Pre-Design Investigation Report
Cumberland Bay Sludge Bed - Wilcox Dock
Operable Unit No. 1

Work Assignment No. D003821-8

Prepared for:

SUPERFUND STANDBY PROGRAM
New York State
Department of Environmental Conservation
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Albany, New York 12233

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Department of Environmental Conservation
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1.0 INTRODUCTION

This report provides the results of the Pre-design Investigation Report of Operable Unit No. 1 (OU-1) of the Cumberland Bay Sludge Bed - Wilcox Dock Site ("Site"), Site No. 5-10-017, prepared by by Rust Environment & Infrastructure (Rust). This report summarizes the performed under Work Assignment D003821-8 of the State Superfund Contract between the New York State Department of Environmental Conservation (NYSDEC) and Rust and incorporates information from previous investigation as applicable.

1.1 Site Description - Operable Unit No. 1

OU-1 is located in the northwest corner of Cumberland Bay in Lake Champlain, east of the City of Plattsburgh, Clinton County, New York. It is bordered to the south by Wilcox Dock (also referred to as the New York State Department of Transportation Barge Terminal) and to the west by the shoreline. OU-1 extends to the north to the approximate location of the Chamber of Commerce Building and to the east approximately 750 feet offshore. The present OU-1 definition includes all underwater areas within and along the northwestern portion of Cumberland Bay in Lake Champlain and on the adjacent shoreline where accumulations of contaminated sludge are present in thicknesses greater than 0.25 feet. The calculated area of the sludge bed based on core sample data, geophysical surveying, scuba investigation, and manual probing is estimated to be approximately 58 acres . A location map is included as Figure 1.

Cumberland Bay is a small, somewhat rectangular part of the west side of Lake Champlain. Depths in the Bay can exceed 50 feet but water depths in the vicinity of the Site do not exceed 17 feet and are generally under 10 feet. The City of Plattsburgh is located on the west side of the Bay, where the Saranac River and Scomotion Creek flow into the Bay. The north shoreline of Cumberland Bay is occupied by the Plattsburgh Municipal Beach, a NYS Office of Parks and Recreation campground, and numerous motels and restaurants. On the east side, Cumberland Head, a large peninsula, extends into the Bay.

The Wilcox Dock is an engineered structure, 200 feet wide by 400 feet long and is presently controlled by the New York State Canal Corporation under the jurisdiction of the New York State Thruway Authority (NYSTA). Historically, land deeded to Willard G. Wilcox by the State of New York in the late 1800's was reappropriated back to the State of New York Department of Public Works in 1914. Subsequently, a barge canal terminal was envisioned, planned, designed and constructed. In the mid-1960's, as a result of a rehabilitation project conducted to preserve the dock as a Barge Canal Terminal at Plattsburgh, the south and east sides of the dock and a short portion of the north side of the dock were reinforced with sheet piling. The NYS Canal Corporation currently issues permits for the mooring of small water craft around the dock and limits access to the dock. The Georgia Pacific Corporation also controls access to a second entry to the dock area where it maintains a pump house for plant operations. Georgia Pacific presently operates a lake-water pump intake located between the southwest portion of the Wilcox Dock and the adjacent breakwater.

The sludge bed material covers most of the OU-1 area ranging in thickness from approximately 0.25 to 10 feet. The thickest portions are located in a dredged channel adjacent to Wilcox Dock. The underlying "natural" soils consist of sand and silt.

The deepest water locations are between Wilcox Dock and the breakwater located to the south (approximately 10 to 17 feet) resulting from previous dredging activities performed by the NYSTA for the passage of barges. Similar dredging was performed along the north and northeast sides of Wilcox Dock. Water depths to the top of the sludge within the sludge bed vary between 0 feet at the shore line and approximately 7 feet.

1.2 Site History

Historically, land deeded to Willard G. Wilcox by the State of New York in the late 1800's was reappropriated back to the State of New York Department of Public Works in 1914, during which time a barge canal terminal was envisioned, planned, designed and constructed. Completion of construction occurred circa 1920 with the beginning of commercial traffic to the dock facility.

Industries in the area at the turn of the century and early 1900's included the Lozier Automobile Company, Saranac Pulp and Paper Company, Standard Pulp and Products Company, and Borst-Forest-Dixfiel. Several oil companies, including Colonial Beacon, Standard, Shell and Sucony Vacuum Oil Company maintained pipe lines from Wilcox Dock to storage facilities inland from the bay. In 1935 and in 1951, the NYS Division of Canals and Waterways dredged the canal access along the dock to accommodate larger fuel bearing vessels. The Diamond Match Company (1944), Vanity Fair (1955), and ultimately, the Georgia Pacific Company (1963-present) occupied property adjacent to the Site.

Records indicate that for several decades wastes from some local industries were discharged to local streams which ultimately discharge into Cumberland Bay or were directly discharged into the bay. Sawmills on the Saranac River discharged wastes into Cumberland Bay, where prevailing winds and currents in the summer dispersed the solids against the beach areas at the north end of the bay. Also, pulp and paper mills on the shore of the bay near Dead Creek disposed of solids and organic materials (Frederic R. Harris, Inc., 1979). Untreated waste disposal ended in the early 1970's when the Plattsburgh Sewage Treatment Plant began treating wastes from the local industries. Over the years, wave action and water currents eroded the sludge bed and transported wood chips and organic debris along the shorelines and beaches to the north as well as to other areas within Cumberland Bay. For several years, the Site was considered a public nuisance, emitting unpleasant odors and hampering boating and swimming activities in the area. Environmental sampling from 1992 through 1994 confirmed the presence of PCBs, and to a lesser extent polychlorinated dibenzodioxins (dioxins) and dibenzofurans (furans) within the sludge and along the shoreline and beach areas.

At the present time, there is a health advisory in effect for several species of fish within Lake Champlain and Cumberland Bay due to elevated PCB levels in the fish; the advisory specifies, "eat no more than one meal per month". In addition, the commercial sale of yellow perch from Cumberland Bay is prohibited due to PCB concentrations in the fish, which exceed the US Food and Drug Administration (FDA) marketplace standard of 2 ppm.

1.3 Previous Reports

A Site Characterization Report, dated November, 1995, was prepared by Rust to summarize the methods and findings of a preliminary investigation. The Site Characterization Report defined and characterized the nature and extent of contamination in the sludge bed adjacent to Wilcox Dock.

A Treatability Study, dated November, 1995, was prepared by Kiber Environmental Services, Inc. to evaluate the effectiveness of dewatering and immobilization treatment of the sludge bed, and to determine water treatment protocols for process water.

A Feasibility Study (FS) Report, dated May 1997, was prepared by Rust to identify and evaluate remedial alternatives for the Site.

Also in May 1997, a qualitative baseline health risk assessment (HRA) and a Fish and Wildlife Impact Analysis (FWIA) was submitted by Rust as Addendum No. 1 to the SC to evaluate the potential risks posed under current site conditions and to verify the need for Site remedial measures.

The NYSDEC prepared a Record of Decision dated December 1997 which presents the remedial measured to be performed at the Cumberland Bay Sludge Bed Site.

2.0 SLUDGE BED CHARACTERIZATION

Prior to initiating the remedial design, additional information was gathered between December 1997 and June 1998 to better define the perimeter and bottom of the sludge bed for use in developing bid documents. Winter conditions were employed for collection of samples over the frozen lake surface which enabled samplers to collect thicker and more complete samples of the sludge bed and to access areas on the lake difficult to sample by boat due to shallow water depths in some areas and wave disturbance in windy open areas. Other technologies were also used to evaluate the sludge bed including geophysical methods and diver surveys. The following sections summarize the sludge bed data collected in previous investigations and describes the methods and results of data collected during the pre-design investigation. The results are then synthesized in a general description of the sludge bed character and extent. This is followed by a discussion of the PCB sampling program and a summary of the distribution of PCBs within the sludge bed.

2.1 Topographic and Bathymetric Surveying

For the purpose of this project, the site bathymetry is defined as the lake bottom surface elevation (which in the area of the sludge bed is the top of sludge). Bathymetry was measured during each round of sludge bed core collection to determine depth of water, sludge thickness and subsequently, the sludge bottom elevation. It was observed that the bathymetry changed from one sampling event to the next. This is expected due to dynamics of lake currents which may tend to erode and/or deposit lake bottom sediments. The bathymetry can be used on the design drawings as a guide for the Contractor, but a note should be added that bathymetry changes over time and should be verified within a month or two of initiation of dredging.

The following sections describe the bathymetry surveys that were performed at the Cumberland Bay Sludge Bed Site. The datum, controls and methods for performing each survey are detailed. Also provided is a summary of the site topographic survey to show how topography it tied to bathymetry.

2.1.1 Methods

2.1.1.1 Site Topography

As described in the Site Characterization (SC) Report, dated November 1995, a detailed topographic base map of the Site and surrounding area was constructed from an existing aerial photograph and site survey. The photo was taken on May 1991 by Eastern Topographics of Wolfeboro, New Hampshire. All pertinent site features including property lines, roadways, buildings, etc., are identified on the base map. The NYSDEC established two benchmarks on the Site which were used as horizontal and vertical control points. Details for the control points are provided in Appendix A. From those benchmarks, in August 1995, Rust performed surveys of additional points which were used to develop the base map. The Site topography is shown on Figure 2-1.

