	SLGT03-16	SLGT03-04 (close)	SLGT03-02	SLGT03-25
Field Sample ID	SL-SE001533-0-3G07	SL-SE001534-0-3G07	SL-SE001535-0-3G07	SL-SE001536-0-3G07	SL-SE001537-0-3G07	SL-SE001538-0-3G07	SL-SE001539-0-3G07	SL-SE001533-1-3G07
Date Collected	08/07/2003	08/07/2003	08/07/2003	08/07/2003	08/07/2003	08/07/2003	08/07/2003	08/07/2003
Depth	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5
Source	EPA_COE	EPA_COE	EPA_COE	EPA_COE	EPA_COE	EPA_COE	EPA_COE	EPA_COE
QC								Duplicate Sample
INORGANICS								
PERCENT SOLIDS (%)	27.1	21	27.4	28.3	40.8	37.5	36.8	28.1
METALS								
ANTIMONY (mg/kg)	8.1	4.7	16.1	8.8	8.5	3.2	8	7.4
ARSENIC (mg/kg)	9.6	23.5	12.5	18.1	8.1	14.4	7.3	7.8
BARIUM (mg/kg)	70.8	113	117	115	67.5	106	71	61.7
BERYLLIUM (mg/kg)	0.37	0.86	0.8	0.82	0.42	0.64	0.25	0.33
CADMIUM (mg/kg)	33.6 J	68.3 J	39.7 J	83.2 J	37.6 J	24.5 J	35.5 J	30.0 J
CHROMIUM (mg/kg)	143 J	553 J	189 J	353 J	146 J	391 J	156 J	123 J
COBALT (mg/kg)	11.8	15.6	24.2	15.7	11.2	11.2	10.6	10.2
COPPER (mg/kg)	1340	3560	2090	3490	1500	1680	2720	1190
LEAD (mg/kg)	509 J	1080 J	770 J	1020 J	729 J	2120 J	512 J	431 J
MERCURY (mg/kg)	4.7	19.9	5.2	14.2	5.3	14.2	6.4	4.4
NICKEL (mg/kg)	95.5 J	162 J	149 J	182 J	82.9 J	101 J	83.9 J	82.3 J
SELENIUM (mg/kg)	2.1	3.1	2.7	2.6	1.2	1.6	1.8	1.7
SILVER (mg/kg)	40	106	60.5	114	42.9	51	57.2	34.1
TIN (mg/kg)	145 J	386 J	199 J	407 J	152 J	229 J	520 J	127 J
VANADIUM (mg/kg)	92.2 J	117 J	313 J	208 J	115 J	62.3 J	257 J	78.5 J
ZINC (mg/kg)	1280	3500	2050	2390	1150	2000	1080	1090

Figures



LEGEND

- EDGE OF WATER
- RAILROAD
- VEGETATION
- PROPERTY BOUNDARY
- BOUNDARY BETWEEN COMMONLY OWNED PROPERTIES

NOTES:

1. THE BASE MAP FEATURES PRESENTED ON THIS FIGURE WERE PHOTOGRAMMETRICALLY MAPPED FROM APRIL 1990 AERIAL PHOTOGRAPHS.
2. TAX BOUNDARY INFORMATION OBTAINED FROM CITY OF PITTSFIELD'S TAX ASSESSOR'S OFFICE AND IS CURRENT THROUGH SEPTEMBER 5, 1997.

0 200' 400'

GRAPHIC SCALE

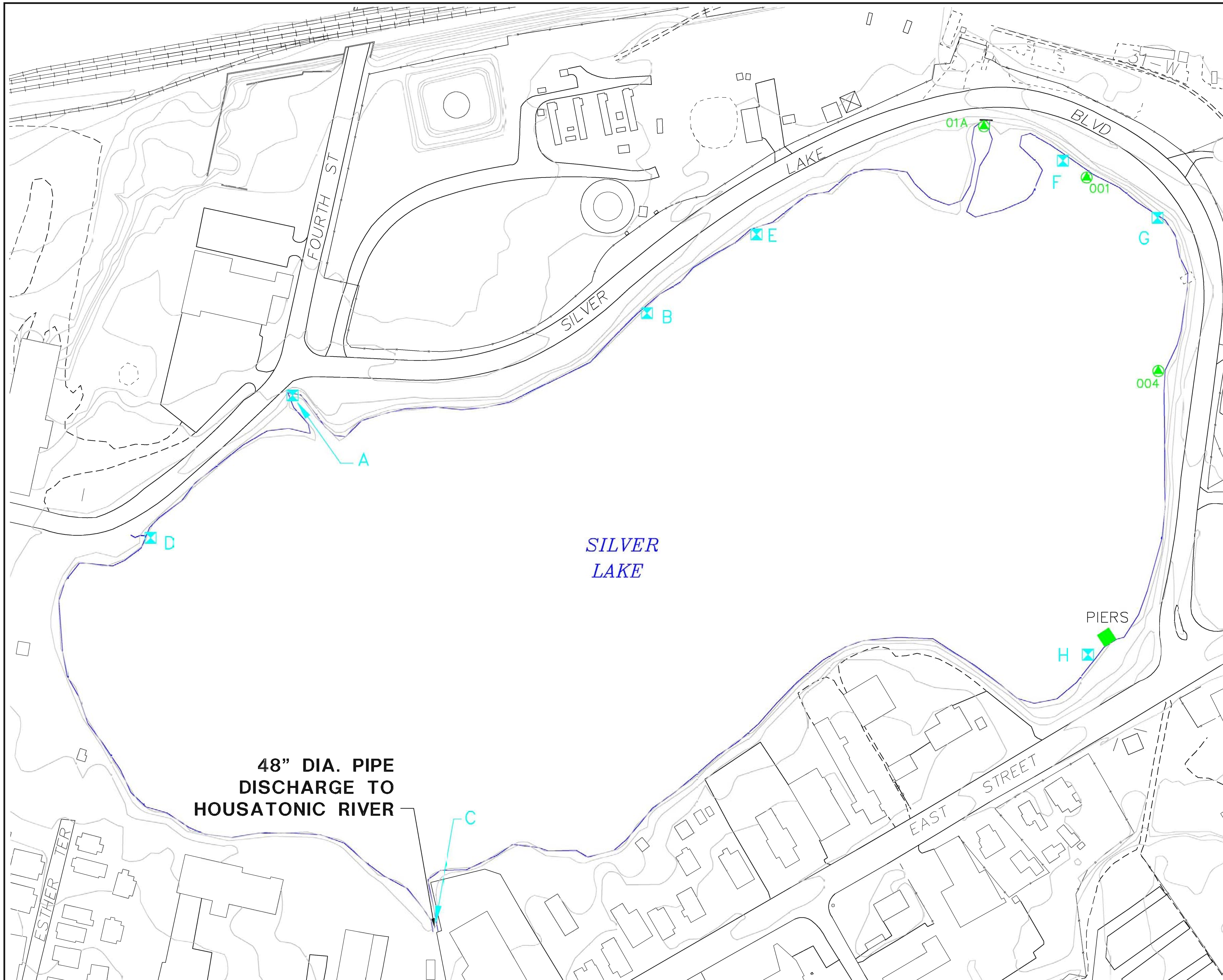
GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
SILVER LAKE
PRE-DESIGN INVESTIGATION REPORT

SILVER LAKE SITE MAP

BBL
BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

FIGURE
1

X: 40152X02.DWG, 40152X03.DWG
LMAN: 428-A
P: PAGESET/PLT-BL
2/9/04 SYR-85-LJP LJP SDL
C/40152027/PDI/40152B01.DWG



KEY:

- 2 SQUARE CONCRETE PIERS, 5 FEET x 5 FEET
- MUNICIPAL SEWER OUTFALL
- NPDES OUTFALL
- EDGE OF WATER
- PAVED ROADWAY
- RAILROAD
- FENCELINE
- 970 ELEVATION CONTOUR

NOTES:

1. MAPPING IS BASED ON AERIAL PHOTOGRAPHS AND PHOTOGRAMMETRIC MAPPING BY LOCKWOOD MAPPING, INC. – FLOWN IN APRIL 1990; DATA PROVIDED BY GENERAL ELECTRIC COMPANY, AND BLASLAND AND BOUCK ENGINEERS, P.C. CONSTRUCTION PLANS.
2. NOT ALL PHYSICAL FEATURES SHOWN.
3. THE LOCATION OF OUTFALLS, PHYSICAL STRUCTURES AND THE SITE BOUNDARY ARE APPROXIMATE.

0 160' 320'

GRAPHIC SCALE

X: 40152X00.DWG, X01.DWG
LMAN: RLP
P: PAGESET/PLT-DL
2/10/04 SYR-85-RLP LJP SDL
C/40152027/PDI/40152G01.DWG

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
SILVER LAKE
PRE-DESIGN INVESTIGATION REPORT

SILVER LAKE OUTFALL LOCATIONS

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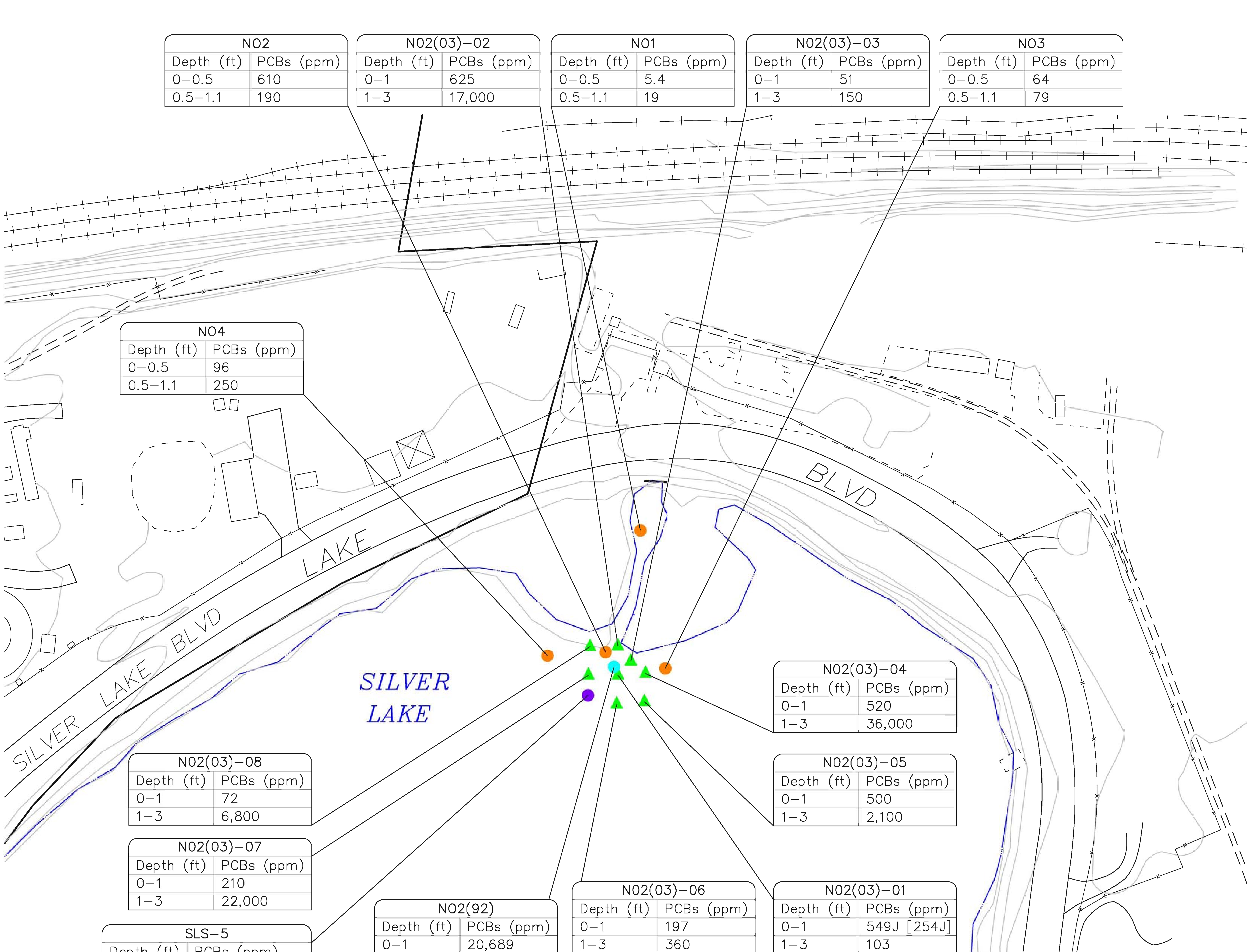
FIGURE
2



N02	
Depth (ft)	PCBs (ppm)
0–0.5	610
0.5–1.1	190

N02(03)–02	
Depth (ft)	PCBs (ppm)
0–1	625
1–3	17,000

N01	
Depth (ft)	PCBs (ppm)
0–0.5	5.4
0.5–1.1	19

N02(03)–03	
Depth (ft)	PCBs (ppm)
0–1	51
1–3	150

N03	
Depth (ft)	PCBs (ppm)
0–0.5	64
0.5–1.1	79

N04	
Depth (ft)	PCBs (ppm)
0–0.5	96
0.5–1.1	250

N02(03)–04	
Depth (ft)	PCBs (ppm)
0–1	520
1–3	36,000

N02(03)–08	
Depth (ft)	PCBs (ppm)
0–1	72
1–3	6,800

N02(03)–05	
Depth (ft)	PCBs (ppm)
0–1	500
1–3	2,100

N02(03)–07	
Depth (ft)	PCBs (ppm)
0–1	210
1–3	22,000

N02(92)	
Depth (ft)	PCBs (ppm)
0–1	20,689

N02(03)–06	
Depth (ft)	PCBs (ppm)
0–1	197
1–3	360

N02(03)–01	
Depth (ft)	PCBs (ppm)
0–1	549J [254J]
1–3	103

SLS–5	
Depth (ft)	PCBs (ppm)
0–1	350
1–2	300
2–3	420
3–4	640
4–5	290
5–6	11,000 [13,000]
6–6.67	18,000

LEGEND:

- STEWART LABORATORIES SAMPLING LOCATION (1982)
- MISCELLANEOUS GRAB SAMPLING LOCATION (1992)
- MCP/RFI SEDIMENT SAMPLING LOCATION (1995)
- PRE–DESIGN SEDIMENT SAMPLING LOCATION (2003)
- EDGE OF WATER
- PAVED ROADWAY
- RAILROAD
- FENCELINE
- 970 ELEVATION CONTOUR

NOTES:

1. THE BASE MAP FEATURES PRESENTED ON THIS FIGURE WERE PHOTOGRAMMETRICALLY MAPPED FROM APRIL 1990 AERIAL PHOTOGRAPHS.
2. ALL SAMPLE LOCATIONS ARE APPROXIMATE. HOWEVER, LOCATIONS SAMPLED IN 1991, 1994, 1995 AND 2003 WERE SURVEYED BY BLASLAND, BOUCK & LEE, INC.
3. ALL SEDIMENT DATA ARE PRESENTED IN DRY WEIGHT – PARTS PER MILLION (ppm). DUPLICATE RESULTS ARE SHOWN IN BRACKETS.
4. J – ANALYTE WAS POSITIVELY IDENTIFIED BUT THE ASSOCIATED NUMERICAL VALUE IS AN ESTIMATED CONCENTRATION.

0 50' 100'
GRAPHIC SCALE

X: 40152X00.DWG, X01.DWG
LMAN: JER
P: PAGESET/PLT–DL
2/10/04 SYR–85–JER KMD SDL
C/40152027/PDI/40152G10.DWG

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
SILVER LAKE
PRE–DESIGN INVESTIGATION REPORT

SEDIMENT SAMPLING LOCATIONS AND RESULTS

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engineers, scientists, economists

FIGURE
3

LEGEND

BENTHIC SAMPLE LOCATION

BENTHIC SAMPLE LOCATION WITH BE-7 ANALYSIS

ELEVATION CONTOUR

NOTES:

1. MAPPING IS BASED ON AERIAL PHOTOGRAPHS AND PHOTOGRAMMETRIC MAPPING BY LOCKWOOD MAPPING, INC. – FLOWN IN APRIL 1990; DATA PROVIDED BY GENERAL ELECTRIC COMPANY, AND BLASLAND AND BOUCK ENGINEERS, P.C. CONSTRUCTION PLANS.
2. NOT ALL PHYSICAL FEATURES SHOWN.
3. SITE BOUNDARY IS APPROXIMATE.
4. ALL LOCATIONS ARE APPROXIMATE.
5. THE CONTOUR INFORMATION PRESENTED ON THIS DRAWING REPRESENTS THE RESULTS OF A SURVEY PERFORMED BY OCEAN SURVEYS, INC. ON 10–13 JUNE 2003 AND CAN ONLY BE CONSIDERED AS INDICATING THE CONDITIONS EXISTING AT THAT TIME. REUSE OF THIS INFORMATION BY CLIENT OR OTHERS BEYOND THE SPECIFIC SCOPE OF WORK FOR WHICH IT WAS ACQUIRED SHALL BE AT THE SOLE RISK OF THE USER AND WITHOUT LIABILITY TO OSI.