2.1.1.2 August 1995 Cores

In August 1995, core locations were established at the site on 200 foot centers along north and east trending coordinates. These locations are shown on Figure 2 of the SC Report and also on Figure

2-1, herein, which is a compiliation of all core locations since 1995. The locations were established by communication between a surveyor on shore and a technician with a buoy or PVC pipe on a boat. The locations were tied to one Site benchmark and an arbitrary coordinate system was selected for in house mapping. At each core location, core tubes or a probe was used to determine the depth of water. The bathymetric elevation was calculated by subtracting the water depth from the water elevation as measured at a USGS gauge on Lake Champlain at Rousse's Point on the day of coring. The core locations, coring methods and the results of the bathymetric survey are provided in the SC Report.

2.1.1.3 December 1997 Shoreline Cores

Shoreline cores were collected in December 1997 when the lake water levels were low (approximately 95 feet) and the sampling locations were not submerged. A discussion of this sampling event is provided in Section 2.6. The shoreline sample locations and ground surface elevations were surveyed by Rust personnel and tied into the NYSDEC Site benchmarks using the NY State Plane Coordinate System (NAD 83). These elevations are used to define the topography/bathymetry along the shoreline areas of the Site. The elevations are indicated on the core logs (discussed in Section 4.0) and the locations are shown on Figure 2-1.

2.1.1.4 February 1998 Tape Soundings

In February 1998, Site investigations were performed through 12 to 18 inches of ice that had frozen over the sludge bed. A grid was established on the ice using the same horizontal coordinate system as established in 1995, but with a tighter grid (nodes 100 foot on center) and the survey coordinates were recorded relative to NY State Plane Coordinate System (NAD 83). The 1998 grid is shown on Figure 2-2. The grid nodes were marked with flags and nontoxic paint. The locations were established by communication between a surveyor on shore and a technician with markers on the ice, or by stretching tape between marked locations. The grid was tied into the NYSDEC benchmarks. At each grid node a hole was drilled through the ice and a weighted tape measure was used to measure the depth from the top of ice to the top of the sludge bed (i.e., lake bottom). The depth to top of sludge was subtracted from the elevation of the ice as surveyed by Rust surveyors. The variation in the top of ice elevation measured at one location near the dock on two consecutive days was less than one hundredth of a foot so it was assumed that the ice elevation measured on the first day could be used for the full week of probing data. Also, the ice was relativey flat so the top of ice elevation measured at the one location was used for all of the sampling points. The results of these measuring tape soundings are provided on Table 2-1.

2.1.1.5 April 1998 Tape Soundings

The results of the coring performed in February 1998 (see Section 2.2.1.3) indicated that additional data was needed around the southeast perimeter of the sludge bed and between the dock and the breakwater. In April 1998, a sampling boat was used to collect additional cores. The 100 foot center grid established for the February 1998 investigation was expanded to include areas of interest on the perimeter of the sludge bed. Grid locations were established using a Trimble Pathfinder ProXRS DGPS, with Omnistar Satellite Service, based on NY State Plane Coordinate System (NAD 83). The DGPS unit was located on the sampling boat and used to navigate the boat to the selected sample location (grid node). Due to drifting, the actual sample was frequently not on the grid node, so the DGPS was used to survey the point where the sample was actually collected (within an accuracy of 10 or 20 feet). The sampling locations are shown on Figure 2-1.

At each sampling location a weighted tape measure was used to measure the depth from the lake water surface to the top of the sludge bed (i.e., lake bottom). The depth to top of sludge was subtracted from the lake elevation as measured at the USGS gauge at Rousse's point on that day. The results of the measuring tape soundings are provided on Table 2-1.

2.1.2 Results

The topographic and bathymetric contour map shown as Figure 2-2 was prepared using the most recent bathymetric data collected for that point (predominantly February and April 1998 data). Note that this surface is dynamic and should be verified before remedial work begins at the site.

2.2 Sludge Bed Thickness and Extent

The vertical and horizontal extent of the sludge bed has been identified through a series of investigations since August 1995. The various methods for characterizing the extent of the sludge bed included coring, probing, geophysical surveys and diver surveys. The methods are detailed in Section 2.2.1 and the results are summarized in Section 2.2.2.

2.2.1 Methods

2.2.1.1 August 1995 Cores

As discussed previously (Section 2.1.1.2), in August 1995, core locations were established at the site on 200 foot centers along north and east trending coordinates. At each location an attempt was made to collect a core of the sludge bed and underlying sand. The lower portions of the core were analyzed by immunoassay test kit with 10% laboratory confirmation analysis to determine the vertical extent of PCBs associated with the sludge bed. Coring methods included direct push of a core tube, use of vibracore equipment and use of various types of core catchers at the entry end of the core tubes. The core locations, coring methods, core logs and the results of the 1995 investigations are provided in the SC Report.

2.2.1.2 October 1996 Cores

Additional sludge bed samples were collected north of Wilcox Dock and from within the dredged channel east of Wilcox Dock and the breakwater at locations shown in Figure 2-1. Sampling was performed on October 16 and 17, 1996 by NYSDEC and TAMS personnel. The purpose of the sampling was to further define the extent of sludge in the channel area.

Coring Procedures and Equipment

Additional sludge bed sample locations were determined in the field by NYSDEC personnel. Sample locations were approximated (not surveyed) and were referenced to the core location grid map which was prepared for the August, 1995 sampling program.

The cores were collected using the same two basic coring methods as were used during August, 1995. Cores were obtained from a pontoon boat, using either a vibracore sampler or push coring. The methodologies are described in detail in the SC Report. The vibracore and push core sampling equipment was provided by NYSDEC. In general, the procedure for core collection was to position the boat over the desired sampling location and securing the boat with an anchor to prevent drifting. The coring device was then advanced to the maximum depth of the casing (to refusal for the vibracore apparatus and about four feet for the push core). Casing liners were removed from the corer apparatus, capped, and delivered to Wilcox Dock where a geologist logged the core.

The geologist logging the cores first drained off the standing water in the core. The core liner was then cut in half lengthwise using a circular saw and divided into two symmetrical sections. The cores were visually logged in a dedicated field note book using the United Soil Classification System (USCS) and photographed for future reference. Samples were then collected from the cores as described in the following section. Core logs are provided in Appendix B.

Sludge Sample Collection

On October 16, 1996, the sampling crew (including NYSDEC Division of Water personnel), using the vibracore apparatus, mobilized to four locations for core collection. Three samples (96-AS-1, 96-AS-2 and 96-CH-1) were successfully collected. One location, approximately 300 feet east of the sludge bed, was visited without a successful sample being collected. This sample location was selected to determine whether a shallow bathymetric reading in the area was indicative of additional sludge bed material or a sand bar. No sludge was identified at this sampling point and no sample could be collected because the vibracore was unable to penetrate the sandy sediments. It was concluded that the rise in the bay floor is related to a sand bar or a similar type of naturally occurring topographic feature. The Division of Water crew demobilized the vibracore equipment from the Site on October 16, 1996.

On October 17, 1996, the sampling crew, equipped with only the push corer, mobilized to three new sampling locations, as well as the unsuccessful vibracore location. Once again, no sample was collected at that location due to the lack of sludge or cohesive sediments. Core 96-CH-2 was collected from the dredged channel and cores 96-AS-3 and AS-4 were collected in the known sludge bed area.

In general, sample recovery using either coring method (vibracore or push core) was adequate for recovering sludge. However, due to low particle cohesion, neither coring method was particularly effective at collecting the underlying, naturally occurring sandy sediments. Only one core (96-CH-2) contained an appreciable amount of the underlying sediment and that was collected using the push core method.

Cores 96-CH-1 and 96-CH-2 were collected from locations within the dredged channel as shown on Figure 1. 96-CH-1 was comprised entirely of sludge from which one composite sample was collected for PCB laboratory analysis. In addition, a one-gallon bucket was filled with the remaining sludge from the 96-CH-1 core for leachability and turbidity correlation testing. 96-CH-2 contained intervals of sludge, layered sludge and sand, and sand. One sample was collected from each discrete interval for PCB laboratory analysis. PCB analytical results for these samples are summarized on Table 1.

Cores 96-AS-1 through 96-AS-4 were collected from locations west of the dock from within the known sludge bed area as shown on Figure 2-1. A single, composite sludge sample was collected for PCB laboratory analysis from each core except 96-AS-2, which contained four distinct layers of sludge. Each of the four layers in 96-AS-2 were sampled discretely and sent to the NYSDEC laboratory for PCB analysis. A one-gallon bulk sample was collected from each location for leachability and turbidity correlation testing. PCB analytical results for these samples are discussed in Section 2.3. Turbidty correlation testing is discussion Section 2.4.3.

Each core sample was maintained on ice in the field between October 16 and 17, 1996 in a dedicated sample cooler. Upon completion of the sampling program samples collected for potential PCB laboratory analysis were delivered to Rust's Albany, New York office for PCB immunoassay screening. Due to the relatively small number of sludge samples collected, immunoassay testing was not considered warranted and all of the samples were forwarded to Inchcape Testing Services, Aquatec Laboratories, Colchester, Vermont (Inchcape) for PCB analysis following the NYSDEC Analytical Services Protocol (ASP) Method 95-3. The bulk samples were also delivered to Rust for leachability and turbidity correlation testing. The NYSDEC samples were delivered to the NYSDEC laboratory on the day of collection.

2.2.1.3 February 1998 Probing and Coring

The original sludge bed characterization was based on a 200 foot center grid. Between February 16 and 26, 1998, under frozen ice conditions, additional sludge bed probing and coring was performed on a grid with approximately 100 foot centers (see Section 2.1.1.4 and Figure 2-3). The probing was used to define sludge bed thickness and elevations. Cores were collected at probe locations to verify the effectiveness of probing to determine the top and bottom of the sludge bed.

Probing Procedures

During previous coring events the field technicians had observed a significant density difference between the sludge and the underlying native sand. This was evident from the relative pressure needed to penetrate the respective material with the sample core. During the previous sampling events, the native sand frequently was not recovered (due to lack of penetration of the sand falling out of the core upon core extraction). The probing program was developed under the assumption that the density difference at the interface between the sludge bed and the underlying sand would be perceivable to a person pushing a probe and would be a quick means of determining the sludge bottom elevation rather than collecting a core. The sludge bed was probed at the locations shown on Figure 2-3.

Cores were collected (using the piston method discussed below) at some of the probe locations to evaluate the accuracy of the probing method. The piston method allowed for the successful recovery of the underlying sand. The coring results indicated that density of the underlying sand varies vertically. In some cases there is a lower density sand near the sludge bed sand interface which grades to a higher density sand. Therefore the probing method, although indicative of the shape of sludge bed bottom surface, was only able to provide depth information to an accuracy of ± 6 to 12 inches. The probing results are provided on Table 2-1.

Coring Procedures and Equipment

During the February 1998 investigation, an newly developed core collection method, a piston core sample, was employed in an attempt to acheive better core recoveries, especially in areas containing thick layers of sludge (i.e., the dredged channel area). Cores were collected at sample locations shown on Figure 2-3.

A schematic of the piston core device develped by Rust is shown on Figure 2-4. It consists of 2-1/4 inch flush jointed Schedule 40 PVC, 2 inch flush jointed Schedule 40 clear PVC, and the piston. The piston was constructed of a nine inch long 5/8 inch lag bolt inserted through a five inch long piece of 1-1/4 inch schedule 20 PVC fitted with end caps. The bottom (downward end) was fitted with a 2-1/4 inch soft rubber seal with the invert facing downward. One inch outside diameter (OD) by 5/8-inch inside diameter (ID) washers were used for spacing and to tightly secure the soft rubber to the PVC.

The piston, when fitted into the clear PVC (always from the bottom) created a seal tight enough to resist being displaced by the core as it enters the tube. 5/8-inch steel rods from a hand auger were connected to the top of the piston and used to hold the piston at fixed elevation as the core tube was driven past it. The suction created by the piston was sufficient to prevent compression of the core as the tubes were driven or significant loss of the core sample as the tube was extracted.

The coring tubes could be driven by hand or with a slide hammer. Rust constructed a 20 lbs slide hammer out of 2" galvanized pipe fitted on both ends with 1-inch to 1-1/4-inch stepdown bushings. This allowed the hammer to slide freely over the steel rods without considerable play in the motion.

Through practice field crew discovered that best core recovery was achieved when the entire unit was withdrawn in one quick motion. Alternately the piston rod could be broken down in 5 or 10 foot sections as it is removed. The recovery using the piston method was very high compared to the vibracore or push methods previously used.

Sludge Sample Collection

During the February 1998 sampling program, cores were collected from the locations shown on Figure 2-3. The core logs are provided in Appendix C. Samples were collected for PCB analysis at core locations N-2400 and M-2400.

Upon completions of this coring and probing program all sludge bed core information was compiled and analyzed. The data are provided on Table 2-2. Each core sample was evaluated to determine if useful sludge bed top and bottom elevations could be obtained. Table 2-2 also shows a comparison between the core samples and probing performed at the same location. Final sludge bed data was selected for use in the design of the dredging program as shown in the three right-hand columns on Table 2-2. Contouring of the sludge bed data indicated that additional information was needed east and south of Wilcox Dock to fully define the extent of the sludge bed.

2.2.1.4 April 1998 Cores

The results of the coring performed in February 1998 indicated that additional data was needed around the southeast perimeter of the sludge bed and between the dock and the breakwater. In April 1998, a sampling boat was used to collect additional cores. The core locations are shown on Figure 2-3.

Coring Procedures and Equipment

The piston core sampler was used by NYSDEC and Rust personnel from a pontoon sampling boat as described for the October 1996 samping event. Sample recovery was as successful as in February 1998. Core locations were selected to provide the best definition of the sludge bed while minimizing the number of cores collected. The coring points were located through the use of a DGPS unit as described in Section 2.1.1.5 and are shown on Figure 2-1. Core logs are provided in Appendix D.

The information from the core logs was added to the sludge bed data summary table provided as Table 2-2. Other than areas where the sludge bed pinches out and becomes difficult to measure accurately through coring, this final round of cores provided sufficient data to estimate the areal extent volume of the sludge bed.

During the April 1998 coring event, samples were collected for PCB analysis from 15 cores across the sludge bed to evaluate the PCB concentration distribution throughout the sludge bed.

2.2.1.5 Geophysical Survey

Ground penetrating radar (GPR) and Electromagnetic (EM) surveys are geophysical methods frequently used to identify subsurface anomalies. These methods were employed at the Cumberland Bay Site to help identify objects that may hinder hydraulic dredging processes.

An EM survey was used to identify metal objects which may be submerged in the sludge and a GPR survey was used to serve a similar function as well as identifying the top and bottom of the sludge bed, if possible. These surveys were performed in February 1998, by Hager-Richter Geoscience when ice on the bay was sufficiently thick to walk on safely and to fully support any necessary equipment.

The geophysical surveys were performed on only a portion of the sludge bed. The targeted portions were areas where the sludge thickness is greater than one foot. Details of the geophysical survey methods are provided in the Geophysical Survey Report prepared by Hager-Richter Geoscience, dated July 1998, provided in Appendix E. The results of the geophysical survey were as follows:

- Only one possible submerged metal object was detected using EM Methods, near the east end of Wilcox Dock.

- Many other small submerged objects and two large objects were detected in the survey area. The objects were inferred to be non-metallic, and most are located in the southwestern portion of the survey area.

- The apparent conductivity data determined by the EM survey and the results of the GPR survey exhibit general correlation with the lateral extent and thickness of the sludge bed.

The results of the GPR survey are shown on Figure 2-5.

2.2.1.6 Diver Survey

Between June 22 and 28, 1998, Complete Diving Services was used to define the outer extent of the sludge bed where the thickness diminishes to an amount difficult to measure using coring methods. Divers equipped with real-time video and audio equipment probed the top 6 to 12 inches of the sludge bed along established gridlines. The divers were also used to investigate unidentified submerged objects detected using the remote GPR and EM geophysical methods, and to document the conditions of submerged bulkheads and water intakes.

The divers provided a work boat and the necessary probes and cores to conduct the work. Full-time audio contact was maintained with the topside crew. Divers documented significant observations by the audio record and color videotape.

Lateral Extent of Sludge Bed

The diving contractor performed an underwater reconnaissance of the western portion of the sludge bed to determine the lateral extent of the bed. The divers intended to follow preselected transects A through K as shown on Figures 2-6. Rust identified the location of the starting points and the orientation of each transect to the nearest approximately 10 feet, through use a Trimble Pathfinder DGPS unit. The objective of the reconnaissance along these transects was:

- Identification of the edge of the sludge bed as defined by a sludge thickness of 0.25 feet; and
- Assessment of the ease of identifying the presence, depth and thickness of the sludge bed using underwater visual, probing, test pitting, sludge sampling, and videography techniques, and comparison with the use of those techniques at the water surface.

The divers began at transect A. Moving from the north to the south the divers observed a fine sand bottom with sparse vegetation and small clusters of fresh water clams (or similar species). After walking the full length of the transect it was concluded that the edge of the sludge bed could not be readily visually detected from the surface without some disturbance of the bottom. Upon disturbance of the surface soil the edge of the sludge bed is indicated by an increase in fines.

As it took more time than anticipated to perform a transect, every other transect was surveyed by the divers. The divers walked from the outside of the sludge bed, toward the sludge bed at transects C, E, G and J. General observations at these locations included the following:

- While moving toward the sludge bed there appeared to be an increase in vegetation. This may be due to increased organics in the lake bottom sediments, water depth, or the energy of the environment.
- At A, C and E the lake bottom changed from relatively clean sand to sand with a higher percentage of silts.
- At G and J the lake bottom changed from relatively clean sand to mostly silt. Within the thicker portions of the sludge bed the material that the divers picked up in their hands was a cohesive mixture of sludge which had a relatively high angle of repose and would break up into chucks as well as create a cloud of turbidity. The majority of the turbidity cloud was settle quite quickly.

At transect J, a high density of vegetation was observed along the shallower portion of the transect reducing to no vegetation in the deeper portion of the breakwater area.