0 220' 440'

GRAPHIC SCALE

X: 40152X00.DWG, X06.DWG
LMAN: RLP
P: PAGESET/PLT-DL
2/10/04 SYR-85-RLP LJP SDL
C/40152027/PDI/40152G02.DWG

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
SILVER LAKE
PRE-DESIGN INVESTIGATION REPORT

PRE-DESIGN INVESTIGATION BENTHIC AND BE-7 SAMPLE LOCATIONS

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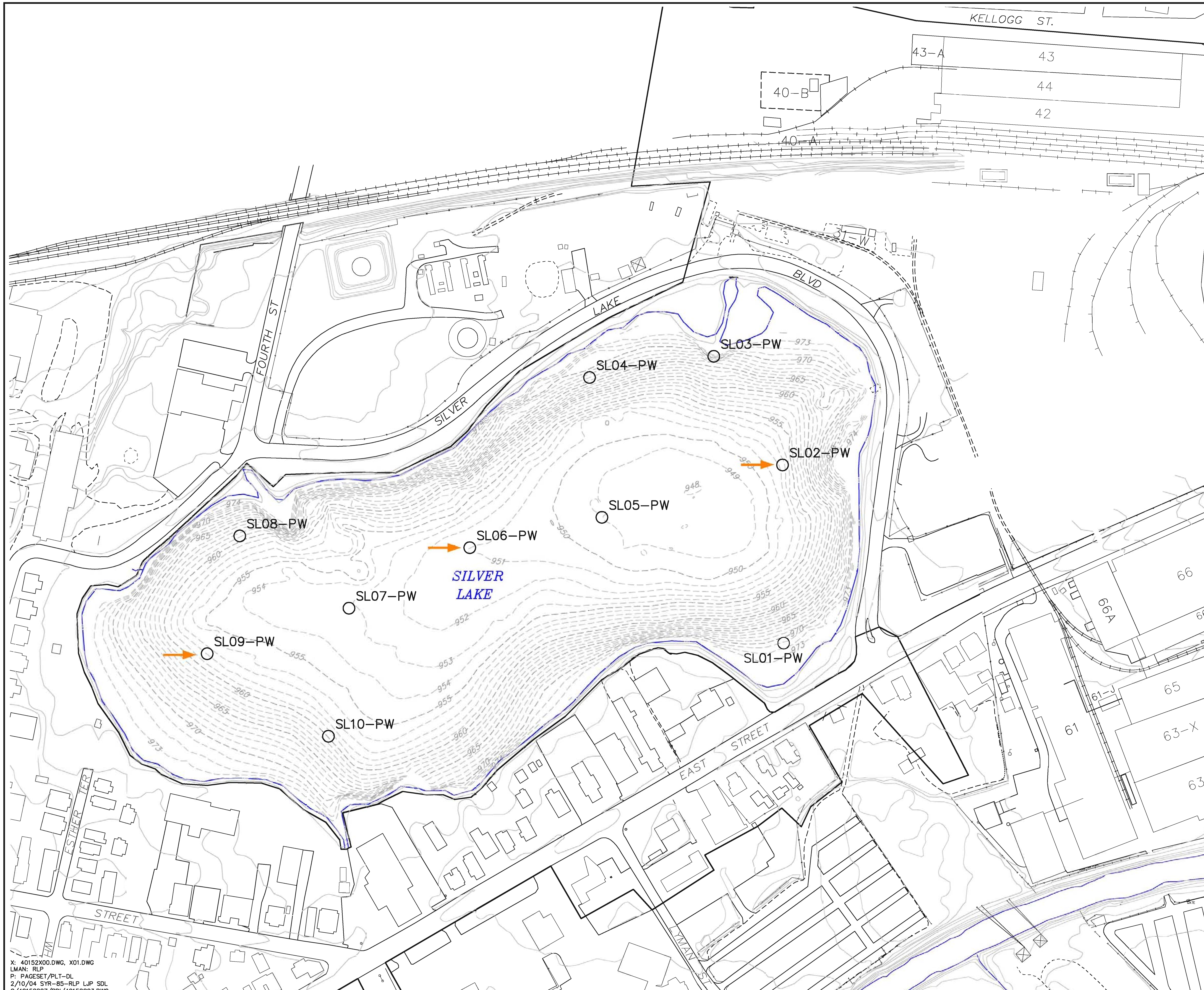
engineers, scientists, economists

FIGURE
4



LEGEND

- ○ PORE WATER SAMPLE LOCATION
- → SBLT SAMPLE LOCATION
- - - - ELEVATION CONTOUR

NOTES:

1. MAPPING IS BASED ON AERIAL PHOTOGRAPHS AND PHOTOGRAMMETRIC MAPPING BY LOCKWOOD MAPPING, INC. – FLOWN IN APRIL 1990; DATA PROVIDED BY GENERAL ELECTRIC COMPANY, AND BLASLAND AND BOUCK ENGINEERS, P.C. CONSTRUCTION PLANS.
2. NOT ALL PHYSICAL FEATURES SHOWN.
3. SITE BOUNDARY IS APPROXIMATE.
4. ALL LOCATIONS ARE APPROXIMATE.
5. THE CONTOUR INFORMATION PRESENTED ON THIS DRAWING REPRESENTS THE RESULTS OF A SURVEY PERFORMED BY OCEAN SURVEYS, INC. ON 10–13 JUNE 2003 AND CAN ONLY BE CONSIDERED AS INDICATING THE CONDITIONS EXISTING AT THAT TIME. REUSE OF THIS INFORMATION BY CLIENT OR OTHERS BEYOND THE SPECIFIC SCOPE OF WORK FOR WHICH IT WAS ACQUIRED SHALL BE AT THE SOLE RISK OF THE USER AND WITHOUT LIABILITY TO OSI.

0 220' 440'

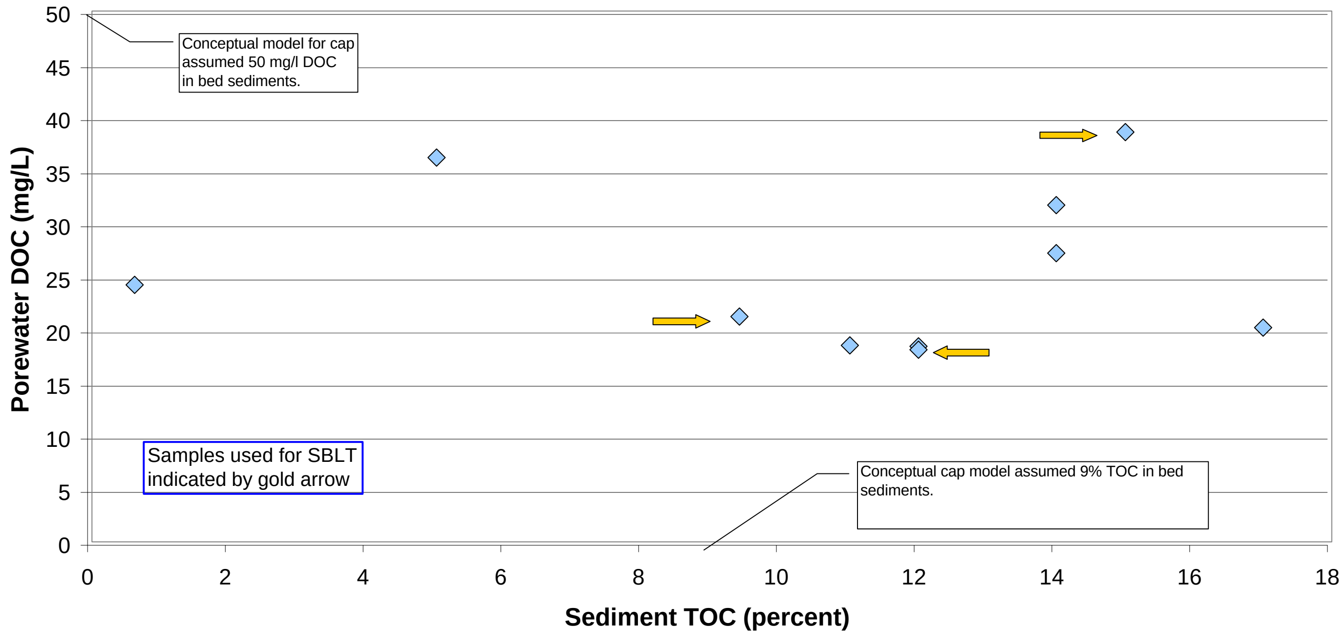
GRAPHIC SCALE

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
SILVER LAKE
PRE-DESIGN INVESTIGATION REPORT

PRE-DESIGN INVESTIGATION PORE WATER SAMPLE AND SBLT LOCATIONS

BBL BLASLAND, BOUCK & LEE, INC. engineers, scientists, economists

FIGURE **5**



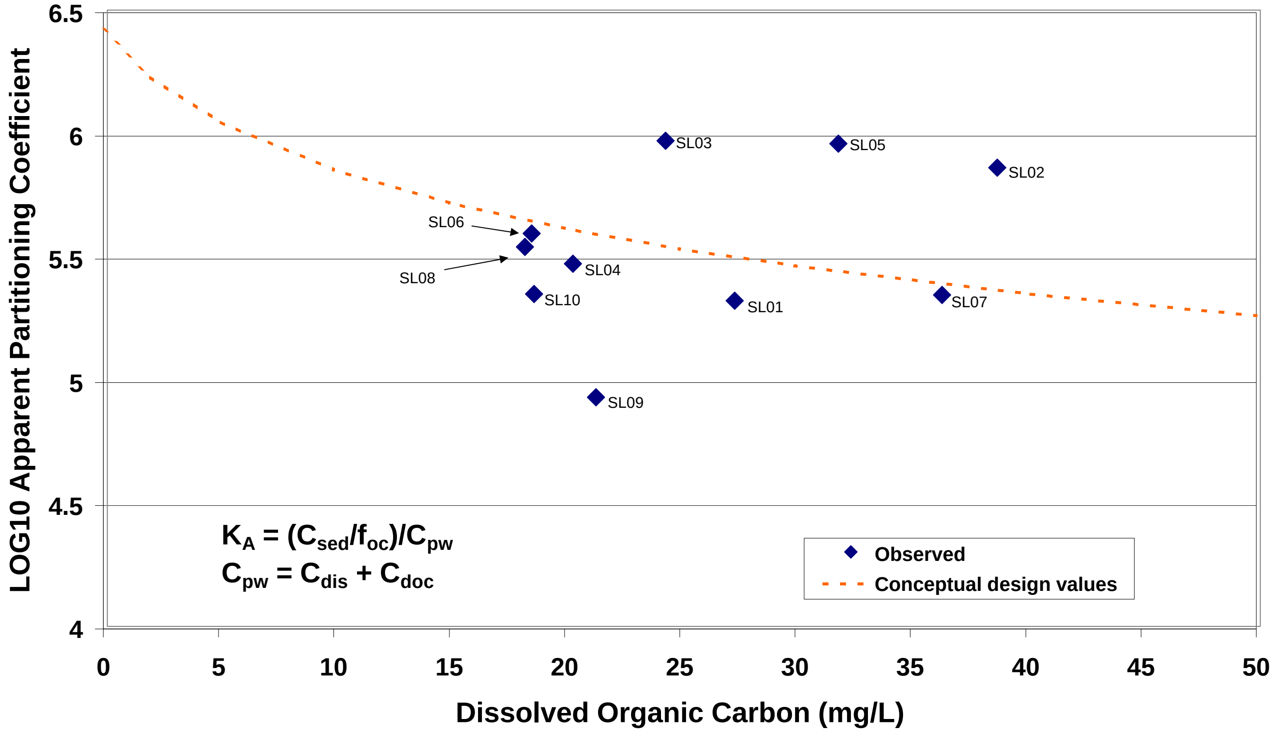
GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS

SILVER LAKE
PRE-DESIGN INVESTIGATION REPORT

PORE WATER SAMPLING: LACK OF RELATION BETWEEN DOC AND TOC

BBL

FIGURE 6

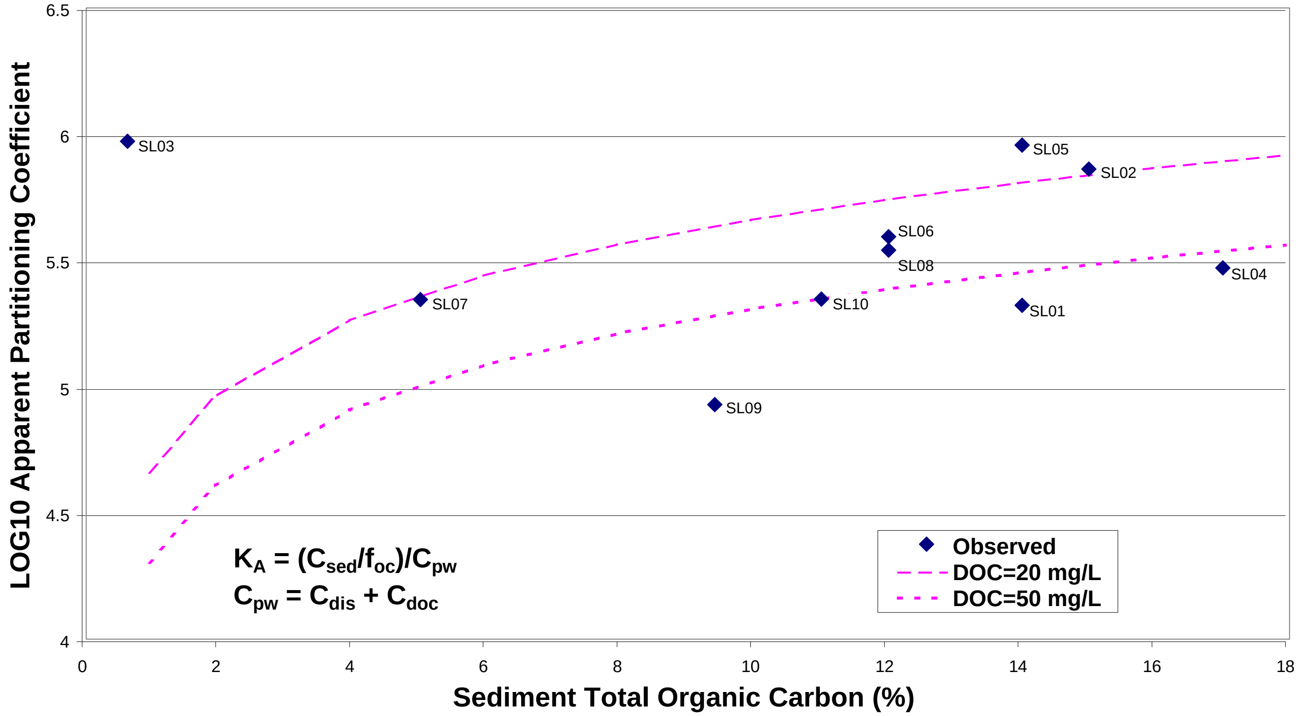


GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
SILVER LAKE
PRE-DESIGN INVESTIGATION REPORT

OBSERVED K_A VS. OBSERVED DOC

BBL

FIGURE
7

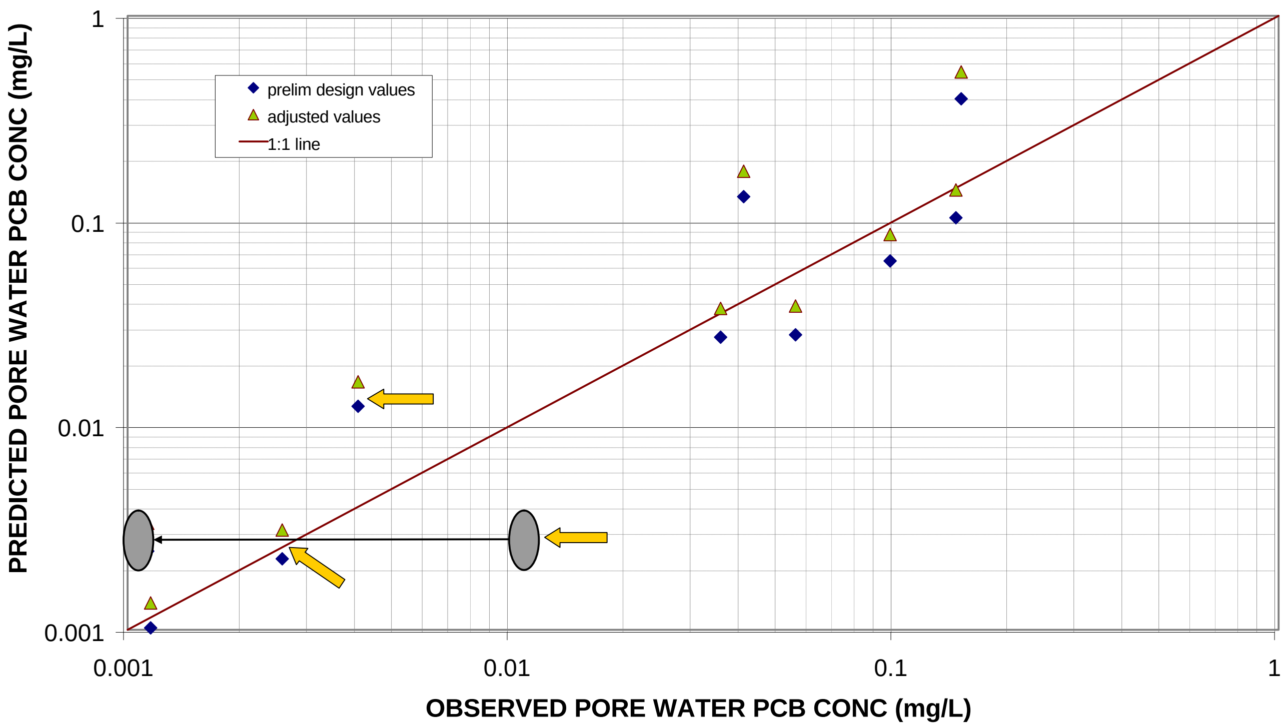


GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
SILVER LAKE
PRE-DESIGN INVESTIGATION REPORT

OBSERVED K_A VS. OBSERVED TOC

BBL

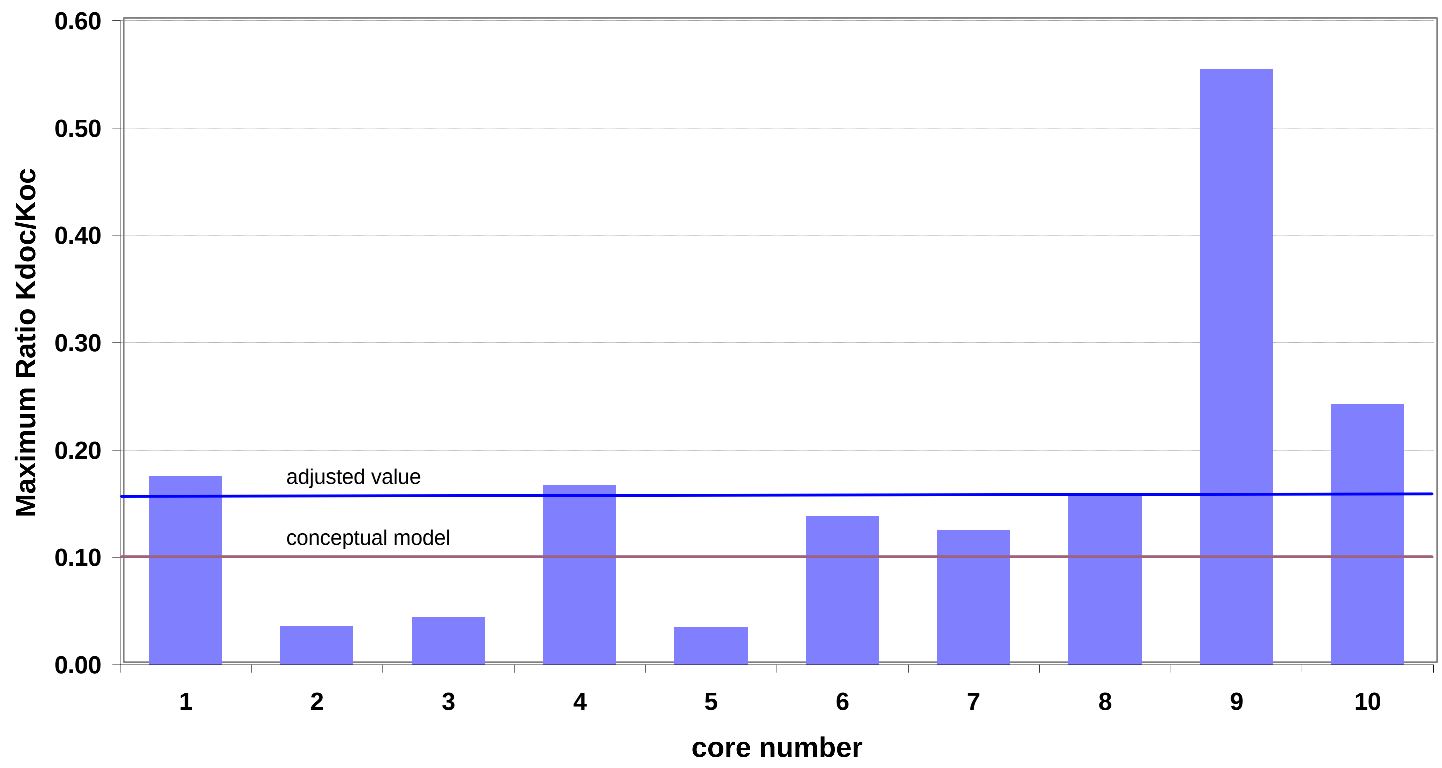
FIGURE
8



GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
SILVER LAKE
PRE-DESIGN INVESTIGATION REPORT

OBSERVED VS. PREDICTED PORE WATER PCB CONCENTRATIONS

FIGURE
9

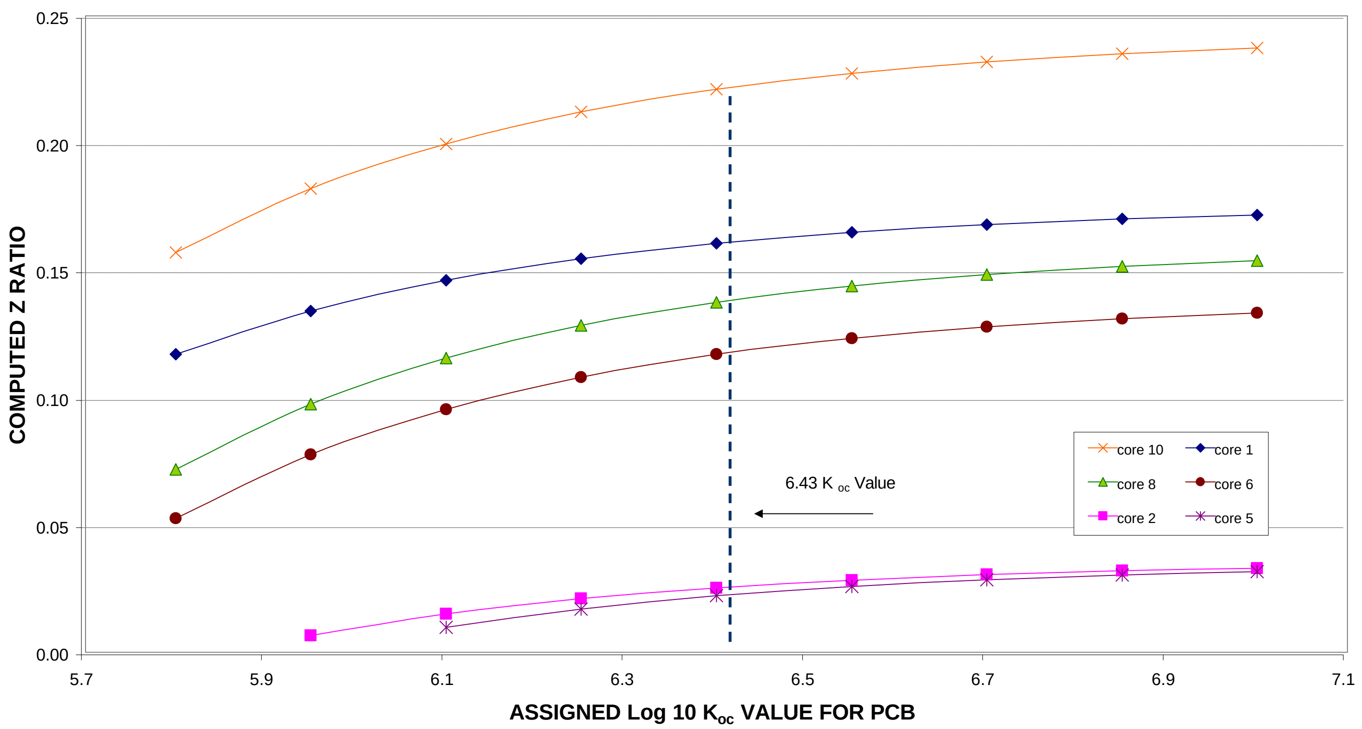


GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
SILVER LAKE
PRE-DESIGN INVESTIGATION REPORT

MAXIMUM RATIO:
K_{doc}/K_{oc}

BBL

FIGURE
10



GENERAL ELECTRIC COMPANY

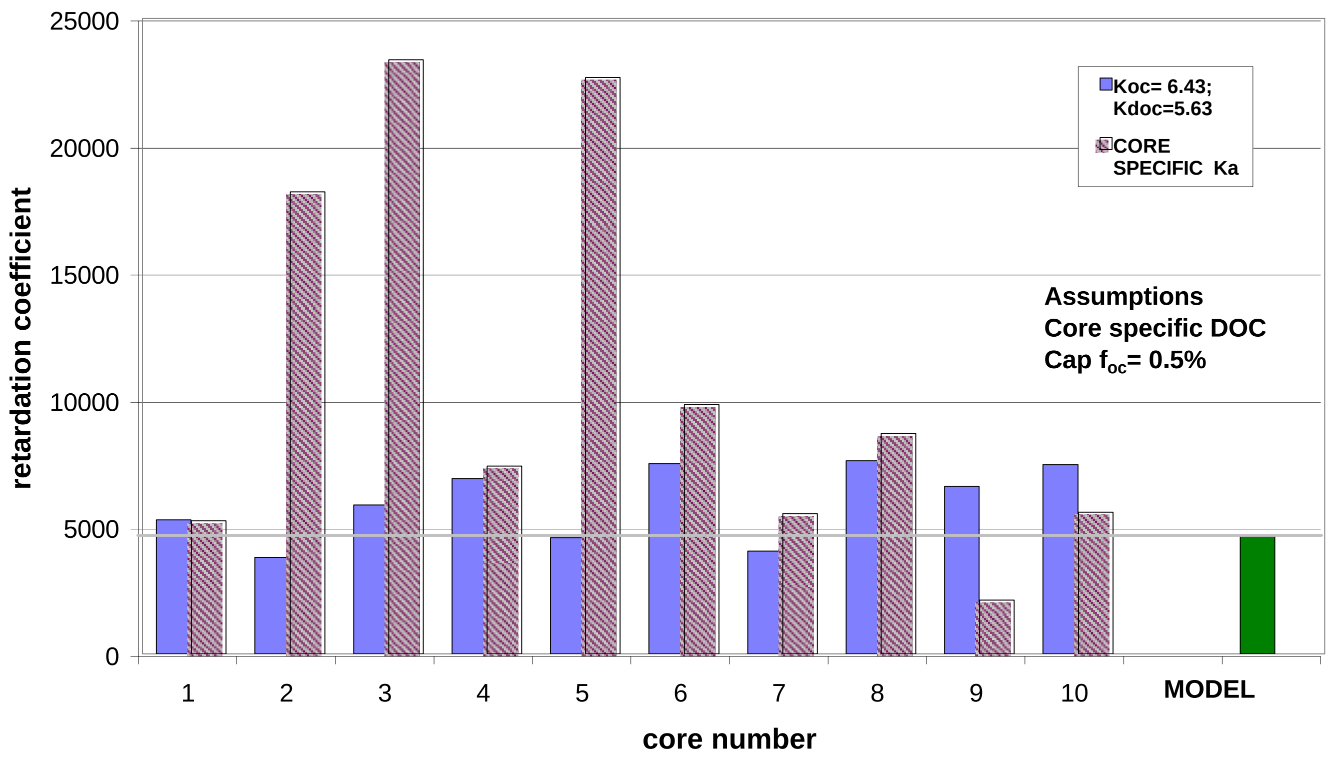
PITTSFIELD, MASSACHUSETTS

SILVER LAKE
PRE-DESIGN INVESTIGATION REPORT

RANGE OF POSSIBLE Z RATIOS

BBL

FIGURE
11



GENERAL ELECTRIC COMPANY

PITTSFIELD, MASSACHUSETTS

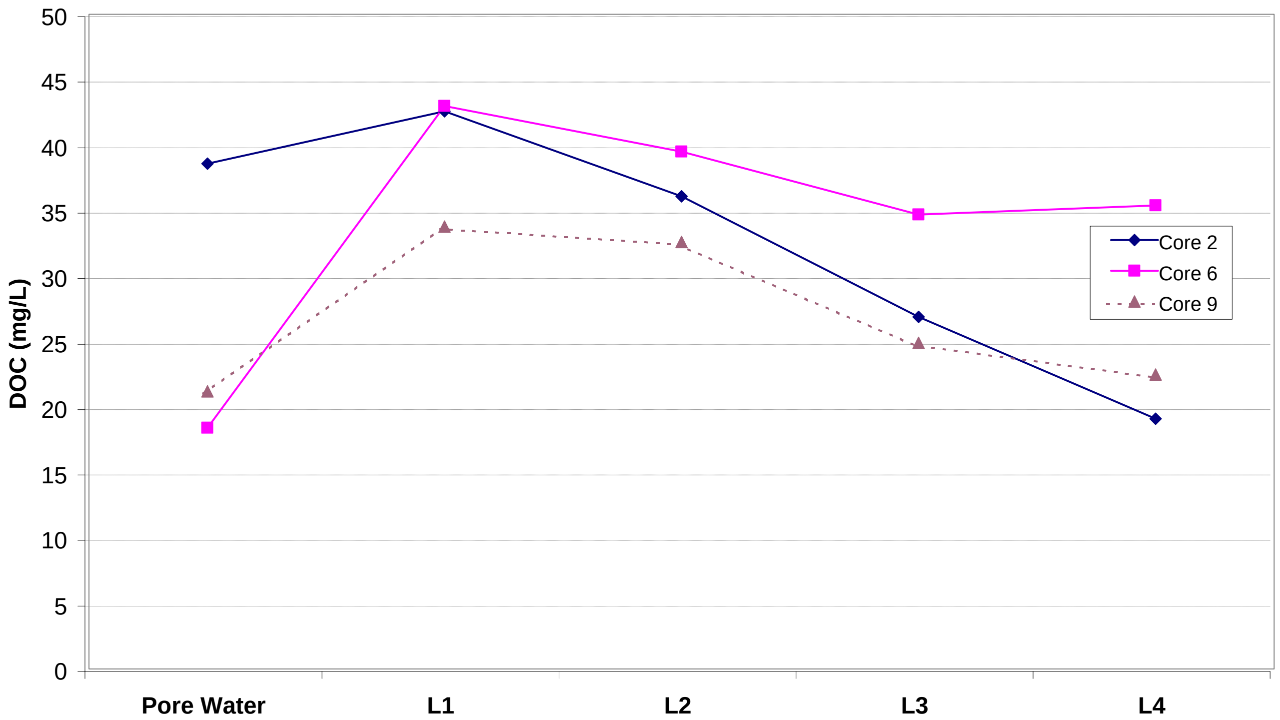
SILVER LAKE

PRE-DESIGN INVESTIGATION REPORT

COMPUTED CAP RETARDATION COEFFICIENT

BBL

FIGURE 12

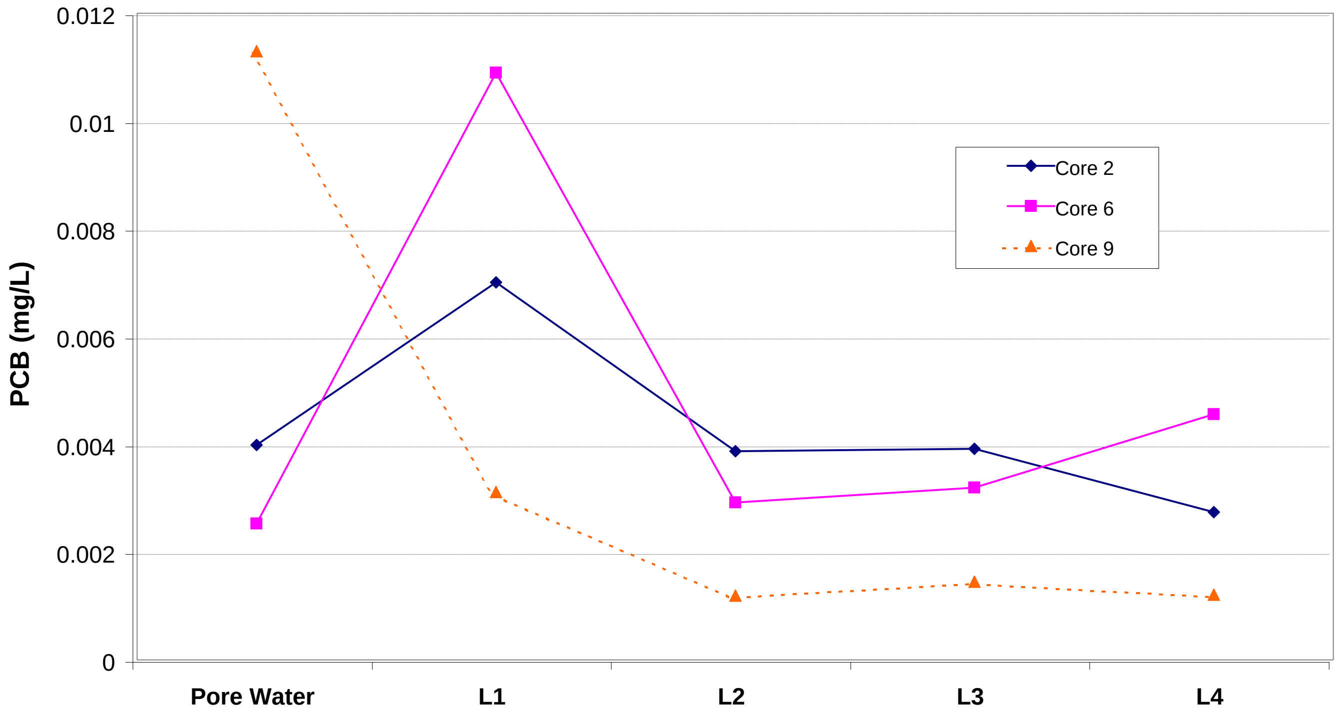


GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
SILVER LAKE
PRE-DESIGN INVESTIGATION REPORT

PORE WATER DOC- SBLT

BBL

FIGURE
13

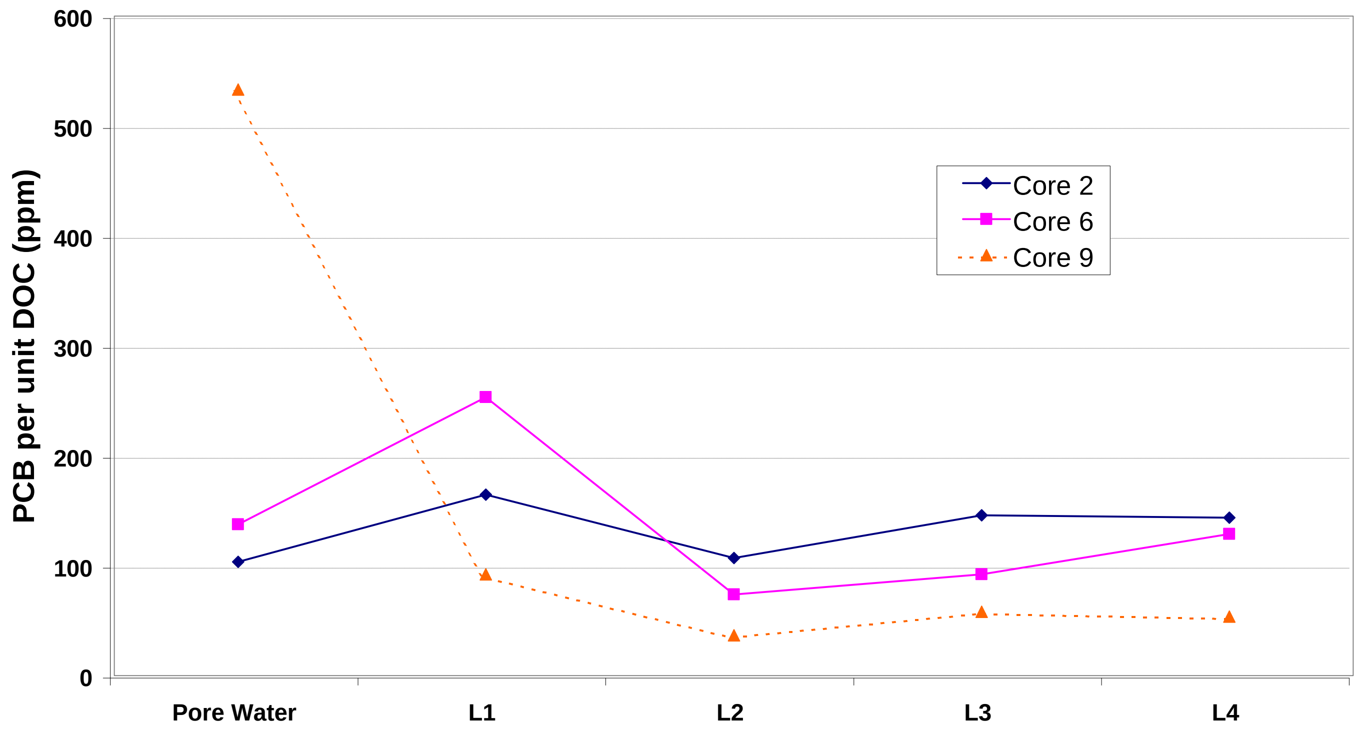


GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
SILVER LAKE
PRE-DESIGN INVESTIGATION REPORT

PORE WATER DISSOLVED PCB- SBLT

BBL

FIGURE
14

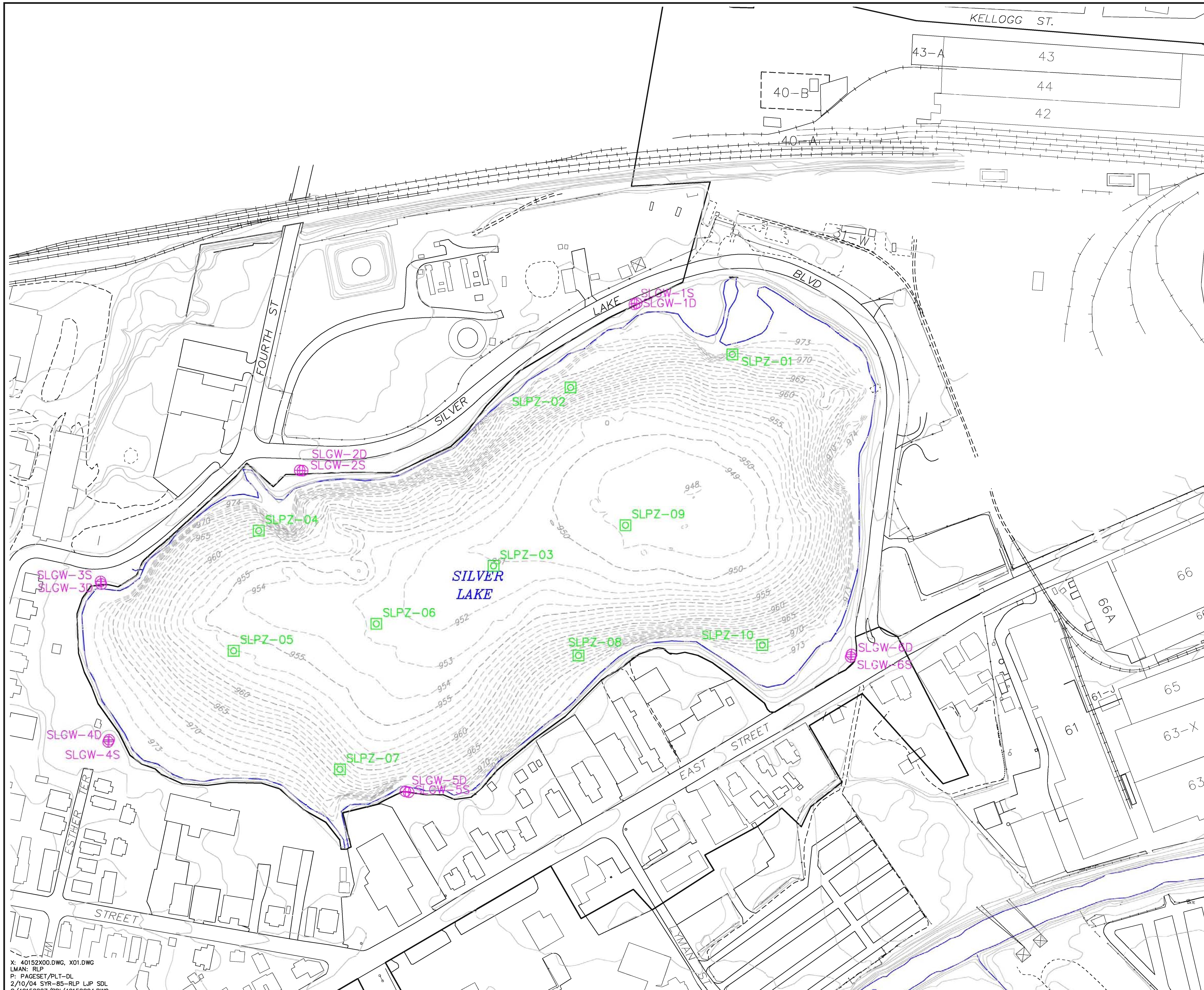


GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
SILVER LAKE
PRE-DESIGN INVESTIGATION REPORT

PORE WATER DISSOLVED PCB/ UNIT DOC- SBLT

BBL

FIGURE **15**



LEGEND

WELL PAIR LOCATIONS

LAKE PIEZOMETER LOCATIONS

ELEVATION CONTOUR

NOTES:

1. MAPPING IS BASED ON AERIAL PHOTOGRAPHS AND PHOTOGRAMMETRIC MAPPING BY LOCKWOOD MAPPING, INC. – FLOWN IN APRIL 1990; DATA PROVIDED BY GENERAL ELECTRIC COMPANY, AND BLASLAND AND BOUCK ENGINEERS, P.C. CONSTRUCTION PLANS.
2. NOT ALL PHYSICAL FEATURES SHOWN.
3. SITE BOUNDARY IS APPROXIMATE.
4. ALL MONITORING WELL LOCATIONS ARE APPROXIMATE.
5. THE CONTOUR INFORMATION PRESENTED ON THIS DRAWING REPRESENTS THE RESULTS OF A SURVEY PERFORMED BY OCEAN SURVEYS, INC. ON 10–13 JUNE 2003 AND CAN ONLY BE CONSIDERED AS INDICATING THE CONDITIONS EXISTING AT THAT TIME. REUSE OF THIS INFORMATION BY CLIENT OR OTHERS BEYOND THE SPECIFIC SCOPE OF WORK FOR WHICH IT WAS ACQUIRED SHALL BE AT THE SOLE RISK OF THE USER AND WITHOUT LIABILITY TO OSI.

0 220' 440'

GRAPHIC SCALE

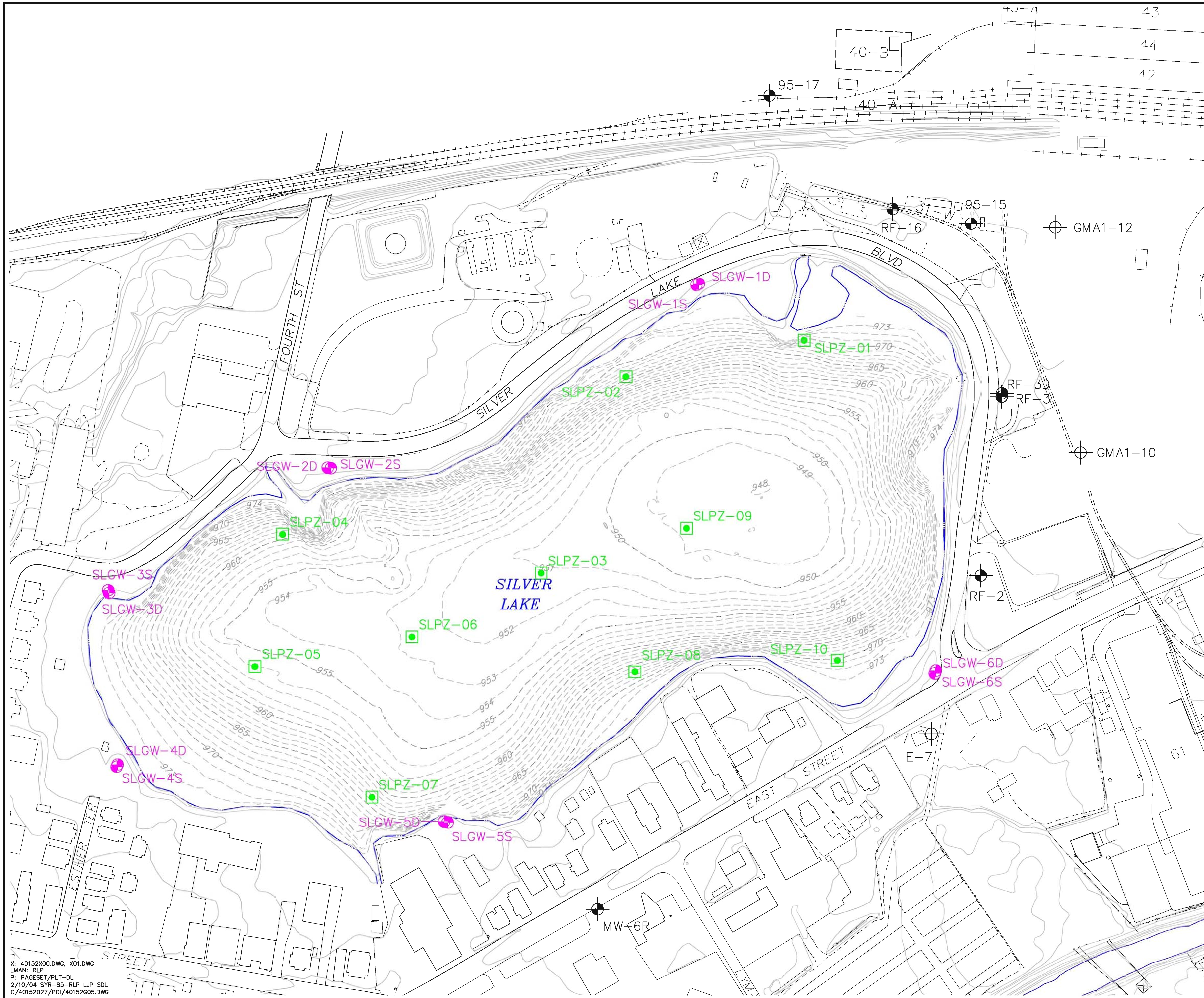
X: 40152X00.DWG, X01.DWG
LMAN: RLP
P: PAGESET/PLT-DL
2/10/04 SYR-85-RLP LJP SDL
C/40152027/PDI/40152G04.DWG

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
SILVER LAKE
PRE-DESIGN INVESTIGATION REPORT

PRE-DESIGN INVESTIGATION WELL PAIR AND PIEZOMETER LOCATIONS

BBL
BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

FIGURE **16**



LEGEND

- ELEVATION CONTOUR
- PRE-DESIGN WELL PAIR LOCATIONS