Video footage was recorded for each of these transects and is available in the project file. The real-time counter was not functional at the time of diver survey so the times are not available.

Water Currents

On two occasions the divers were asked which direction the turbidity cloud generated by their walking through the sludge bed would tend to flow. Off the northeast end of Wilcox Dock (with a wind direction from the east-southeast, the water flow was reported to be to the east, northeast (away from the dock). Closer to the shoreline in the mudflats area, with the wind from the east-southeast, the water flow was reported to be in the same direction as the wind.

Debris or Large Object Search

In the mudflats area, near the shoreline, numerous unidentified objects were detected during the geophysical survey as shown on Figure 2-5. The divers walked along six transects in this area to characterize the nature of any debris fully or partially exposed in the sludge bed. The following is a summary of the reconnaissance.

The divers moved from east to west along transects located by Rust and labeled as O-1 through O-5. They also walked and recorded videotape of a transect starting at the east end of O-5 and diagonally (to the northwest) to approximately the west end of O-1. The locations of the transects are shown on Figure 2-7. At each transect a variety of logs, stumps, vegetation and rocks were noted. At transect O-4 a boat mooring was discovered. It was buried in the sludge but the diver could feel the top and indicated that it was of metal construction with a rounded top and with a handle in the center of the rounded top surface. It may be round or mushroom shaped (a typical shape for boat moorings). The location of the mooring is shown on Figure 2-7.

The two large geophysical anomalies were also investigated by the divers. The two ends of the east-west trending linear anomaly were marked with buoys by Rust. The diver walked along the length and then zig-zagged in the area probing with metal rod in search of something like a pipe or other linear object. The diver found nothing that would have elicited such a signal as was seen on the GPR survey results. The object may be below the sludge bed and in the underlying sand (beyond the reach of the diver's probe.

The second large anomaly evaluated was the wide north-south trending anomaly. The diver probed from the northeast corner of this anomaly to the southeast corner and consistently hit a dense layer. In areas this dense material could be penetrated into softer material. It was concluded that this feature is most likely a sand bar.

Underwater Structures

As part of the diver survey, the divers observed and documented the following:

- General condition of submerged portions of the bulkhead at Wilcox Dock; and
- Construction and condition of the submerged portions of the industrial water intake structure south of Wilcox Dock.

The divers began videoing the bulkhead in a fashion typical for structural inspections. This was slow and considered unnecessary for this project. When asked whether the video camera could be moved back for a more panoramic view of the submerged bulkhead, the diver indicated that the visibility was lost after drawing the camera away from the bulkhead.

The diver visually inspected Georgia Pacific's industrial intake structure and noted that an approximately 6 foot high by 5 foot wide opening exists in the sheet pile wall surrounding the intake structure. The diver was directed not to enter the intake structure area.

2.2.2 Results

The sludge bed is characterized by three distinctly different areas which vary in bed thickness. These areas are depicted on Figure 2-8 and have been identified as the Mudflat Area, Dock Area and Breakwater Area. The nature of the sludge bed is described below for each of these areas.

Mudflats Sludge Area

This Mudflat sludge area occupies approximately 30.6 acres and is characterized by a broad continuous layer (bed) of relatively thin sludge ranging from 0.25 feet to 3 feet thick, and averaging 1.5 feet thick. The estimated in-place sludge bed thickness is shown on Figure 2-8. Profiles through this area are shown on Figure 2-9. The estimated in-place volume of sludge in this area, not including underlying material that may be removed during the dredging operation, is estimated to be approximately 55,800 cy.

The sludge in this area is expected to be comprised primarily of dark (brown to black) fibrous pulp with highly organic material such as wood chips, root matter, and saturated silty material exhibiting a chemical-type odor. Small amounts of lighter-colored (gray) fibrous pulp may be present. Solids contents are expected on the order of 30%.

A recently compiled bathymetric map is presented in Figure 2-2, and represents the best information available. Water depth will vary with lake fluctuations. Under a mean lake elevation of 95.5 feet AMSL, the water depth will range from 0 feet to 8 feet deep. Under extreme conditions, the lake may be 7 feet deeper to 2 feet shallower. Lake waves, current direction and velocity are expected to change with weather conditions. The area is also subject to currents from the a sewer outfall shown on Figure 2-8.

The sludge bed is underlain by a generally denser, gently lake-ward sloping bay bottom comprised of native silty sand or banded sand. A contour map of this surface, i.e., bottom of sludge, is presented on Figure 2-10.

The bed grades laterally to the Shoreline excavation area on the west, to the Dock sludge area and adjacent shoreline to the south, and to Cumberland Bay to the east and north (Figure 2-8). The exact western limit of the Mudflat sludge area adjacent to the shoreline will be determined during construction, and depends upon a number of factors including lake level, and dredging and excavation equipment access. Lake level changes may result in the shoreline shifting laterally as much as 600 feet over the gradually sloping bay bottom, alternately exposing and submerging Mudflat sludge. For the purpose of this report, the western edge of the Mudflat sludge area generally coincides with mean lake level, which also generally coincides with the edge of the persistent emergent vegetation, i.e. cattails.

The exact eastern and northern edges of the Mudflat sludge area will be confirmed during construction based on the location of the edge of the continuous bed of sludge at that time. It is likely that relatively thin, discontinuous, mobile accumulations of sludge will be present on the bay bottom outside the bed, but these accumulations are not considered part of the bed for remediation purposes. These mobile, local accumulations may extend far out into the bay beyond the work area. For the purpose of the remediation, "discontinuous" means no sludge bed detected within an approximately 50-foot long transect transverse to the sludge bed boundary.

The Mudflat sludge area is further subdivided into a sheltered zone within the broad cove-like area northwest of Wilcox Dock at the southwest half of the bed, and an unsheltered zone to the northeast that is more exposed to wave action and currents from the prevailing southerly winds anticipated in this part of Cumberland Bay during the warm-weather months when most of the Mudflat dredging is likely to occur. The potential for natural resuspension and transport of the re-suspended bottom sediments and sludge is anticipated to be greater in the unsheltered area.

Contained debris within the sludge bed may include sunken logs, tree branches, roots, boat moorings and anchors, sunken boats, drill rods, material discharged from sewer outfalls, fishing gear, rip rap, bricks, concrete blocks, wires, abandoned pipes, and so forth. Accumulations of unidentified objects in the sludge bed detected using geophysical methods area over part of the area are shown on Figure 2-5; locations of specific submerged objects are shown on Figure 2-7. Aquatic vegetation may be present, particularly in the nearshore areas. This debris and vegetative material may require mechanical removal techniques where encountered, but the nature and frequency of this material is not expected to preclude the feasibility of hydraulic dredging as a primary dredging method.

Dock Sludge Area

The Dock sludge area occupies approximately 8.8 acres and is characterized by a continuous layer (bed) of relatively thick sludge ranging from 0.25 feet to approximately 10 feet thick, and averaging 4.3 feet thick. Thickness in the dock area are shown on Figure 2-8. A profile through the dock area is shown on Figure 2-9. The estimated in-place volume of sludge in the Dock sludge area, not including underlying material that may be removed during the dredging operation is estimated to be approximately 50,900 cy.

The sludge in this area is expected to be comprised of dark brown and gray fibrous pulp, wood chips and saturated silty material. Deeper layers may be partially consolidated and characterized by solids content approaching 60% in contrast to the shallower and intermediate sludge with solids content on the order of 10-15%. Gases of decomposition are present.

Dock area bathymetry in the work area is presented on Figure 2-3. Under a mean lake elevation of 95.5 feet AMSL, the water depth will range from 2 feet to 11.5 feet deep. Under extreme conditions, the lake may be 7 feet deeper to 2 feet shallower. Lake waves and current direction are not anticipated to be of significant concern during the dredging operation because this area will be isolated from the lake by a sheet pile wall. Lake water levels inside and outside the piling are expected to be essentially the same, unless hydraulic dredge pumping induces an inward hydraulic gradient.

Debris within the sludge bed may include sunken logs, tree branches, boat moorings and anchors, sunken boats, drill rods, fishing gear, bricks, concrete blocks, wires, and so forth. The size and frequency of debris in the former dredged channel off Wilcox Dock is expected to vary from the Mudflat area. Wilcox Dock was at one time a busy oil barge off-loading facility. Locations of submerged objects detected in the shallowest sludge using geophysical methods over part of the area are shown on Figure 2-5. Aquatic vegetation is unlikely to be encountered, given the presence of deep water and former navigational dredging in this area. The debris may require mechanical removal techniques where encountered, but the nature and frequency of this material is not expected to preclude the feasibility of hydraulic dredging as a primary dredging method.

The sludge in this area was deposited on the deepened side slopes and silty sand bottom of the former navigational dredged area immediately adjacent to the north and east sides of Wilcox Dock. A layer of lake bottom sediment deposited after navigational dredging and before sludge deposition, although not observed, may be present in some areas. As described above, the Dock area sludge is expected to be relatively stratified in physical and chemical properties.