- PRE-DESIGN LAKE PIEZOMETER LOCATIONS
- MONITORING WELL

NOTES:

1. MAPPING IS BASED ON AERIAL PHOTOGRAPHS AND PHOTOGRAMMETRIC MAPPING BY LOCKWOOD MAPPING, INC. – FLOWN IN APRIL 1990; DATA PROVIDED BY GENERAL ELECTRIC COMPANY, AND BLASLAND AND BOUCK ENGINEERS, P.C. CONSTRUCTION PLANS.
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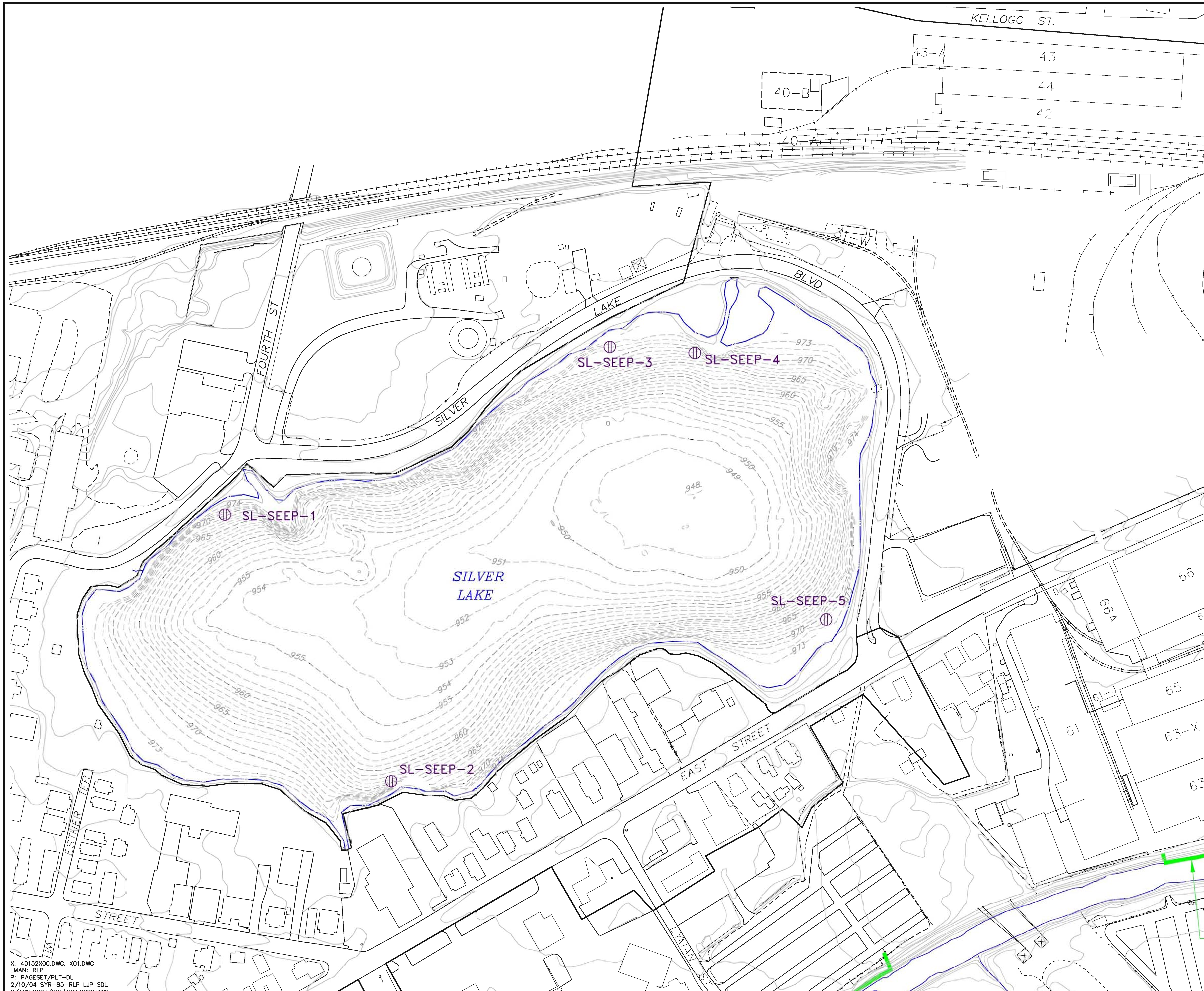
GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
SILVER LAKE
PRE-DESIGN INVESTIGATION REPORT

GROUNDWATER AND LAKE LEVEL MEASUREMENT LOCATIONS

BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

FIGURE
17

X: 40152X00.DWG, X01.DWG
LMAN: RLP
P: PAGESET/PLT-DL
2/10/04 SYR-85-RLP LJP SDL
C/40152027/PDI/40152G05.DWG



LEGEND

- SEEPAGE METER LOCATIONS
- ELEVATION CONTOUR

NOTES:

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4. ALL LOCATIONS ARE APPROXIMATE.
5. THE CONTOUR INFORMATION PRESENTED ON THIS DRAWING REPRESENTS THE RESULTS OF A SURVEY PERFORMED BY OCEAN SURVEYS, INC. ON 10–13 JUNE 2003 AND CAN ONLY BE CONSIDERED AS INDICATING THE CONDITIONS EXISTING AT THAT TIME. REUSE OF THIS INFORMATION BY CLIENT OR OTHERS BEYOND THE SPECIFIC SCOPE OF WORK FOR WHICH IT WAS ACQUIRED SHALL BE AT THE SOLE RISK OF THE USER AND WITHOUT LIABILITY TO OSI.

0 220' 440'

GRAPHIC SCALE

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
SILVER LAKE
PRE-DESIGN INVESTIGATION REPORT

PRE-DESIGN INVESTIGATION SEEPAGE METER LOCATIONS

BBL BLASLAND, BOUCK & LEE, INC. engineers, scientists, economists

FIGURE 18

LEGEND

- LAKE PIEZOMETER WATER SURFACE LOCATION
- APPROXIMATE OUTFALL LOCATIONS
- ELEVATION CONTOUR
- MINITROLL SURFACE WATER ELEVATION MONITORING POINT

NOTES:

1. MAPPING IS BASED ON AERIAL PHOTOGRAPHS AND PHOTOGRAMMETRIC MAPPING BY LOCKWOOD MAPPING, INC. – FLOWN IN APRIL 1990; DATA PROVIDED BY GENERAL ELECTRIC COMPANY, AND BLASLAND AND BOUCK ENGINEERS, P.C. CONSTRUCTION PLANS.
2. NOT ALL PHYSICAL FEATURES SHOWN.
3. SITE BOUNDARY IS APPROXIMATE.
4. GE WEATHER STATION LOCATED APPROXIMATELY 1800' EAST OF LAKE, BETWEEN BUILDINGS 64T AND 64G OF THE GE FACILITY.
5. THE CONTOUR INFORMATION PRESENTED ON THIS DRAWING REPRESENTS THE RESULTS OF A SURVEY PERFORMED BY OCEAN SURVEYS, INC. ON 10–13 JUNE 2003 AND CAN ONLY BE CONSIDERED AS INDICATING THE CONDITIONS EXISTING AT THAT TIME. REUSE OF THIS INFORMATION BY CLIENT OR OTHERS BEYOND THE SPECIFIC SCOPE OF WORK FOR WHICH IT WAS ACQUIRED SHALL BE AT THE SOLE RISK OF THE USER AND WITHOUT LIABILITY TO OSI.

0 220' 440'

GRAPHIC SCALE

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
SILVER LAKE
PRE-DESIGN INVESTIGATION REPORT

WATER BUDGET METER LOCATIONS

BBL
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engineers, scientists, economists

FIGURE 19

Outfall C: Looking downstream at channel and culvert to Housatonic River .

Outfall A: Looking upstream into culvert. Orange stripes designate locations for velocity measurements

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS

SILVER LAKE

PRE-DESIGN INVESTIGATION REPORT

OUTFALL A and C

BBL

FIGURE
20

Outfall B: Prior to removal of sediment and debris.

Outfall B: Showing conveyance after removal of sediment and debris.