Available navigational dredging design information suggests that the former navigational dredging, which occurred prior to sludge deposition, extended to a bottom elevation on the order of approximately 78-82 feet adjacent to the dock. This is generally corroborated by the elevations of the bottom of sludge (Figure 2-10). It appears that sludge deposition has completely filled the former channel at the southwest end of the channel north of the dock, whereas the southeast end of the channel has substantially thinner sludge. It is estimated that the original cut slopes for the navigational dredging were on the order of 3 (horizontal) to 1-1 (vertical), but this has not been corroborated by field data.

Breakwater Sludge Area

The breakwater sludge area occupies approximately 11.7 acres and is characterized by a relatively thin sludge layer ranging from 0.25 feet to 4 feet thick, and averaging 1.5 feet thick. The estimated in-place sludge thickness is shown on Figure 2-8. A profile of the breakwater area is shown on Figure 2-9. The in-place volume of sludge in this area, not including underlying material that may be removed during the dredging operation is estimated to be approximately 23,500 cy.

The sludge in this area is expected to be comprised material similar to that in the Mudflat sludge area. Lacustrine silt muck may also be present. Solids contents are expected on the order of 30%.

Debris within the sludge may include sunken logs, tree branches, roots, boat moorings and anchors, sunken boats, drill rods, fishing gear, bricks, concrete blocks, wires, abandoned pipes, and so forth. The size and frequency of debris in the former dredged intake channel is expected to vary from the Mudflat sludge area. Wilcox Dock was at one time a busy oil barge off loading facility and a rip rap protected breakwater border the Breakwater. Geophysical methods were not used in this area to locate objects in the sludge bed. Aquatic vegetation is unlikely to be encountered, given the presence of deep water and former navigational dredging in this area. Where encountered, debris may require mechanical removal techniques, but unless the rip rap placed on and adjacent to the shoreline poses a problem, the nature and frequency of this material is not expected to preclude the feasibility of hydraulic dredging as a primary dredging method.

A recently compiled bathymetric map of the Breakwater bottom surface is presented in Figure 2-3, and represents the best information available. Water depth will vary with lake fluctuations. Under a mean lake elevation of 95.5 feet AMSL, the water depth will range from 8.5 feet to 16.5 feet deep. Under extreme conditions, the lake may be 7 feet deeper to 2 feet shallower. Lake waves and current direction and velocity are expected to change with weather conditions, but except for the eastern portion, which is similar to the unsheltered portion of the Mudflat area, Wilcox Dock and the breakwater shelter most of this area from severe lake waves and currents.

The sludge in this area was deposited on the side slopes and silty sand bottom of the former navigational dredged area immediately adjacent to the south side of Wilcox Dock and entrance channel. A layer of lake bottom sediment deposited after navigational dredging and before sludge deposition, although not observed, may be present in some areas. Available navigational dredging design information suggests that the former navigational dredging, which occurred prior to sludge deposition, extended to a bottom elevation on the order of 78-82 feet adjacent to the dock. This is generally corroborated by the elevations of the bottom of sludge (Figure 2-10). The deepest lake bottom elevation (79 feet AMSL) encountered in the project area was measured in this area adjacent to Wilcox Dock, but it appears that sludge deposition in this area was substantially less than observed on the north side of the dock.

The north side of this area is defined by Wilcox Dock and the Dock dredge area possibly by a temporary sheet pile wall or silt curtain that will extend easterly out from the dock. The east side is defined by the edge of the former Wilcox Dock dredged channel. The southeast part is an arbitrary Operable Unit 1-1 line that cuts across the former navigational dredge channel. The south side is the rip rap protected breakwater, and the west side is the mainland shoreline, which includes a private water intake structure. The slopes of the rip rap facing on the breakwater were shown on original design drawings as ranging from 2 (horizontal) to 1-1 (vertical) to 2.5 on 1-1, but this has not been corroborated by field data.

2.3 Sludge Bed PCB Concentrations

The extent of PCB concentrations in the vicinity of the sludge bed was evaluated during several investigations prior to the remedial design. The following sections describe each of the sampling events.

2.3.1 1994 Sampling

In March 1994, the NYSDEC collected cores from the sludge bed area. Five cores were analyzed for PCBs. The sampled core thicknesses ranged from 0.8 to 1.4 feet in thickness and for each core a sample was collected every two centimeters for PCB analysis by the NYSDEC. The PCB concentrations ranged between approximately non-detect to 1,850 ppm. The highest concentrations were detected in the channel area. The Aroclor detected was primarily 1242.

In August 1994, the NYSDOH collected six cores from the sludge bed area. These cores thicknesses ranged from 1 to 3 feet in thickness. PCB analysis was performed by RECRA laboratory. The results of PCB analysis of these cores were as high as 550 ppm.

The methods, locations and analytical results for these investigations can be obtained from the NYSDEC. The data is summarized in Table 2-4.

2.3.2 1995 Sampling

In August 1995, as part of the SC activities, samples of the sludge bed and underlying sand were analyzed for PCBs. The methods and results are detailed in the SC Report. PCB concentrations ranged from non-detect to 270 ppm, primarily Aroclor 1242. Sampling results also indicated that the PCBs are associated with the sludge bed material (which is highly organic) and non-detect within the underlying sand.

In addition to individual core samples, one composite sample was collected from cores located across the sludge bed. The analytical result of this composite sample was 21 ppm. Sampling rational and methods are provided in the SC Report. The data is resummarized on Table 2-4.

2.3.3 1996 Sampling

As discussed in Section 2.2.1 above, samples were collected on October 16 and 17, 1996 by NYSDEC and TAMS personnel. The purpose of the sampling program was to further characterize the concentrations of PCBs in the sludge. The data are summarized on Table 2-5.

The results of sludge sampling confirm that higher concentrations of PCBs are present in the thicker channel materials adjacent to the dock, than at other locations throughout the sludge bed. The PCB concentrations in the channel adjacent to the long axis of the dock on the northwest side ranged from 150 ppm to 250 ppm. Whereas the PCB concentrations in the sludge off the end of the dock (location CH-1) and from locations in thinner portions of the sludge bed (locations AS-3 and AS-4) were ranged from 44 to 74 ppm. These concentrations are somewhat higher than the PCB level in the composite sludge sample collected during the 1995 Site Characterization which was collected from a mixture of sludge cores from random locations throughout the sludge bed and contained a PCB concentration of 21 ppm. The sludge collected off the end of the breakwater had a relatively low PCB concentration of 1.56 ppm. The sand collected from beneath the sludge at CH-2, as expected, contained less than 1-1 ppm of PCBs.

The leachability testing of the 5 sludge samples (with PCB concentrations ranging from 65 to 290 ppm) resulted in TCLP PCB concentrations ranging from 1.3 to 16 ppb. The TCLP results indicate that the sludge in the channels, if exposed to leaching conditions, could release PCB concentrations in excess of the NYSDEC groundwater standard of 0.1 ppb.

2.3.4 1998 Sampling

As discussed in Section 2.2.1 above, samples were collected in February and April 1998 by NYSDEC and Rust personnel. The purpose of the sampling program was to further characterize the concentrations of PCBs in the sludge. A summary of the cores analyzed is provided on Table 2-6.

2.3.5 Summary of PCB Concentrations

The results of the recent PCB sampling are summarized on Figure 2-11. PCB concentrations in the Mudflats Sludge Area are expected to average less than 50 mg/kg, and no predictable stratification in these concentrations is expected.

PCB concentrations in the Dock Sludge Area are expected to average over 50 mg/kg for much of the material to be removed from this area. The available data appears to indicate that some layers of sludge contain appreciably higher concentrations of PCBs than other layers. Three general layers of sludge have been detected. Highest PCB concentrations have been detected in the middle layer which is predominantly light gray pulp. The overlying sludge layer, which is present at the present lake bottom, has intermediate concentrations that are lower than the pulp, but still frequently greater than 50 mg/kg. The deepest layer of sludge appears to have the lowest concentrations, at or approaching non-detectable..

PCB concentrations in the Breakwater Sludge Area are expected to average less than 50 mg/kg, and no predictable stratification in these concentrations is expected.

3.0 TREATABILITY STUDIES

Several studies were performed to collect data on the treatability and behavior of the sludge bed sediments relative to various treatment technologies. These studies are summarized in the following sections.

3.1 Kiber Environmental Study

A Treatability Study Report was prepared in November 1995 by Kiber Environmental Services, Inc. (Kiber), under contract to Rust, as a presentation of the final results for the treatability study conducted on sludge sampled from the Cumberland Bay Sludge Bed Site. The treatability study was conducted to determine the effectiveness of dewatering and immobilization treatment of the sludge, and water treatment protocols for the process water.

3.1.1 Scope

The objectives of the treatability study were to identify:

- the chemical and physical properties of the untreated sludge,
- the volume and weight reduction achievable through removal of free water from the sludge using dewatering processes,
- water treatment techniques capable of removing biochemical oxygen demand (BOD), chemical oxygen demand (COD), total suspended solids (TSS), and PCBs from the filtrate generated by the dewatering process,
- immobilization reagents capable of reducing the leachability of PCBs present in the untreated material, and
- immobilization reagents which improved the physical properties of the sludge.

The treatability study was conducted in four distinct phases including untreated characterization, dewatering evaluations, water treatment evaluations, and immobilization evaluations.

Untreated characterization analyses involved the determination of the physical and chemical properties of sludges sampled from the Site. During the dewatering phase of the treatability study, Kiber evaluated several mechanical and non-mechanical dewatering methods, including filter press, Buchner funnel, and gravity drainage. Biological and chemical precipitation processes were both investigated for treatment of the filtrate generated during dewatering. Kiber performed immobilization treatment using a variety of non-proprietary reagents. The treated materials were evaluated for chemical and physical properties.

3.1.2 Results

The results of the treatability study indicate that both dewatering and immobilization technologies are effective at improving the physical characteristics of the sludge. Dewatering treatment provided volume reduction in the untreated sludge. Immobilization treatment was successful at maintaining low leachable concentrations of PCBs and at improving the physical properties of the untreated sludge. Testing methods, tabulated results, photographs and back-up calculations and data sheets are provided in the November 1995 report from Kiber.

Untreated Characterization

The results of the analysis of untreated sludge are summarized in the following table:

Parameter	Unit	Results(1-1)		
		A	B	C
I. Chemical Analysis				
Material pH	s.u.	6.1	6.2	6.2
II. Physical Properties				
Moisture Content(2)	%	71	64	71
Bulk Density	lb/ft^3	74	75	74
Bulk Specific Gravity	-	1.2	1.2	1.2
Solid Specific Gravity	-	2.3	2.3	2.3
Paint Filter	Pass/Fail	Fail	-	-
Liquid Release	Pass/Fail	Fail	-	-

(1-1) A, B and C represent multiple aliquots of the untreated sludge
(2) Wet weight basis
\- Not analyzed or not applicable

Dewatering Evaluations

The results of the dewatering testing indicate that treatment will reduce the moisture content of the untreated sludge. The moisture content of the sludge was decreased from 69% for the raw sludge to between 54 and 64% for the dewatered filter cakes. Overall, filter press and Buchner funnel treatment provided the best dewatering treatment for the sludge, achieving final sludge moisture contents 54 and 57% respectively. The available data indicates that a belt filter press or a recessed plate filter press would most efficiently reduce the volume of sludge during remediation.

Slight improvement was achieved in the dewatering efficiency through addition of aluminum sulfate or sulfuric acid in conjunction with filter press treatment at a pressure of 100 lbs/in^2. Due to the small decrease in moisture content obtained using the conditioning agents, it may not be cost effective to use conditioners during full-scale sludge dewatering.

Water Treatment Evaluations

Water treatment testing included column settling evaluations, slurry reactor testing and chemical precipitation testing. The analyses were performed using a 5% slurry developed with tap water and the as-received sludge. Analyses performed during the column testing indicate that concentrations of suspended solids generally decreased at each sample depth throughout the testing process. The data indicated that the majority of settling occurred within the first 2 hours of testing.

Results of the slurry reactor testing indicate significant variation in the COD analyses performed over a period of 14 days. Due to the high variability of the data obtained, no conclusions have been drawn on the effectiveness of this technology. Chemical precipitation treatment of the 5% slurry indicates that precipitation treatment can remove the suspended solids and significantly reduce contaminant concentrations.

Immobilization Evaluations

Immobilization treatment successfully increased the unconfined compressive strength of the sludge and reduced the leachability of PCBs from the sludge. A maximum unconfined compressive strength of 20 lbs/in^2 was achieved using the as-received sludge and 29 lbs/in^2 was achieved using the dewatered sludge.

3.2 Gradational Analysis and Sludge Separation Study

During the February 1998 probing and coring program, approximately 20 samples were collected from various locations throughout the sludge bed for grain size analyses (sieve, hydrometer and total organic carbon) for the purpose of evaluating spatial variability of grain size across the sludge bed. Grain size has an impact on slurry density, booster pump requirements, and sediment separation and settling technologies. Ranges in grain size distribution will be used to design the slurry dewatering and water treatment system.

The analyses were performed at Kiber Environmental. Particle size gradation curves for samples collected with a 2-inch diameter sampler are included in Appendix F.

An additional gradational analysis was performed on one composite of the sludge bed. The separated fractions were analyzed for PCBs to evaluate the potential benefits of physically separating the sludge. The results are provided on Table 3-1. The gradation curve is provided in Appendix G.

3.3 Turbidity/Suspended Solids Correlation Bench Test

3.3.1 Introduction

If dredging is performed as part of the remediation at Cumberland Bay, suspended sediment control will likely be necessary. Real-time turbidity/suspended solids monitoring will likely be at critical and background locations at the Site. The real-time turbidity/suspended solids readings would be transmitted to a shore-based station via radio telemetry for evaluation by field personnel.

The turbidity/suspended solids data would be used to provide a real-time warning system that PCB concentrations in the water column are exceeding acceptable concentrations due to dredging activities. A basic assumption of this program is that the PCBs are sorbed to the wood pulp/sediment and are not dissolved to any great extent in the water column. The chemical and physical properties of PCBs support this assumption, as does the field data collected from Cumberland Bay.

To evaluate the relationship between turbidity and suspended solids concentrations, a bench scale study was performed using both a YSI Multi-Parameter Water Quality Monitor (YSI Model 6820, S/N 96F50676) and a D&A Instrument Company OBS-3 suspended solids and turbidity sensor (S/N 395) connected to a Coastal Leasing MicroLite datalogger (S/N 10218). These two instruments were selected for evaluation based on the remote sensing and real-time capabilities of the instruments. A second purpose of the bench scale study was to select an instrument for use during the dredging portion of the site remediation that provides a reliable estimate of suspended solids levels at low concentrations.

3.3.2 Methods

In order to accurately portray the conditions a the Cumberland Bay Sludge Bed Site, the monitoring equipment used to develop a correlation between turbidity and suspended solids concentrations was calibrated using sediment from the study area. To form the composite sample used for this bench test, 50.0 grams of each of the following grab samples from the study area were weighed out and thoroughly mixed in a clean, one liter, wide mouth glass sample container:

- 96-CH-1
- 96-AS-1
- 96-AS-2

These samples were collected on October 16, 1996 by TAMS and NYSDEC personnel.

Five (5) aliquots of this composite sample were then weighed out into clean, one liter, wide mouth glass sample containers, 500 mL of distilled water was added to each container. Three (3) additional samples were prepared as follows:

1. A thoroughly mixed 250 mL aliquot of the 21.8 mg/L sample was taken and mixed with 250 mL of distilled water to create a 10.9 mg/L sample.

2. A thoroughly mixed 250 mL aliquot of the 10.9 mg/L sample was taken and mixed with 250 mL of distilled water to create a 5.45 mg/L sample.

3. A thoroughly mixed 250 mL aliquot of the 5.45 mg/L sample was taken and mixed with 250 mL of distilled water to create a 2.725 mg/L sample.

The samples were vigorously shaken for one (1-1) minute and turbidity measurements were made with the YSI turbidity meter. The NTU value was derived for each sample and recorded. Turbidity measurements were then made with the OBS-3 sensor/Coastal MicroLite and the output in volts derived for each sample was recorded. These results are summarized in Table 3-2 and graphically represented in Figure 3-1.

3.3.3 Discussion

The D & A Instrument Company OBS-3 suspended solids and turbidity sensor connected to a Coastal Leasing MicroLite datalogger demonstrated a more linear response than the YSI Multi-Parameter Water Quality Monitor. Review of the data presented in Table 3 and Figure 3 indicate that the total suspended solids (TSS) concentrations can be extrapolated to a lower limit of approximately 1-1 mg/L (ppm) using the MicroLite/OBS-3 system. PCB concentrations in sludge/wood chip samples collected from Cumberland Bay have varied from concentrations below 1-1 mg/Kg (ppm) to as high as 1,800 mg/Kg. The average sediment concentration based on results from 18 sludge samples collected by Rust and TAMS personnel in 1995 and 1996 was approximately 58 mg/Kg.

Assuming an average sludge concentration of 58 mg/Kg at a suspended solids reporting limit of 1-1 mg/L, the potential PCB concentration in the water column would be approximately 0.058 ug/L (ppb):

$$\begin{aligned}(\text{PCB Conc.}_{\text{Water Column}} \text{ in mg/L}) &= (\text{PCB Conc.}_{\text{Sediment}} \text{ in mg/Kg}) \text{ x } (1\text{-}1 \text{ x } 10^{-6} \text{ Kg TSS/L})\\ &= (58 \text{ mg/Kg}) \text{ x } (1\text{-}1 \text{ x } 10^{-6} \text{ Kg TSS/L})\\ &= 5.8 \text{ x } 10^{-5} \text{ mg/L}\\ &= 0.058 \text{ ug/L}\end{aligned}$$

If during dredging operations the TSS at a downgradient location is 1-1 mg/L above background, and it is assumed that all the TSS is related to the dredging operation, the water column PCB concentration would be approximately 0.058 ug/L, based on an average sludge concentration of 58 mg/Kg. If it is assumed that the sludge concentration is the highest historically detected (1,850 mg/Kg) the water column PCB concentration would potentially be 1.85 ug/L at a TSS concentration of 1-1 mg/L above background.

3.4 Solomon Liquids Testing

Solomon Liquids is a manufacturer of a proprietary sediment dewatering system which combined flocculation and screening to dewater sediments from a liquid waste stream such as is created during hydraulic dredging.