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
SILVER LAKE
PRE-DESIGN INVESTIGATION REPORT

OUTFALL B

BBL
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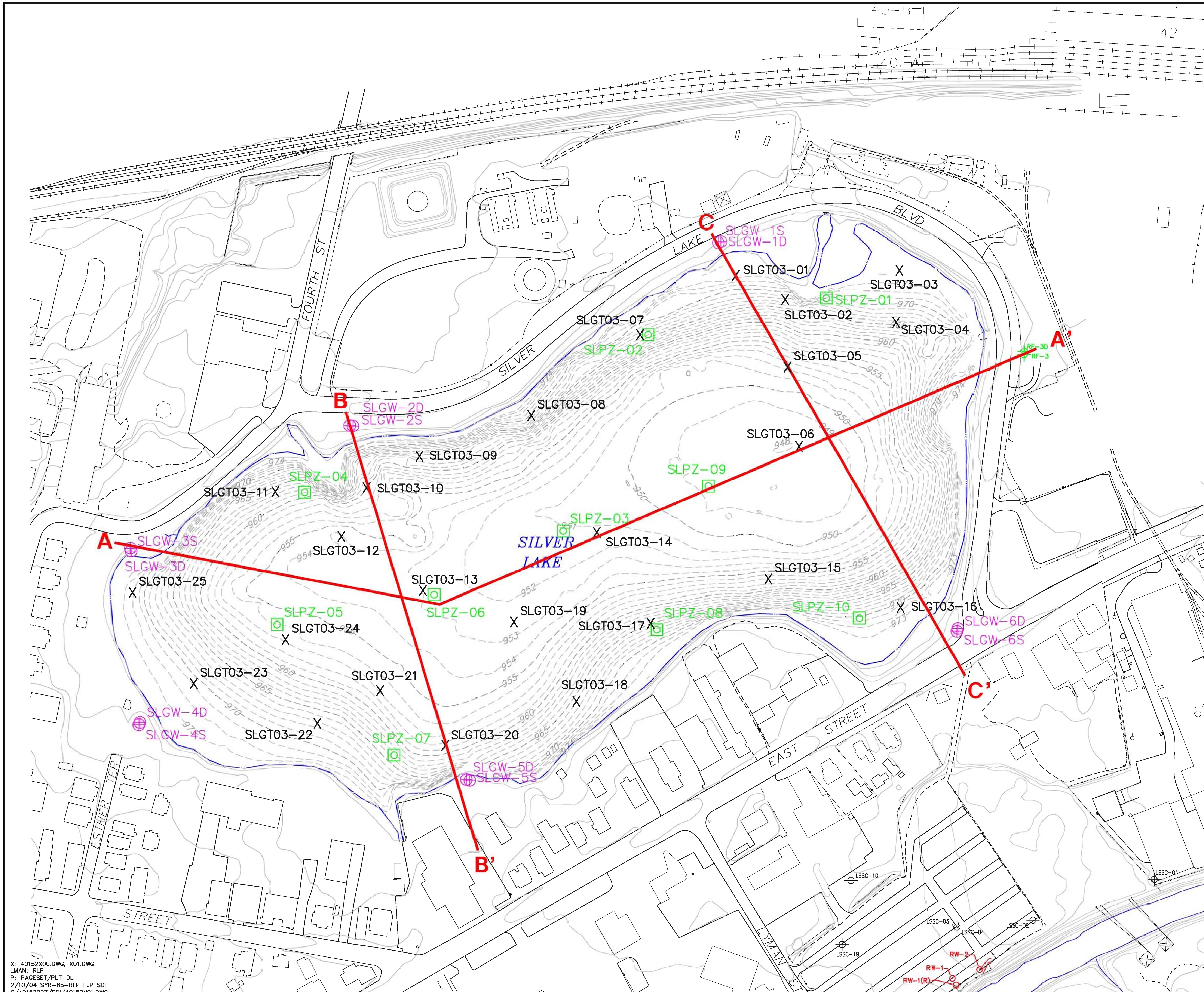
engineers & scientists

FIGURE
21



LEGEND

A—A' CROSS-SECTION LOCATION

X PRE-DESIGN GEOTECHNICAL SAMPLING LOCATIONS

PRE-DESIGN WELL PAIR LOCATIONS

PRE-DESIGN LAKE PIEZOMETER LOCATIONS

ELEVATION CONTOUR

RF-3 PREVIOUS WELL PAIR LOCATION

NOTES:

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0 200' 400'

GRAPHIC SCALE

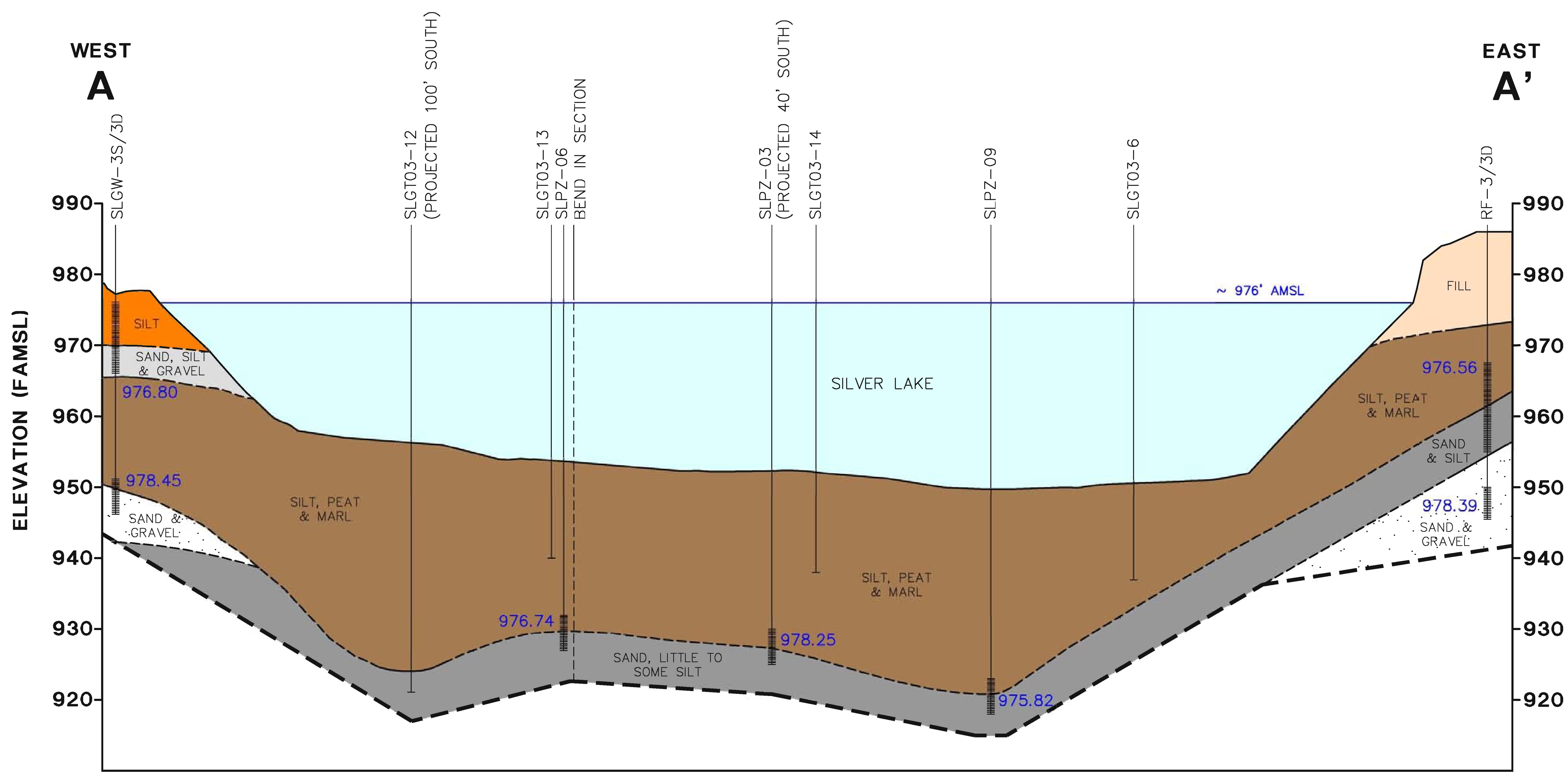
GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
SILVER LAKE
PRE-DESIGN INVESTIGATION REPORT

GEOTECHNICAL CROSS-SECTION LOCATIONS

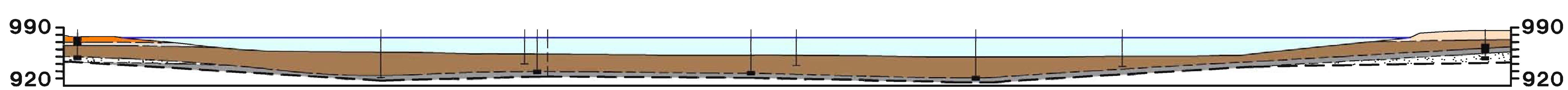
BBL BLASLAND, BOUCK & LEE, INC. engineers, scientists, economists

FIGURE
22

X: 40152X00.DWG, X01.DWG
LMAN: RLP
P: PAGESET/PLT-DL
2/10/04 SYR-85-RLP LJP SDL
C/40152027/PDI/40152V01.DWG



VERTICAL EXAGGERATION = 10X



NO VERTICAL EXAGGERATION

LEGEND:

SLGT03-6 SLPZ-09 ← BORING/WELL/PIEZOMETER NUMBER

← MONITORING WELL/PIEZOMETER

← SOIL BORING

← SCREENED INTERVAL

← BOTTOM OF BORING

——— GEOLOGIC CONTACT (DASHED WHERE INFERRED)

976.56 GROUNDWATER ELEVATION (10/30/03, SEE NOTE 4)

NOTES:

1. PROJECTION DISTANCES OF <40' NOT NOTED.
2. GEOLOGIC CONTACT INFORMATION FOR THE SLPZ-SERIES PIEZOMETERS ARE BASED ON RESISTANCE-TO-PENETRATION OBSERVATIONS MADE AS THE PIEZOMETERS WERE DRIVEN.
3. FAMSL = FEET ABOVE MEAN SEA LEVEL (NATIONAL GEODETIC VERTICAL DATUM OF 1929).
4. WATER-LEVEL DATA FOR THE RF-3 CLUSTER COLLECTED ON 10/16/03.

0 100' 200'
HORIZONTAL GRAPHIC SCALE

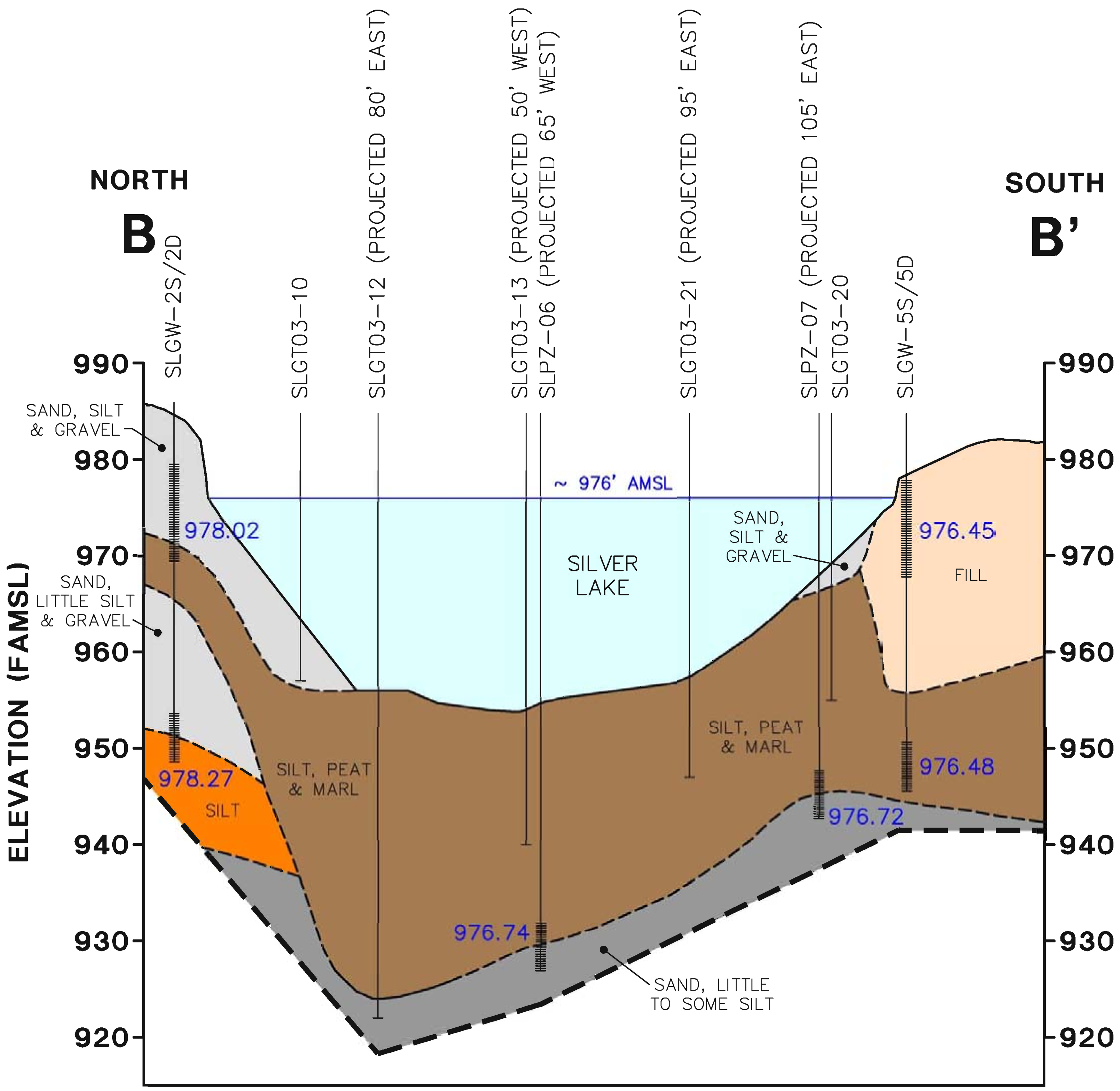
GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
SILVER LAKE
PRE-DESIGN INVESTIGATION REPORT

GEOTECHNICAL CROSS SECTION A-A'

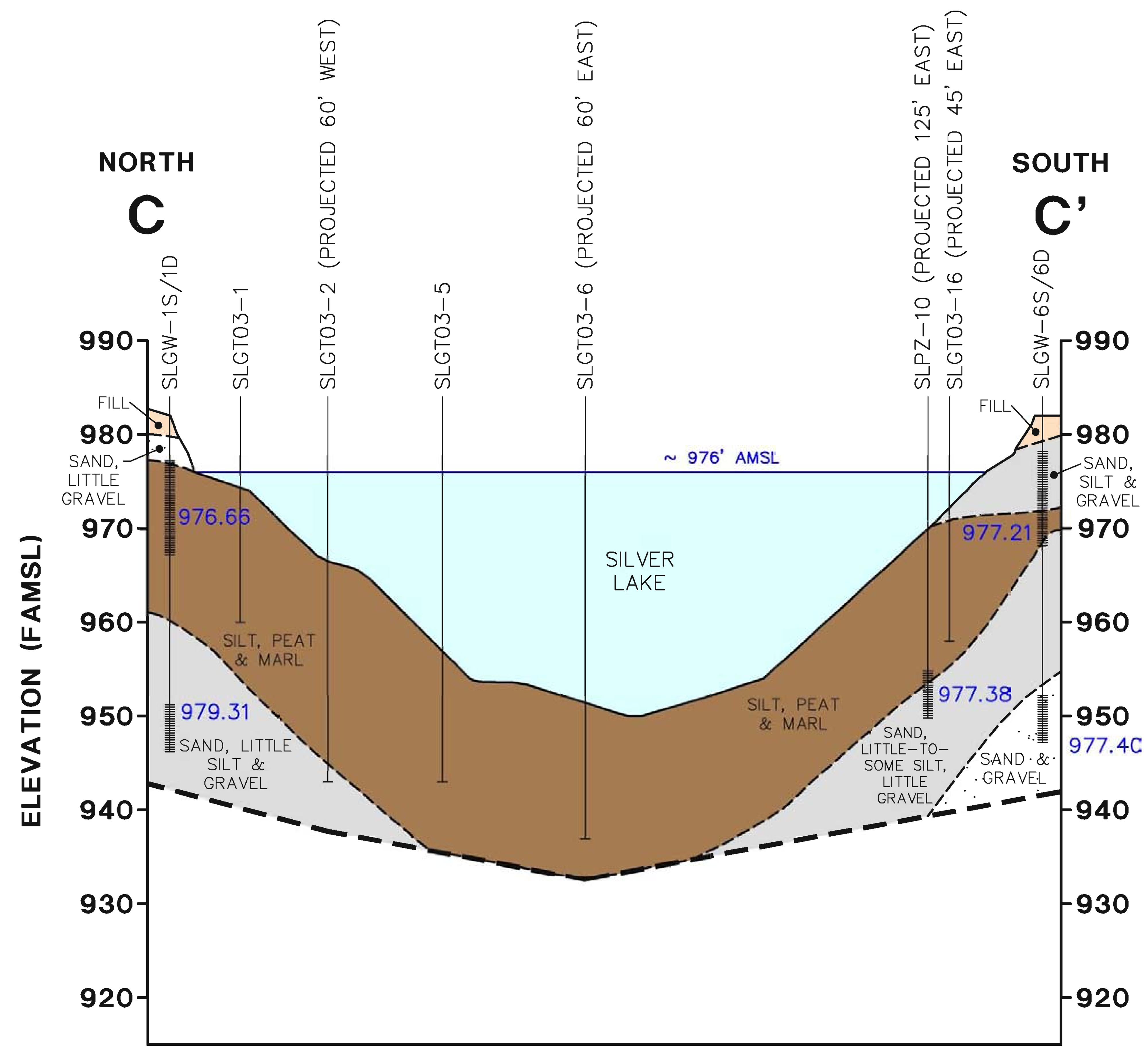
BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

FIGURE
23A

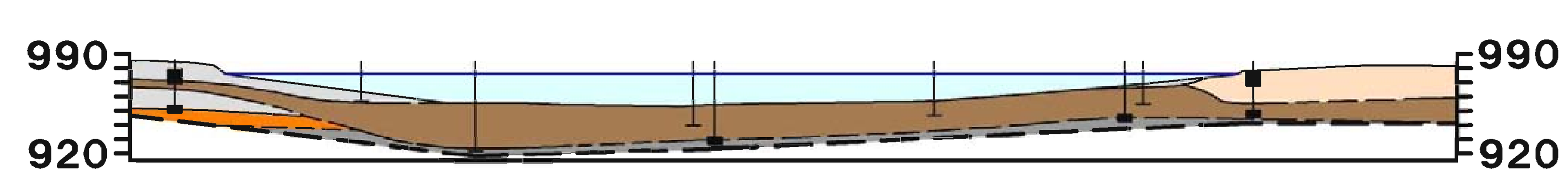
X: 40152X00.DWG
L: ON=*, OFF=REF*
P: PAGESET/PLT-DL
2/10/04 SYR-85-KMD LJP SDL
C/40152027/PDI/40152V02.DWG



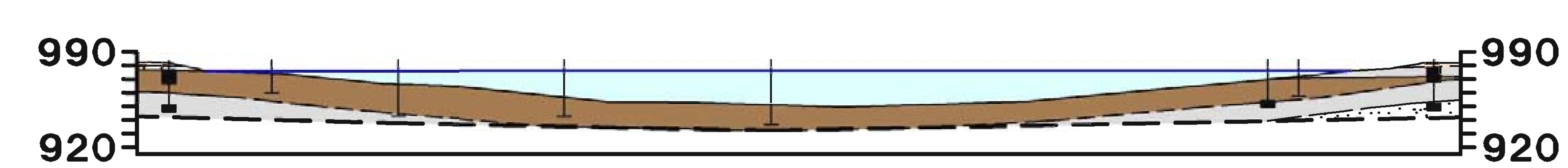
VERTICAL EXAGGERATION = 10X



VERTICAL EXAGGERATION = 10X

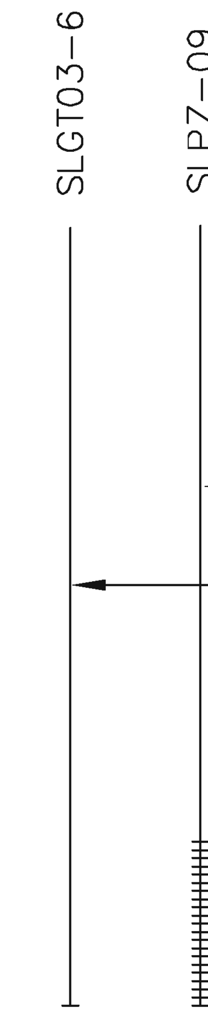


NO VERTICAL EXAGGERATION



NO VERTICAL EXAGGERATION

LEGEND:



GEOLOGIC CONTACT (DASHED WHERE INFERRED)

977.38 GROUNDWATER ELEVATION (10/30/03)

NOTES:

1. PROJECTION DISTANCES OF <40' NOT NOTED.
2. GEOLOGIC CONTACT INFORMATION FOR THE SLPZ-SERIES PIEZOMETERS ARE BASED ON RESISTANCE-TO-PENETRATION OBSERVATIONS MADE AS THE PIEZOMETERS WERE DRIVEN.
3. FAMSL = FEET ABOVE MEAN SEA LEVEL (NATIONAL GEODETIC VERTICAL DATUM OF 1929).