A composite sludge bed sample was collected and approximately 4 gallons were sent to Solomon Liquids in Lakewood, Colorado for a bench test of the Solomon Liquids technology. The results of the bench test indicates that this dewatering method would be effective on the sludge bed material, assuming that the composite sample is representative of the sludge bed. The bench test results are provided in Appendix H.

4.0 SHORELINE CHARACTERIZATION

Sludge in the shallow shoreline areas was collected when the lake water levels were low. Attempts at collecting samples by boat during high water were prevented by insufficient draft for the pontoon sampling boat and by the presence of down trees and brush. A canoe or Jon boat could be maneuvered to the locations but the core tubes could not be pushed with force while leaning over the side of the boat.

4.1 Shoreline Sludge Core Collection

In December 1997, Rust personnel collected 20 samples along the sludge bed shoreline area. These samples were identified as samples W-1 through W-20 and are shown on Figure 4-1. The sample locations were surveyed as described in Section 2.1.1.3. The samples were collected by driving a 2-inch diameter clear PVC sample core tube into the ground using a sledge hammer and withdrawing it using a steel lever. The core tubes were driven to refusal on a dense native sand located approximately 4 to 6 feet below the ground surface. The core tubes were transported to Rust's Albany office, cut open using a circular saw and the core sample was logged by a Rust geologist. Core logs for these samples are provided in Appendix I.

The stratigraphy in the shoreline area is characterized by four distinct layers. On top is approximately 1 to 2 feet of organic mat (i.e., leaves, brush, decomposed matter, roots) which also contains wood chips and sludge washed in with wave action. Underlying the sludge is a 2 to 4 foot layer of banded sand. This sand is generally a fine tan sand with a little silt. Occasionally bands (up to 1 or 2 inches) of woodchips or sludge were observed in the sand indicating a variation in the depositional environment. Underlying the banded sand is a 1 to 2 foot layer of sludge which varies from wood chips to a platy or soft pulp. Underlying the sludge is a dense clean sand that occasionally dropped out of the tip of the core tube. The shoreline stratigraphy is shown on profiles provided as Figures 4-2 through 4-6.

After noting the sample stratigraphy, Rust assumed that the sludge underlying the banded sand would have the highest PCB concentration and would need to be removed. Samples of this layer were analyzed for PCBs to characterize the sludge for disposal. Composites of the material overlying the sludge were also analyzed for PCBs. The analytical results are noted on the profiles (Figures 4-2 through 4-6). Surprisingly, the sludge was in actuality non-detect for PCBs and the overlying material contained varying concentrations of PCBs. Rust was still in possession of the opened core tubes so, to evaluate the concentrations in the most bioavailable portion of the core, the upper 12 inches of organic mat from selected cores were analyzed for PCBs. These results were generally above surface soil cleanup levels (1 ppm for 0 to 12 inches). Since the concentrations in the banded sand between the contaminated organic mat material and the uncontaminated sludge was not adequately vertically defined, and the sample cores in Rust's possession had become too mixed to be considered appropriate for sampling, additional core collection was recommended.

Between April 13 and 17, 1998 samples were collected at 11 new shoreline locations identified as W-21 through W-31. Cores at these locations were collected using the same direct push coring method as in December, although the NYSDEC and Rust personnel were required to wade in water to access the locations. The samples were opened and briefly logged on site to identify the major stratigraphic layers. Samples were collected approximately every 6 inches over three to four feet, or along stratigraphic intervals. The stratigraphy for these cores is shown on the shoreline profiles in Figures 2-2 through 2-6 (no cores logs were prepared). The PCB analytical results are also shown on the profiles.

4.2 Extent of PCB-Contaminated Sludge on the Shoreline

The results shown on Figures 2-2 through 2-6 indicate that in most locations only the organic mat requires removal due to PCB impacted wood chips and sludge washing into these areas over the years. In several areas (particularly near the combined sewer overflow) PCBs were detected in the underlying sand above the subsurface (below 12") PCB cleanup level of 10 ppm. A line is shown on the profiles indicating the depth of suggested shoreline removal.

5.0 CURRENT ECOLOGICAL CONDITIONS

A wetlands delineation was performed at the site to identify sensitive ecological environments. The delineated areas are shown on Figure 5-1. The figure also shows the edge of the tree line (or forested wetland), the edge of the cattails (or emergent wetlands) and the approximate edge of lily pads (aquatic bed) which typically fill portions of the shoreline in the summer months. A fish and wildlife assessment was performed for this area. The methods and results can be found in the Site Characterization Report - Addendum No. 1 dated May 1997.

A more detailed description of the jurisdictional wetlands and plans for wetland mitigation are detailed in the Individual Section 10 and Section 404 US Army Corp of Engineers Permit Application (97830YN) dated August 1998.

6.0 GEOTECHNICAL BORINGS

Due to the potential for using piling at the site for containment of work zones, in 1995 and 1997 geotechnical boring were drilled to characterize the soils underlying the sludge bed.

6.1 1995 Borings, Method, Logs, Surveying

In September 1995 geotechnical borings were spread throughout the sludge bed to evaluation the variability of underlying soils across the site. The 1995 locations are shown on Figure 6-1. The drilling methods, core logs and test results are discussed and provided in the SC report.

6.2 1998 Borings, Method, Logs, Surveying

Once the dock sludge area was identified as being substantially different than other sludge bed area, consideration was given to surround the entire area with a sheet pile wall for the purpose of containing resuspended sludge of higher concentrations and reducing wave energy. Additional geotechnical borings were drilled at five locations as shown on Figure 6-1 (GB-98-1 through GB-98-5).

On September 11, 1995, Atlantic Testing, mobilized a skid-mount drill rig to Wilcox Dock and secured it to a flat-bottomed barge. Deep borings were advanced at each core location. A 4-inch diameter steel casing was driven using a 300-pound hammer dropped from a height of 30 inches. Borings were advanced between 20 feet (H-7) to a maximum of 31 feet (H-5) below the water surface where refusal was encountered. Standard 1.37-inch I.D. split-spoon samplers were used to collect sediment samples. Split-spoons were driven using a 140-pound hammer dropped from a height of 24 inches and blow counts were noted every 6 inches during 2-foot advancement of the spoon. The logs for GB-98-1 through GB-98-5 are provided in Appendix J.

7.0 SURFACE WATER CHARACTERIZATION

7.1 1998 Background Analysis

Rust collected nine surface water samples from three locations in Cumberland bay to establish the pre-construction levels of SPDES-permitted discharge parameters of concern. Samples were collected at three locations to evaluate the spatial variability in surface water quality. Figure 7-1 presents the three surface water sampling locations. Three samples were collected from the entrance of Georgia Pacific's water intake; three samples were collected from approximately 200 feet off of the northwest corner of Wilcox Dock; and three samples were collected approximately 200 feet off the outlet of Scomotion Creek on the north side of Cumberland Bay. Surface water samples were collected from the three locations on three separate occasions (April 30, July 1-1, and September 29, 1998) to evaluate seasonal variations in surface water quality.

The surface water from each sample location was laboratory analyzed for the following parameters:

Aluminum
Copper
Iron
Manganese
Zinc
Sulfate
Hardness
Alkalinity
PCBs

Biological Oxygen Demand (BOD)
Chemical Oxygen Demand (COD)
Ammonia
Nitrate
Total Organic Carbon (TOC)
Total Dissolved Solids (TDS)
Total Suspended Solids (TSS)
Total Phosphate

Results of surface water analyses are presented in Tables 7-1, 7-2 and 7-3. Review of this data indicates that little variation exists either spatially or temporally in the quality of the surface water in Cumberland Bay. Table 7-4 presents the average surface water concentrations measured over time for the three sampling locations.

7.2 Industrial Intake Background Sampling

To monitor surface water quality at Georgia Pacific's intake during average conditions and worst case conditions (i.e., storm events) Rust employed an autosampler to collect one composite sample per day form a tube secured in front of their intake. The daily composite consisted of two grab samples, one collected in the morning and the second collected in the evening. Samples were picked up once per week and field monitored for turbidity. For each week of sampling the composite samples with the highest and lowest turbidity were selected for laboratory PCB and total suspended solids analysis.

Table 7-5 presents the results of analysis of the autosampler composites. Review of this data indicates that over a period of 6 weeks of continual sampling in July and August 1998 no significant variability in PCB concentrations or total suspended solids levels were measured in the water being taken in by Georgia Pacific. Two additional weeks of sampling conducted in September 1998 exhibited similar results. No concentrations of PCBs were detected above the laboratory reporting limits in any of the 16 samples submitted to the laboratory for analysis. Reportable levels of suspended solids were only detected in 5 of the 16 samples (ranging from 4 mg/l to 14 mg/l). These data indicate that the quality of the water at the Georgia Pacific intake station is not significantly impacted by the weather conditions at Cumberland Bay.

8.0 SITE METEOROLOGIC AND HYDRAULIC CONDITIONS

According to a Flood Insurance Study performed for the City of Plattsburgh by the US Department of Housing and Urban Development (October 1977), the mean minimum temperature in the city in January is 9° F and the mean maximum in July is 83° F. On the average there are about 220 days per year when the temperature is 32° F or below. The mean annual precipitation is about 30 inches, about six inches of which is the water content of snowfall in the area; the mean seasonal snowfall is about 60 inches. The prevailing winds as measured at the US Air Force Base, are westerly and southerly.