0 100' 200'
GRAPHIC SCALE

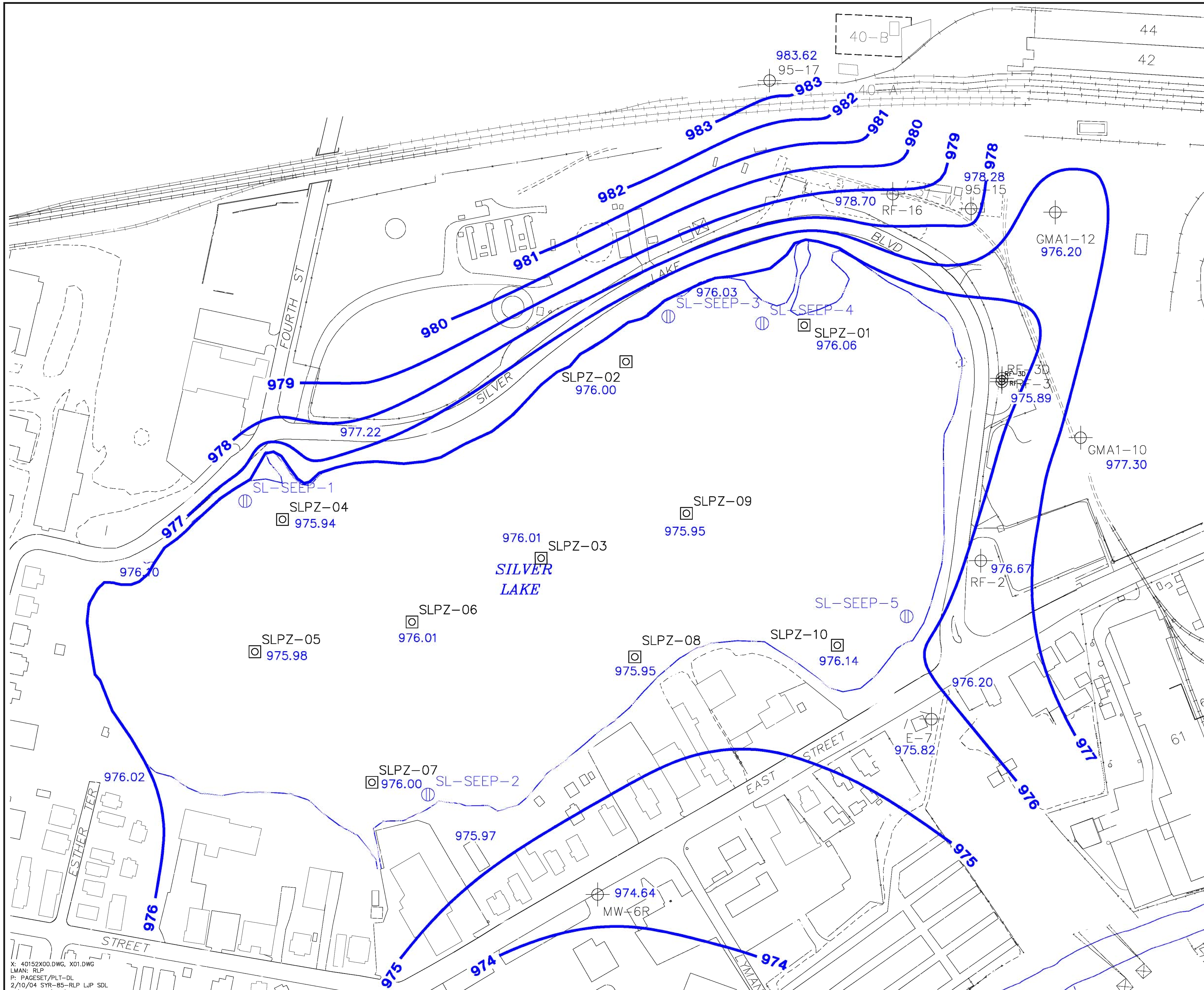
X: 40152X00.DWG
L: ON=*, OFF=REF*
P: PAGESET/PLT-DL
2/10/04 SYR-85-KMD LJP SDL
C/40152027/PDI/40152V03.DWG

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
SILVER LAKE
PRE-DESIGN INVESTIGATION REPORT

GEOTECHNICAL CROSS SECTION B-B' AND CROSS SECTION C-C'

BBL
BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

FIGURE
23B



LEGEND

ELEVATION CONTOUR

PRE-DESIGN WELL PAIR LOCATIONS

PRE-DESIGN LAKE PIEZOMETER LOCATIONS

PRE-DESIGN SEEPAGE METER LOCATIONS

MONITORING WELL

977.30 GROUNDWATER OR LAKE ELEVATION (FT)

977 GROUNDWATER ELEVATION

NOTES:

1. MAPPING IS BASED ON AERIAL PHOTOGRAPHS AND PHOTOGRAMMETRIC MAPPING BY LOCKWOOD MAPPING, INC. – FLOWN IN APRIL 1990; DATA PROVIDED BY GENERAL ELECTRIC COMPANY, AND BLASLAND AND BOUCK ENGINEERS, P.C. CONSTRUCTION PLANS.
2. NOT ALL PHYSICAL FEATURES SHOWN.
3. SITE BOUNDARY IS APPROXIMATE.
4. ALL MONITORING WELL LOCATIONS ARE APPROXIMATE.
5. DATA POSTED FOR SLPZ LOCATIONS INDICATE LAKE ELEVATION MEASURED OUTSIDE PIEZOMETER RISER PIPE.
6. THE CONTOUR INFORMATION PRESENTED ON THIS DRAWING REPRESENTS THE RESULTS OF A SURVEY PERFORMED BY OCEAN SURVEYS, INC. ON 10–13 JUNE 2003 AND CAN ONLY BE CONSIDERED AS INDICATING THE CONDITIONS EXISTING AT THAT TIME. REUSE OF THIS INFORMATION BY CLIENT OR OTHERS BEYOND THE SPECIFIC SCOPE OF WORK FOR WHICH IT WAS ACQUIRED SHALL BE AT THE SOLE RISK OF THE USER AND WITHOUT LIABILITY TO OSI.

0 100' 200'
GRAPHIC SCALE

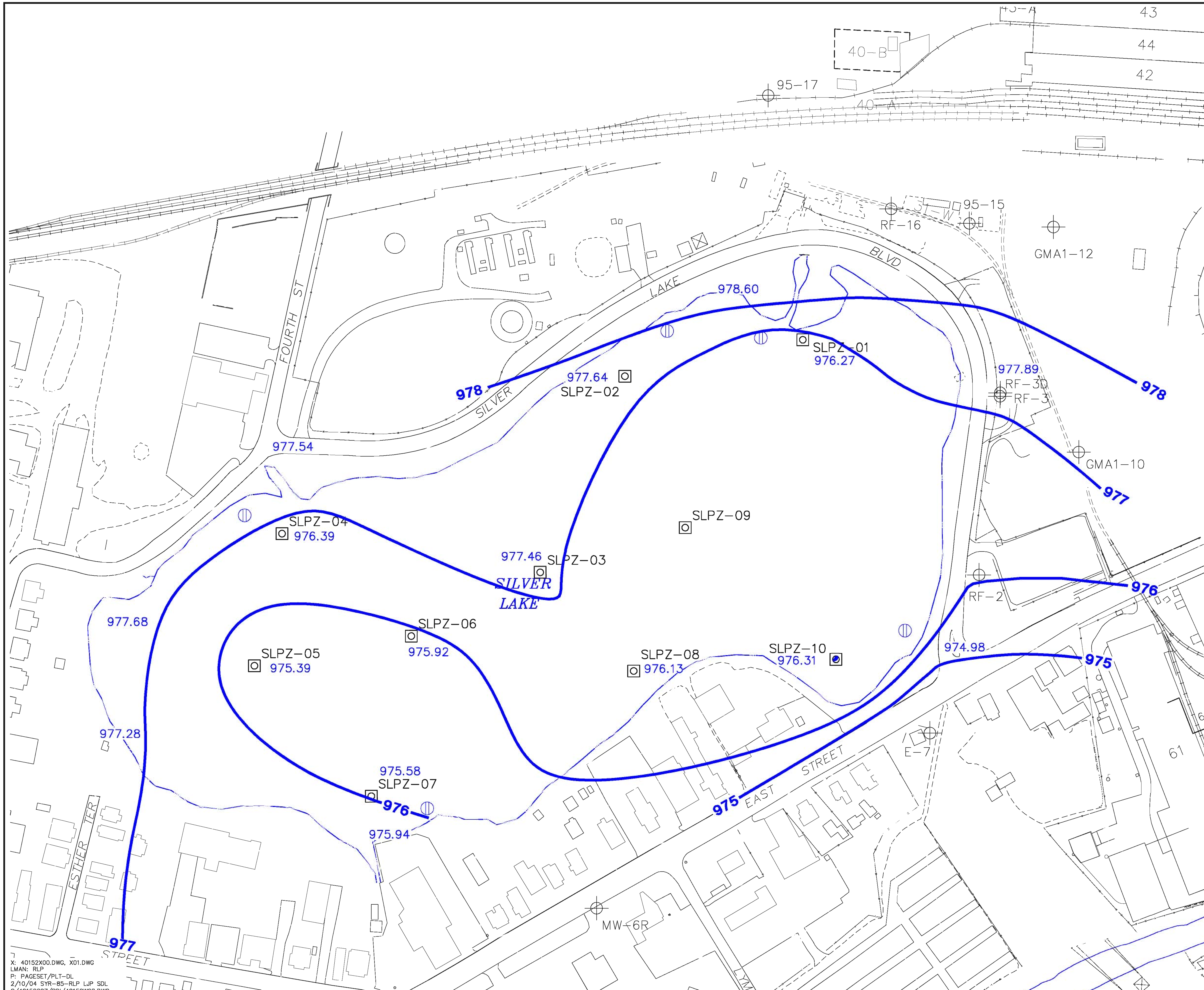
X: 40152X00.DWG, X01.DWG
LMAN: RLP
P: PAGESET/PLT-DL
2/10/04 SYR-85-RLP LJP SDL
C/40152027/PDI/40152W01.DWG

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
SILVER LAKE
PRE-DESIGN INVESTIGATION REPORT

GROUNDWATER ELEVATION CONTOUR MAP - SHALLOW WELLS FALL 2003

BBL®
BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

FIGURE
24A



LEGEND

ELEVATION CONTOUR

PRE-DESIGN WELL PAIR LOCATIONS

PRE-DESIGN LAKE PIEZOMETER LOCATIONS

PRE-DESIGN SEEPAGE METER LOCATIONS

MONITORING WELL

SURFACE WATER ELEVATION MONITORING POINT

977.60 GROUNDWATER ELEVATION (FT)

977 GROUNDWATER ELEVATION CONTOUR LINE (FT)

NOTES:

1. MAPPING IS BASED ON AERIAL PHOTOGRAPHS AND PHOTOGRAMMETRIC MAPPING BY LOCKWOOD MAPPING, INC. – FLOWN IN APRIL 1990; DATA PROVIDED BY GENERAL ELECTRIC COMPANY, AND BLASLAND AND BOUCK ENGINEERS, P.C. CONSTRUCTION PLANS.
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0 100' 200'
GRAPHIC SCALE

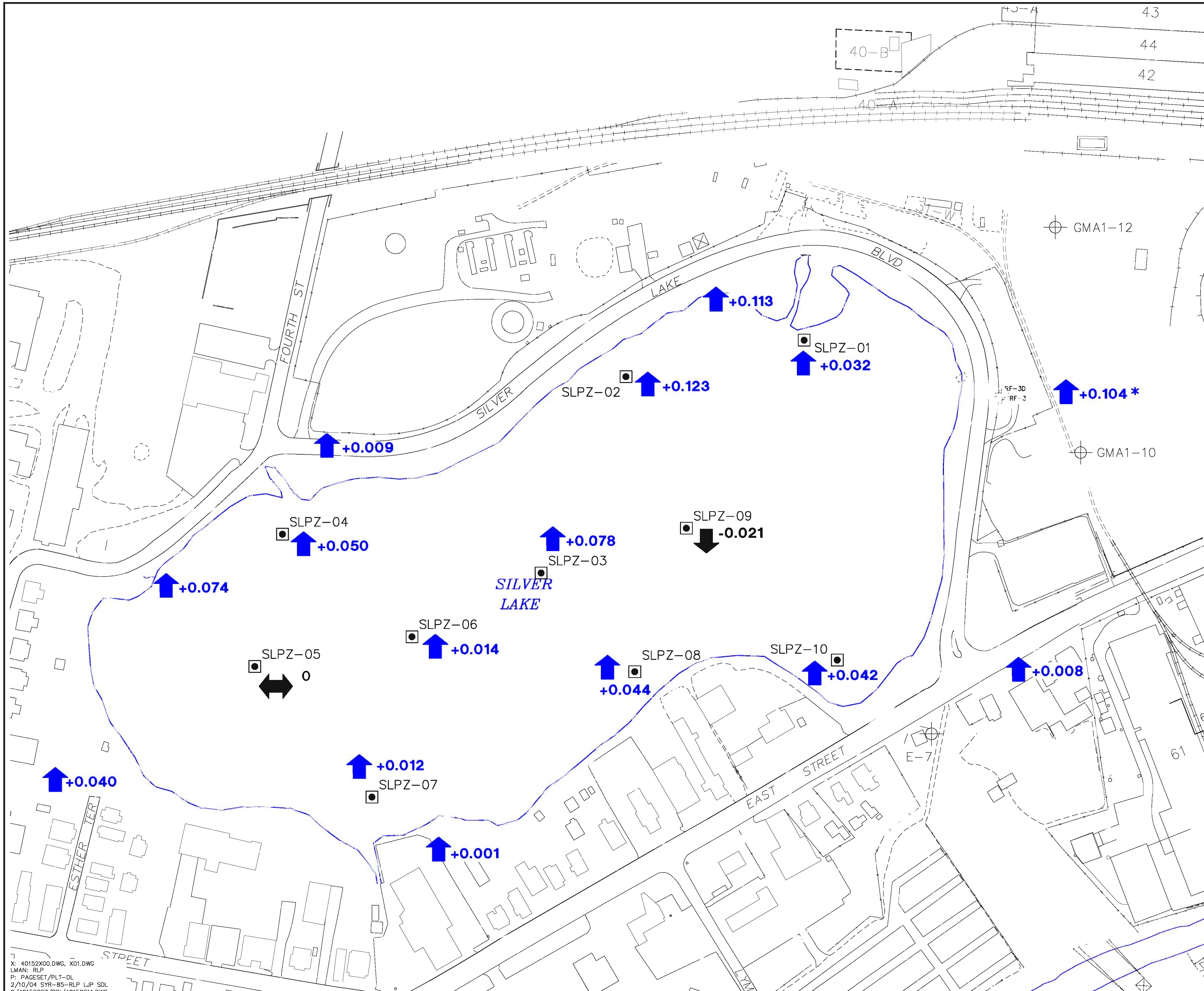
X: 40152X00.DWG, X01.DWG
LMAN: RLP
P: PAGESET/PLT-DL
2/10/04 SYR-85-RLP LJP SDL
C/40152027/PDI/40152W02.DWG

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
SILVER LAKE
PRE-DESIGN INVESTIGATION REPORT

GROUNDWATER ELEVATION CONTOUR MAP - DEEP WELLS FALL 2003

BBL
BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

FIGURE
24B



LEGEND

- ELEVATION CONTOUR
- WELL PAIR LOCATIONS
- PRE-DESIGN LAKE PIEZOMETER LOCATIONS
- +0.009 UPWARD VERTICAL HYDRAULIC GRADIENT
- -0.021 DOWNWARD VERTICAL HYDRAULIC GRADIENT
- 0 NO VERTICAL HYDRAULIC GRADIENT

NOTES:

1. MAPPING IS BASED ON AERIAL PHOTOGRAPHS AND PHOTOGRAMMETRIC MAPPING BY LOCKWOOD MAPPING, INC. – FLOWN IN APRIL 1990; DATA PROVIDED BY GENERAL ELECTRIC COMPANY, AND BLASLAND AND BOUCK ENGINEERS, P.C. CONSTRUCTION PLANS.
2. NOT ALL PHYSICAL FEATURES SHOWN.
3. SITE BOUNDARY IS APPROXIMATE.
4. ALL MONITORING WELL LOCATIONS ARE APPROXIMATE.
5. * DATA FOR THIS WELL PAIR COLLECTED ON 10/16/03.
6. THE CONTOUR INFORMATION PRESENTED ON THIS DRAWING REPRESENTS THE RESULTS OF A SURVEY PERFORMED BY OCEAN SURVEYS, INC. ON 10–13 JUNE 2003 AND CAN ONLY BE CONSIDERED AS INDICATING THE CONDITIONS EXISTING AT THAT TIME. REUSE OF THIS INFORMATION BY CLIENT OR OTHERS BEYOND THE SPECIFIC SCOPE OF WORK FOR WHICH IT WAS ACQUIRED SHALL BE AT THE SOLE RISK OF THE USER AND WITHOUT LIABILITY TO OSI.

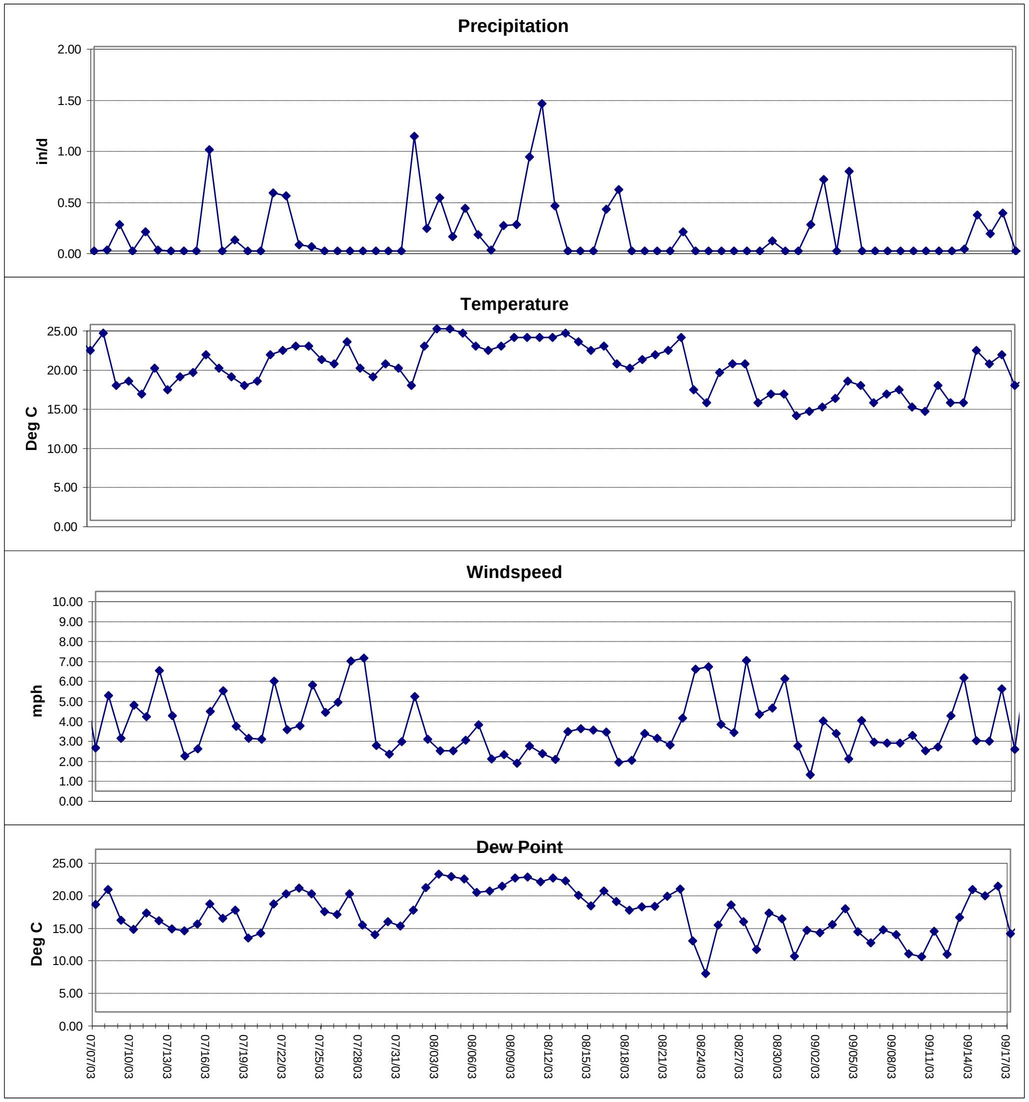
0 100' 200'
GRAPHIC SCALE

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
SILVER LAKE
PRE-DESIGN INVESTIGATION REPORT

VERTICAL HYDRAULIC GRADIENTS (10/30/03)

BBL®
BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

FIGURE
25



Note:
Meteorological data obtained from both a GE maintained weather station at Silver Lake, and a NWS data base supplying weather data from Taunton, Massachussetts.

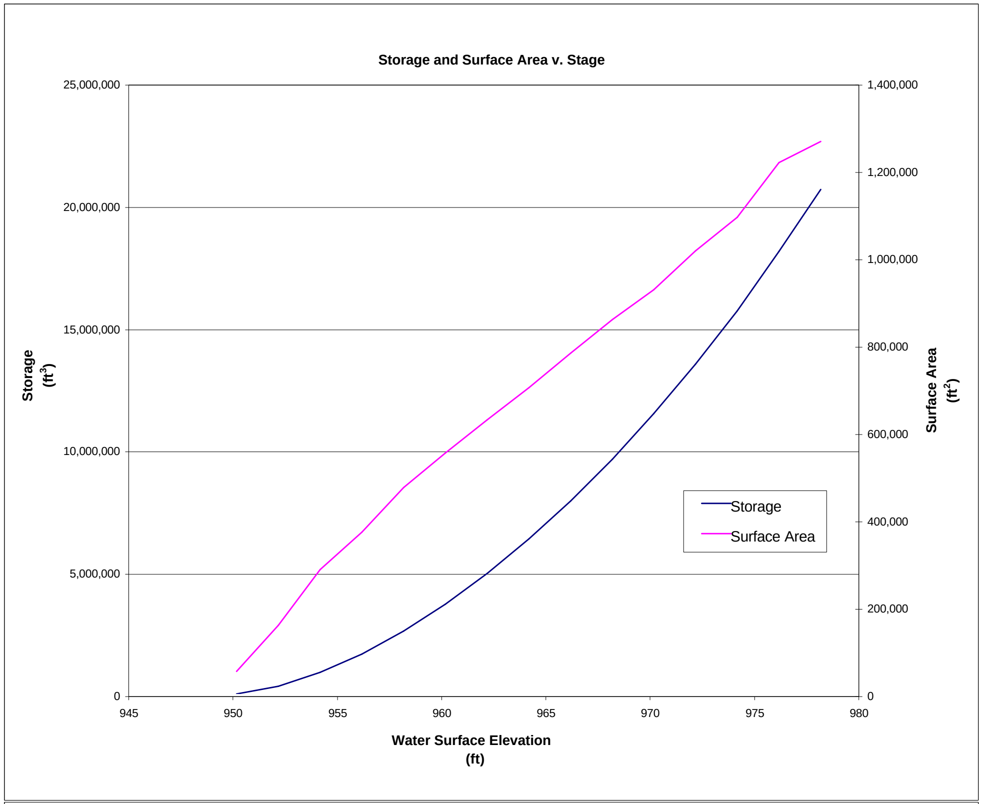
GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
SILVER LAKE
PRE-DESIGN INVESTIGATION REPORT

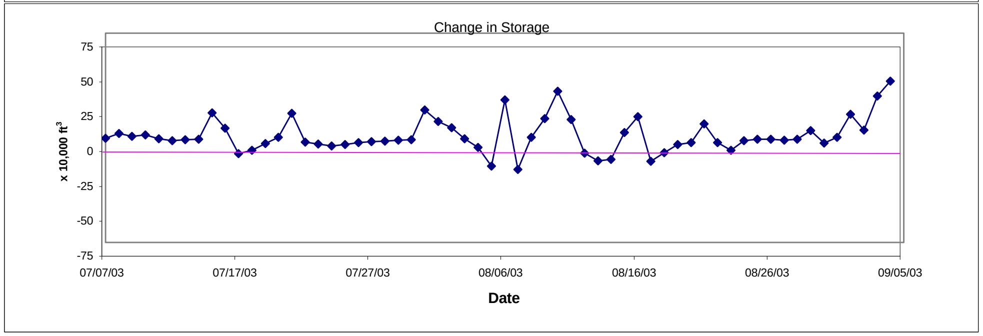
METEOROLOGICAL DATA

BBL

FIGURE
26

V:\GE_Silver_Lake\Reports and Presentations\PDI WP\PDI Report - Sediments\SL.PDI.Fig\sl.pdi.fig 2/11/2004





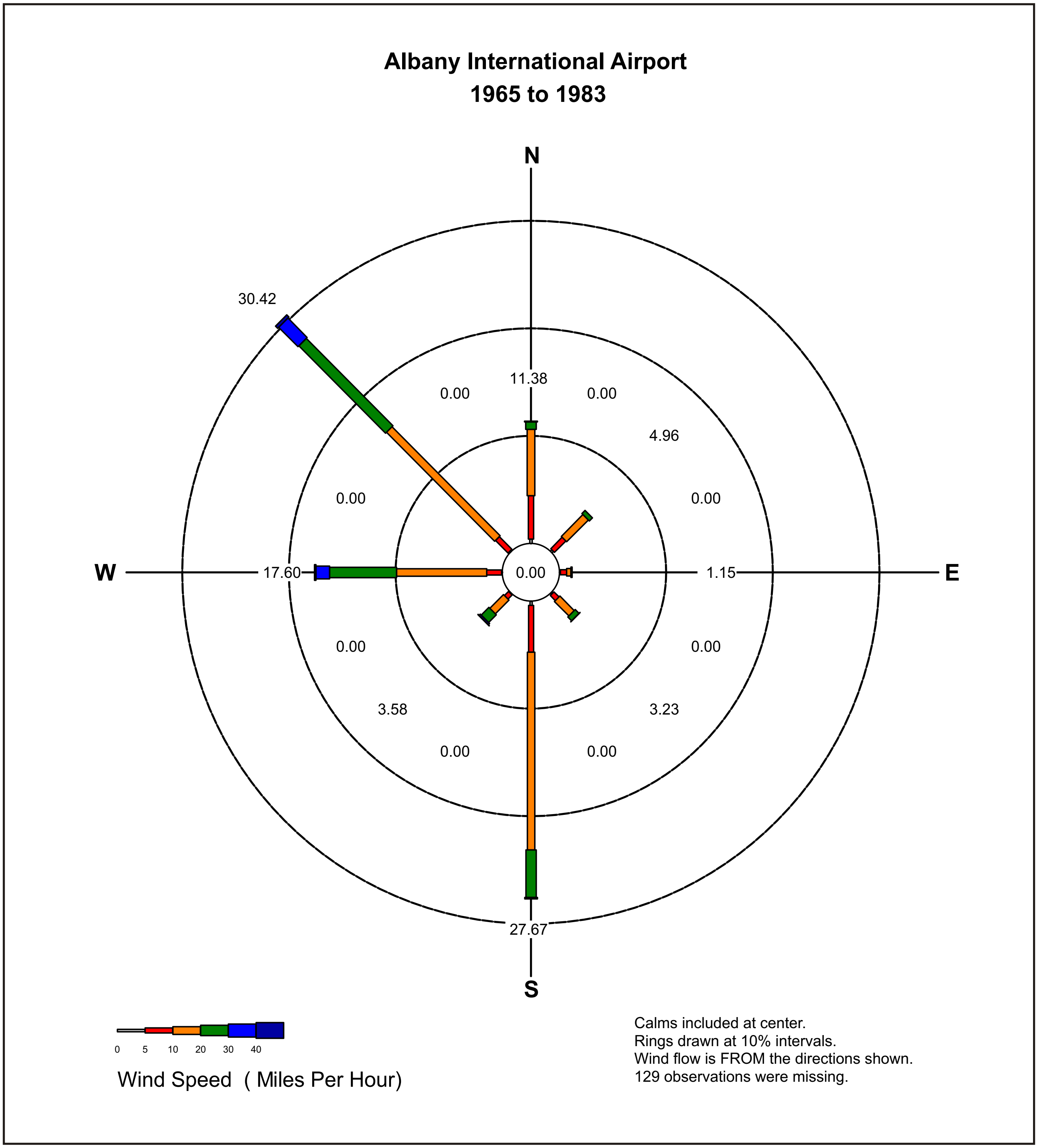
Water Surface Elevation (ft)	Water Surface Area (ft^2)	Lake Volume (ft^3)
950	51,766	lake bottom
952	157,180	314,360
954	284,613	883,585
956	370,072	1,623,729
958	472,585	2,568,898
960	551,485	3,671,868
962	627,825	4,927,518
964	701,020	6,329,557
966	779,968	7,889,494
968	856,947	9,603,388
970	925,629	11,454,646
972	1,013,856	13,482,358
974	1,091,413	15,665,185
976	1,216,302	18,097,788
978	1,265,255	20,628,298

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
SILVER LAKE
PRE-DESIGN INVESTIGATION REPORT

STAGE VS. STORAGE AND AREA

BBL

FIGURE
27



GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
SILVER LAKE
PRE-DESIGN INVESTIGATION

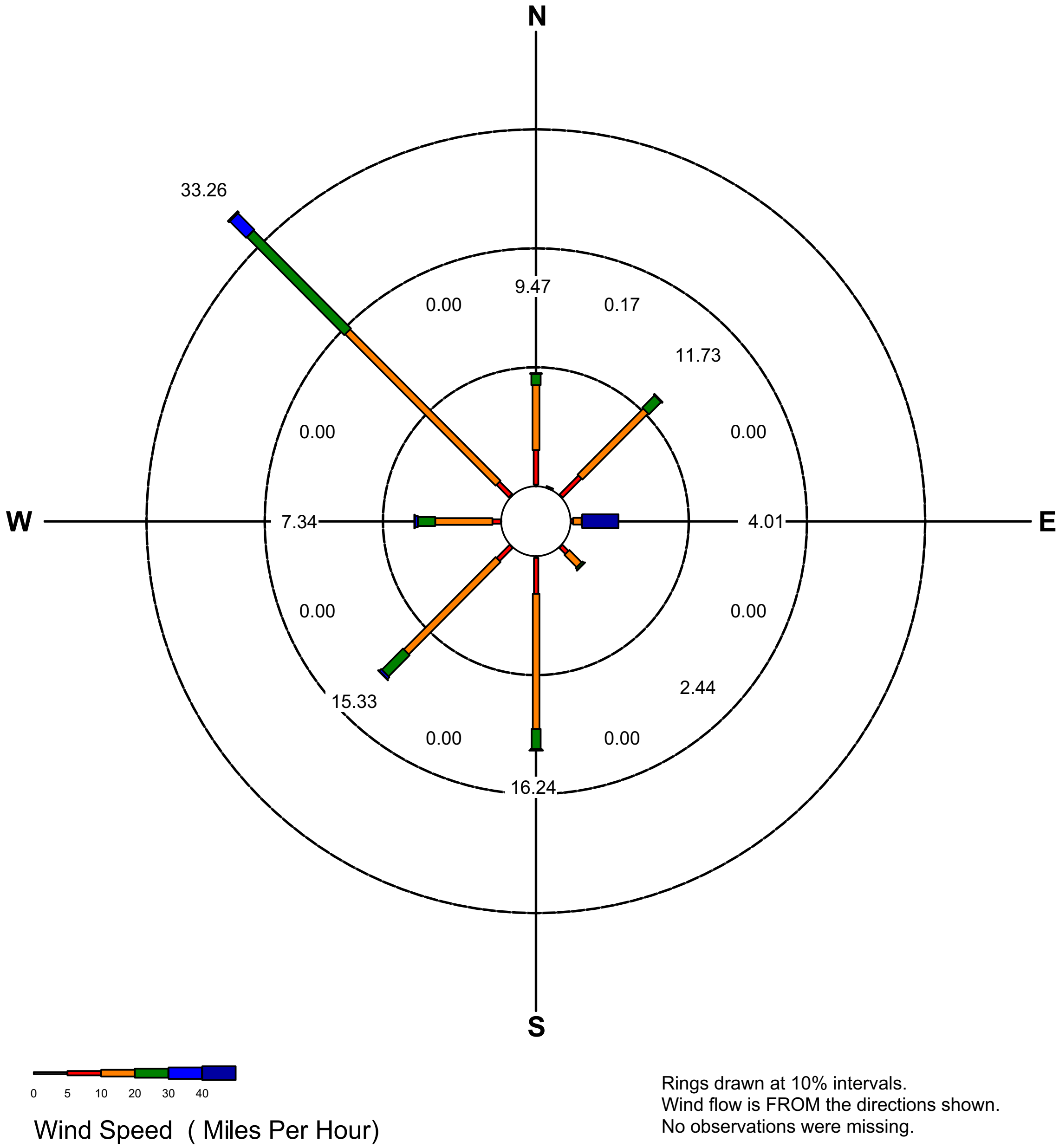
WIND ROSE DIAGRAM
ALBANY INTERNATIONAL AIRPORT
ALBANY, NEW YORK

BBL®
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

FIGURE
28A

01/06/04 SYR-D85-DJH
C:40152017/cdr/40152g01.cdr

Hartford Bradley International Airport
1965 to 1983



Rings drawn at 10% intervals.
Wind flow is FROM the directions shown.
No observations were missing.

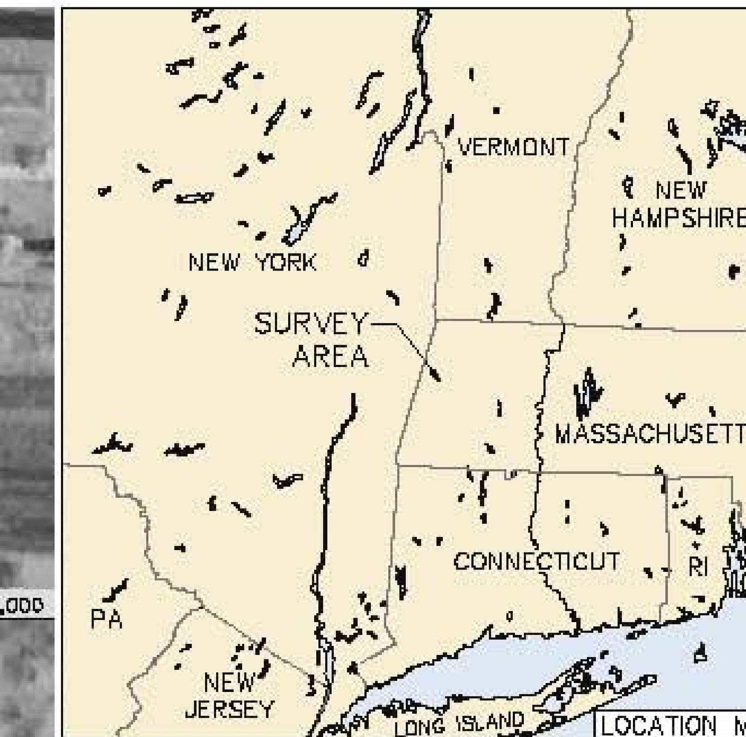
GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
SILVER LAKE
PRE-DESIGN INVESTIGATION

WIND ROSE DIAGRAM
HARTFORD BRADLEY INTERNATIONAL AIRPORT
HARTFORD, CONNECTICUT

BBL
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

FIGURE
28B

01/06/04 SYR-D85-DJH
C:40152017/cdr/40152g02.cdr



SITE PLAN

LEGEND:

SL-01 CONTROL POINT

ORANGE BUOY

SUBMERGED PILING

PROJECT CONTROL INFORMATION (COORDINATES & ELEVATIONS PROVIDED BY BLASLAND, BOUCK, AND LEE, INC.)			
POINT	EASTING (NAD83)	NORTHING (NAD83)	ELEVATION (NGVD 29)
SL-03	186,184.147	2,993,600.100	978.81
ES-15	187,102.536	2,993,099.601	983.98
SL-01	187,208.402	2,993,892.249	984.58

NOTES:

1. GRID SYSTEM IS IN FEET AND IS THE MASSACHUSETTS MAINLAND STATE PLANE COORDINATE SYSTEM (NAD83).
2. ELEVATIONS ARE IN FEET AND ARE REFERENCED TO NATIONAL GEODETIC VERTICAL DATUM 1929 (NGVD 29) BASED ON BENCHMARK "SL-03" WHICH HAS AN ELEVATION OF 978.81' NGVD 29 AS PROVIDED BY BLASLAND, BOUCK, & LEE, INC. WATER LEVEL AT THE TIME OF THIS SURVEY WAS 976.0 FEET (NGVD 29).
3. CONTOURS ARE IN FEET AND WERE COMPUTER GENERATED USING "QUICKSURF" VERSION 5.1 (SCHREIBER INSTRUMENTS, INC.) OPERATING WITHIN "AUTODESK" AUTOCAD VERSION 14.
4. SHORELINE AND FEATURES ARE APPROXIMATE AND WERE TAKEN FROM DIGITAL ORTHOPHOTO QUADRANGLES OBTAINED FROM THE MASSACHUSETTS GEOGRAPHIC INFORMATION SYSTEM (MASSGIS) AND OBSERVATIONS MADE IN THE FIELD.
5. THE INFORMATION PRESENTED ON THIS DRAWING REPRESENTS THE RESULTS OF A SURVEY PERFORMED BY OCEAN SURVEYS, INC. ON 10-13 JUNE 2003 AND CAN ONLY BE CONSIDERED AS INDICATING THE CONDITIONS EXISTING AT THAT TIME. REUSE OF THIS INFORMATION BY CLIENT OR OTHERS BEYOND THE SPECIFIC SCOPE OF WORK FOR WHICH IT WAS ACQUIRED SHALL BE AT THE SOLE RISK OF THE USER AND WITHOUT LIABILITY TO OSI.

100 0 100 200 300

SCALE: 1"=100'

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
SILVER LAKE
PRE-DESIGN INVESTIGATION REPORT

LAKEBED ELEVATIONS

BBL
BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

FIGURE
29

X: 40152X00.DWG, 57810.JPG, 61810.JPG, MAP.PNG
L: ON=*, OFF=REF
P: PAGESET/PLT-DL (03E3040.CTB)
2/10/04 SYR-85-LJP SDL
C/40152027/PDI/OSI_ELEV/40152001.DWG

SIDE SCAN SONAR TARGETS						
TARGET	EASTING (FEET)	NORTHING (FEET)	APPROXIMATE DIMENSIONS IN FEET			DESCRIPTION
			LENGTH	WIDTH	HIEGHT	
1	187,310	2,994,599	16	13	7	SQUARE STRUCTURE WITH SUBMERGED PILINGS
2	187,280	2,994,624	3	3	1	TIRE
3	186,945	2,994,653	4	5	<1	AREA OF 3 SMALL OBJECTS
4	186,913	2,994,556	2	2	1	ROUND OBJECT
5	186,881	2,994,632	22	1	<1	LINEAR OBJECT
6	186,514	2,994,489	3	3	1	TIRE
7	186,435	2,994,408	3	3	1	TIRE
8	186,394	2,994,385	3	3	1	TIRE
9	186,337	2,994,375	3	3	1	TIRE
10	186,304	2,994,361	3	3	1	TIRE
11	186,292	2,994,359	3	3	1	TIRE
12	186,281	2,994,352	13	1	<1	PIPE OR LINEAR OBJECT
13	186,180	2,994,356	3	3	1	TIRE
14	186,304	2,994,298	16	6	5	AUTOMOBILE
15	186,435	2,994,227	6	2	1	UNKNOWN OBJECT
16	186,301	2,994,229	3	3	<1	TIRE
17	186,137	2,994,183	10	4	<1	UNKNOWN OBJECT
18	186,386	2,994,085	8	4	1	AREA OF DEBRIS
19	185,848	2,994,251	40	25	3	AREA OF PILINGS & DEBRIS
20	186,795	2,994,194	1	1	3	PILINGS
21	185,787	2,994,186	1	1	3	PILING
22	185,669	2,994,027	7	5	3	AREA OF DEBRIS
23	185,668	2,994,000	9	3	<1	RECTANGULAR OBJECT
24	185,695	2,993,940	25	8	3	PILINGS

SIDE SCAN SONAR TARGETS						
TARGET	EASTING (FEET)	NORTHING (FEET)	APPROXIMATE DIMENSIONS IN FEET			DESCRIPTION
			LENGTH	WIDTH	HIEGHT	
25	185,705	2,993,959	1	1	3	PILING
26	185,710	2,993,926	1	1	2	PILING
27	186,050	2,993,940	2	2	1	UNKNOWN OBJECT
28	186,045	2,993,703	30	10	1	AREA OF DEBRIS
29	186,083	2,993,698	1	1	3	PILING
30	186,112	2,993,685	1	1	1	UNKNOWN OBJECT
31	186,134	2,993,641	24	12	1	AREA OF DEBRIS
32	186,243	2,993,665	63	15	1–3	AREA OF DEBRIS
33	186,249	2,993,687	15	6	5	POSSIBLE AUTOMOBILE
34	186,525	2,993,748	17	9	1	AREA OF DEBRIS – PIPES
35	186,556	2,993,773	12	8	1	AREA OF DEBRIS – 1–4' BLOCKS
36	186,607	2,993,824	13	10	1	AREA OF DEBRIS – 1–4' BLOCKS
37	186,614	2,993,989	30	10	<1	UNKNOWN OBJECT
38	186,906	2,994,049	38	22	1	2 LINEAR OBJECTS IN A 'T' FORMATION
39	186,976	2,994,027	19	9	1	LINEAR OBJECTS – POSSIBLE PIPES
40	187,303	2,994,144	50	20	1–3	AREA OF DEBRIS – TIRES, PIPES, UNKNOWNS
41	187,311	2,994,194	16	6	4	AUTOMOBILE
42	187,316	2,994,218	10	6	<1	AREA OF DEBRIS – TIRES, UNKNOWNS
43	187,316	2,994,332	15	14	1	AREA OF DEBRIS – TIRES, UNKNOWNS
44	187,296	2,994,456	2	2	2	UNKNOWN OBJECT
45	187,314	2,994,476	2	2	<1	UNKNOWN OBJECT
46	187,341	2,994,475	2	2	1	UNKNOWN OBJECT
47	187,252	2,994,465	50	25	1–3	AREA OF SUBMERGED PILINGS
48	186,665	2,994,083	1175	75	<1	AREA OF POSSIBLE ROPES OR CABLES

LEGEND:

SL-01 CONTROL POINT

FEATURES OBSERVED DURING SURVEY OPERATIONS

SUBMERGED PILING OBSERVED DURING SURVEY OPERATION

SIDE SCAN SONAR TARGET

PROJECT CONTROL INFORMATION (COORDINATES & ELEVATIONS PROVIDED BY BLASLAND, BOUCK, AND LEE, INC.)			
POINT	EASTING (NAD83)	NORTHING (NAD83)	ELEVATION (NGVD 29)
SL-03	186,184.147	2,993,600.100	978.81
ES-15	187,102.536	2,993,099.601	983.98
SL-01	187,208.402	2,993,892.249	984.58

NOTES:

1. GRID SYSTEM IS IN FEET AND IS THE MASSACHUSETTS MAINLAND STATE PLANE COORDINATE SYSTEM (NAD83).
2. SHORELINE AND FEATURES ARE APPROXIMATE AND WERE TAKEN FROM DIGITAL ORTHOPHOTO QUADRANGLES OBTAINED FROM THE MASSACHUSETTS GEOGRAPHIC INFORMATION SYSTEM (MASSGIS) AND OBSERVATIONS MADE IN THE FIELD.
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80' 0 80' 160'

SCALE: 1"=80'

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
SILVER LAKE
PRE-DESIGN INVESTIGATION REPORT

SIDE SCAN SONAR MOSAIC

BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

FIGURE 30

X: 40152X00.DWG, MOSAIC.TIF, SILVER-LAKE.TIF, MAP-PNG
L: ON=*, OFF=REF
P: PAGESET/PLT-DL (03ES043.CTB)
2/10/04 SYR-85-LJP SDL
C/40152027/PDI/OSI_SSSM/40152G01.DWG

LEGEND:

X	PRE-DESIGN GEOTECHNICAL SAMPLING LOCATIONS
⊗	PREVIOUS GEOTECHNICAL SAMPLING LOCATIONS
	EDGE OF WATER
	PAVED ROADWAY
	RAILROAD
	FENCELINE
970	ELEVATION CONTOUR

NOTES:

1. THE BASE MAP FEATURES PRESENTED ON THIS FIGURE WERE PHOTOGRAMMETRICALLY MAPPED FROM APRIL 1990 AERIAL PHOTOGRAPHS.
2. THE CONTOUR INFORMATION PRESENTED ON THIS DRAWING REPRESENTS THE RESULTS OF A SURVEY PERFORMED BY OCEAN SURVEYS, INC. ON 10-13 JUNE 2003 AND CAN ONLY BE CONSIDERED AS INDICATING THE CONDITIONS EXISTING AT THAT TIME. REUSE OF THIS INFORMATION BY CLIENT OR OTHERS BEYOND THE SPECIFIC SCOPE OF WORK FOR WHICH IT WAS ACQUIRED SHALL BE AT THE SOLE RISK OF THE USER AND WITHOUT LIABILITY TO OSI.

0 200' 400'
GRAPHIC SCALE

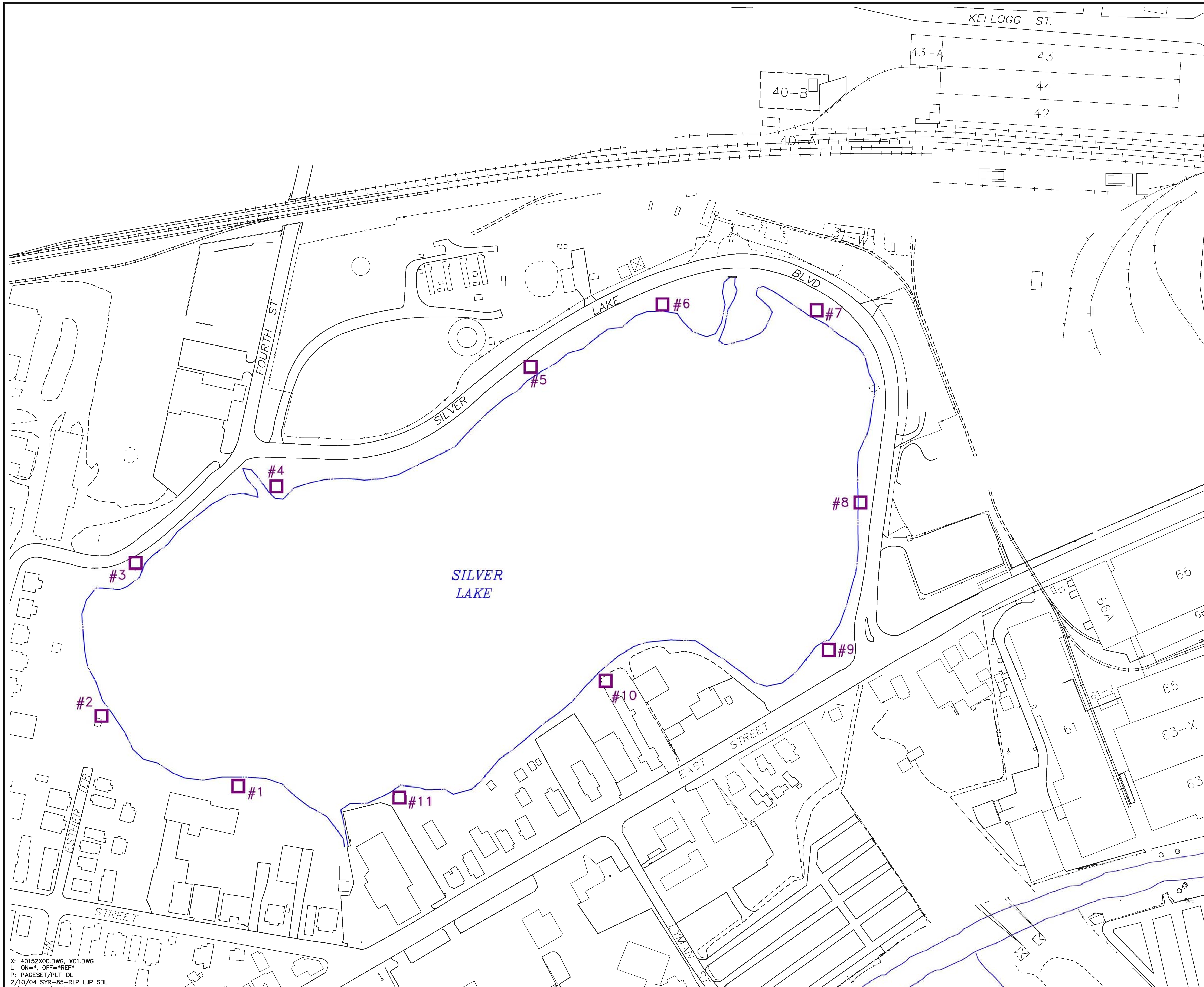
GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
SILVER LAKE
PRE-DESIGN INVESTIGATION REPORT

GEOTECHNICAL SAMPLING LOCATIONS

BBL
BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

FIGURE
31

X: 40152X00.DWG, X01.DWG
LMAN: KLN
P: PAGESET/PLT-DL
2/10/04 SYR-85-KLN LJP SDL
C/40152027/PDI/40152G08.DWG



X: 40152X00.DWG, X01.DWG
L: ON=*, OFF=*REF*
P: PAGESET/PLT-DL
2/10/04 SYR-85-RLP LJP SDL
C/40152027/PDI/40152G09.DWG

LEGEND

SAMPLE PLOT LOCATION

EDGE OF WATER

NOTES:

1. MAPPING IS BASED ON AERIAL PHOTOGRAPHS AND PHOTOGRAMMETRIC MAPPING BY LOCKWOOD MAPPING, INC. – FLOWN IN APRIL 1990; DATA PROVIDED BY GENERAL ELECTRIC COMPANY, AND BLASLAND AND BOUCK ENGINEERS, P.C. CONSTRUCTION PLANS.
2. NOT ALL PHYSICAL FEATURES SHOWN.
3. SITE BOUNDARY IS APPROXIMATE.

0 220' 440'

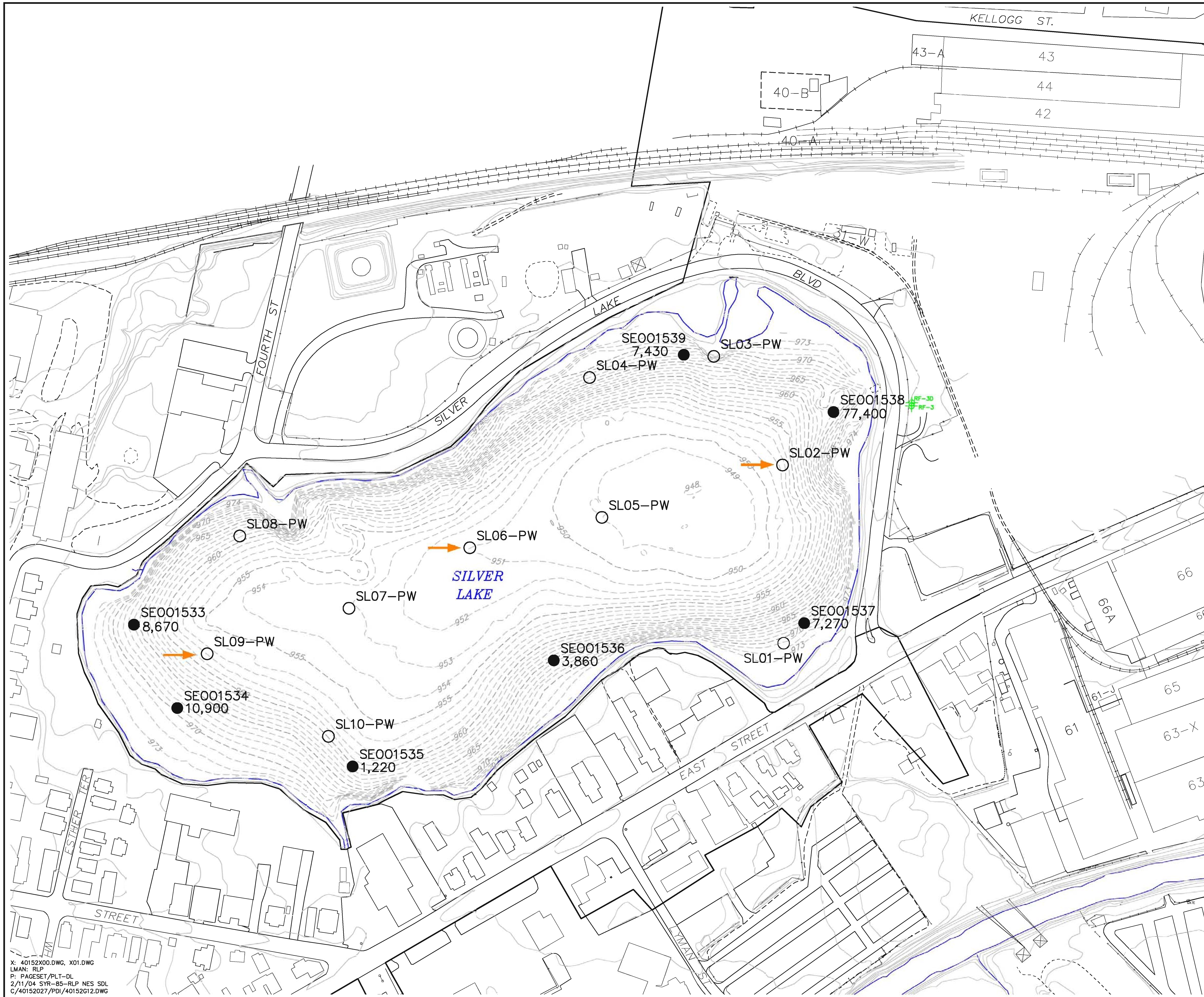
GRAPHIC SCALE

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
SILVER LAKE
PRE-DESIGN INVESTIGATION REPORT

PRE-DESIGN INVESTIGATION
BANK HABITAT CHARACTERIZATION:
SAMPLE PLOT LOCATIONS

BBL
BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

FIGURE
32



LEGEND

- ○ PRE-DESIGN PORE WATER SAMPLE LOCATION
- → PRE-DESIGN SBLT SAMPLE LOCATION
- - - - ELEVATION CONTOUR
- SE001537 ● 7,270 — EPA SAMPLE ID, TPH CONCENTRATIONS, mg/kg

NOTES:

1. MAPPING IS BASED ON AERIAL PHOTOGRAPHS AND PHOTOGRAMMETRIC MAPPING BY LOCKWOOD MAPPING, INC. – FLOWN IN APRIL 1990; DATA PROVIDED BY GENERAL ELECTRIC COMPANY, AND BLASLAND AND BOUCK ENGINEERS, P.C. CONSTRUCTION PLANS.
2. NOT ALL PHYSICAL FEATURES SHOWN.
3. SITE BOUNDARY IS APPROXIMATE.
4. ALL LOCATIONS ARE APPROXIMATE.
5. THE CONTOUR INFORMATION PRESENTED ON THIS DRAWING REPRESENTS THE RESULTS OF A SURVEY PERFORMED BY OCEAN SURVEYS, INC. ON 10-13 JUNE 2003 AND CAN ONLY BE CONSIDERED AS INDICATING THE CONDITIONS EXISTING AT THAT TIME. REUSE OF THIS INFORMATION BY CLIENT OR OTHERS BEYOND THE SPECIFIC SCOPE OF WORK FOR WHICH IT WAS ACQUIRED SHALL BE AT THE SOLE RISK OF THE USER AND WITHOUT LIABILITY TO OSI.

X: 40152X00.DWG, X01.DWG
LMAN: RLP
P: PAGESET/PLT-DL
2/11/04 SYR-85-RLP NES SDL
C/40152027/PDI/40152G12.DWG

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
SILVER LAKE
PRE-DESIGN INVESTIGATION REPORT

EPA SEDIMENT SAMPLE LOCATIONS

BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

FIGURE
33