Also reported in the Flood Insurance Study is information on Cumberland Bay flood potential. High-water levels result from a complex combination of climatic conditions which characterize the winter period including unusually large quantities of precipitation or sudden thaws. Also, resilient ice sheets can be lifted by high waters and strong winds, crushing lake-front structures in their path. Highest water levels have generally occurred in April or early May. The 100 year flood level is estimated to be Elevation 101.97 and the 500 year flood level (based on the highest recorded water level at the closest Lake Champlain gaging station) is estimated to be Elevation 102.32. The maximum height of waves in the Plattsburgh area was estimated to be 3.85 feet.

Water levels in lake Champlain are measured at several gauging points including one USGS gauge at Rousse's Point. Ten years of lake levels at Kings Street Dock was provided to Rust in the form of a hydrograph. This data is provided in Appendix K. Water level highs in the spring are typically over 100 feet and do not drop below 100 feet until early May. The lake level after August is typically below 96 feet.

The deepest water locations at the Site are between Wilcox Dock and the breakwater (approximately 10 to 17 feet) resulting from previous dredging activities performed by the NYSTA for the passage of barges. Similar dredging was performed along the north and northeast sides of Wilcox Dock which was subsequently filled by deposition of sludge.

According to a study of the limnology of Lake Champlain by Glenn E. Myer and Gerhard K. Gruendling, of the State University of New York, Plattsburgh, dated January 1979, the currents in Cumberland Bay are sensitive to wind direction due to the relatively shallow and restricted water. Flow patterns for north and south winds are illustrated in the Myer and Gruendling report. Sections of the study pertinent to Cumberland Bay are provided in Appendix L. The variability in current direction was noted during the diver survey as discussed in Section 2.2.1.6.

TABLES

TABLE 2-1

Februrary 1998 Probing Data
Cumberland Bay Sludge Bed Site

Datum	97.50	(Top of Ice)			
ID	**Depth of Water (1)**	**Elev. Top of Sludge (2)**	**Depth to Hard Sand (3)**	**Elev. Top of Hard Sand (4)**	**Soft Material Thick. (5)**
F 1400	2.80	94.70	2.90	94.60	0.10
F 1500	2.90	94.60	3.10	94.40	0.20
F 1600	3.10	94.40	4.00	93.50	0.90
F 1700	2.80	94.70	3.60	93.90	0.80
F 1800	2.95	94.55	5.00	92.50	2.05
G 1200	2.80	94.70	2.80	94.70	0.00
G 1300	3.10	94.40	3.10	94.40	0.00
G 1400	3.30	94.20	3.30	94.20	0.00
G 1500	3.40	94.10	4.30	93.20	0.90
G 1600	3.60	93.90	4.50	93.00	0.90
G 1700	3.70	93.80	6.20	91.30	2.50
G 1800	3.80	93.70	5.60	91.90	1.80
G 1900	3.80	93.70	5.45	92.05	1.65
G 2000	3.30	94.20	5.40	92.10	2.10
H 900	2.40	95.10	2.40	95.10	0.00
H 1000	2.70	94.80	2.70	94.80	0.00
H 1100	2.90	94.60	2.90	94.60	0.00
H 1200	2.9	94.60	2.9	94.60	0.00
H 1300	3.30	94.20	3.30	94.20	0.00
H 1400	3.40	94.10	3.40	94.10	0.00
H 1500	3.50	94.00	3.50	94.00	0.00
H 1600	3.90	93.60	5.90	91.60	2.00
H 1700	4.00	93.50	6.70	90.80	2.70
H 1800	4.10	93.40	6.35	91.15	2.25
H 1900	4.10	93.40	6.05	91.45	1.95
H 2000	3.90	93.60	6.70	90.80	2.80
H 2100	3.60	93.90	5.00	92.50	1.40
H 2200	3.00	94.50	5.50	92.00	2.50
H 2300	2.50	95.00	5.30	92.20	2.80
H 2400	2.40	95.10	5.20	92.30	2.80
H 2500	1.60	95.90	3.30	94.20	1.70
I 800	2.90	94.60	2.90	94.60	0.00
I 900	3.20	94.30	3.20	94.30	0.00
I 1000	3.30	94.20	3.30	94.20	0.00
I 1100	3.70	93.80	3.70	93.80	0.00
I 1200	3.70	93.80	3.80	93.70	0.10
I 1300	5.30	92.20	8.00	89.50	2.70
I 1400	5.50	92.00	7.20	90.30	1.70
I 1500	5.10	92.40	6.90	90.60	1.80
I 1600	4.50	93.00	7.10	90.40	2.60
I 1700	4.40	93.10	7.30	90.20	2.90
I 1800	4.40	93.10	7.10	90.40	2.70
I 1900	4.40	93.10	6.80	90.70	2.40
I 2000	4.10	93.40	6.00	91.50	1.90
I 2100	3.70	93.80	5.30	92.20	1.60
I 2200	3.40	94.10	6.10	91.40	2.70
I 2300	3.30	94.20	5.85	91.65	2.55
I 2400	3.10	94.40	5.55	91.95	2.45
I 2500	2.70	94.80	5.55	91.95	2.85
I 2600	2.40	95.10	5.30	92.20	2.90
J 800	3.90	93.60	3.90	93.60	0.00
J 900	4.00	93.50	4.00	93.50	0.00
J 1000	5.50	92.00	5.50	92.00	0.00
J 1100	4.70	92.80	5.60	91.90	0.90
J 1200	5.80	91.70	7.60	89.90	1.80
J 1300	5.80	91.70	7.60	89.90	1.80
J 1400	6.20	91.30	7.60	89.90	1.40
J 1500	6.30	91.20	7.50	90.00	1.20

TABLE 2-1

Februrary 1998 Probing Data
Cumberland Bay Sludge Bed Site

Datum	97.50	(Top of Ice)			
ID	Depth of Water (1)	Elev. Top of Sludge (2)	Depth to Hard Sand (3)	Elev. Top of Hard Sand (4)	Soft Material Thick. (5)
J 1600	5.80	91.70	8.50	89.00	2.70
J 1700	5.50	92.00	8.20	89.30	2.70
J 1800	5.10	92.40	6.90	90.60	1.80
J 1900	4.80	92.70	8.25	89.25	3.45
J 2000	4.20	93.30	6.70	90.80	2.50
J 2100	4.00	93.50	6.50	91.00	2.50
J 2200	3.80	93.70	6.50	91.00	2.70
J 2300	3.75	93.75	6.15	91.35	2.40
J 2400	3.60	93.90	6.00	91.50	2.40
J 2500	3.50	94.00	5.40	92.10	1.90
J 2600	3.00	94.50	5.40	92.10	2.40
J 2700	2.70	94.80	4.10	93.40	1.40
K 800	6.20	91.30	6.20	91.30	0.00
K 900	4.90	92.60	4.90	92.60	0.00
K 1000	6.70	90.80	7.90	89.60	1.20
K 1100	7.50	90.00	8.50	89.00	1.00
K 1200	8.70	88.80	9.80	87.70	1.10
K 1300	7.60	89.90	8.70	88.80	1.10
K 1400	7.50	90.00	9.30	88.20	1.80
K 1500	7.30	90.20	8.20	89.30	0.90
K 1600	6.80	90.70	8.75	88.75	1.95
K 1700	6.70	90.80	8.00	89.50	1.30
K 1800	5.40	92.10	7.50	90.00	2.10
K 1900	5.40	92.10	8.75	88.75	3.35
K 2000	4.90	92.60	7.50	90.00	2.60
K 2100	4.45	93.05	7.60	89.90	3.15
K 2200	4.00	93.50	7.60	89.90	3.60
K 2300	3.70	93.80	6.90	90.60	3.20
K 2400	3.70	93.80	6.60	90.90	2.90
K 2500	3.70	93.80	6.00	91.50	2.30
K 2600	3.00	94.50	5.80	91.70	2.80
K 2700	3.00	94.50	5.50	92.00	2.50
L 800	6.80	90.70	7.10	90.40	0.30
L 900	8.10	89.40	9.40	88.10	1.30
L 1000	8.30	89.20	9.10	88.40	0.80
L 1100	8.40	89.10	9.50	88.00	1.10
L 1200	8.50	89.00	9.70	87.80	1.20
L 1300	8.20	89.30	10.10	87.40	1.90
L 1400	8.30	89.20	9.90	87.60	1.60
L 1500	8.30	89.20	9.10	88.40	0.80
L 1600	7.30	90.20	8.40	89.10	1.10
L 1700	7.20	90.30	9.70	87.80	2.50
L 1800	7.10	90.40	9.10	88.40	2.00
L 1900	6.55	90.95	7.55	89.95	1.00
L 2000	5.50	92.00	8.20	89.30	2.70
L 2100	5.30	92.20	6.90	90.60	1.60
L 2200	4.60	92.90	7.00	90.50	2.40
L 2300	4.00	93.50	7.40	90.10	3.40
L 2400	3.80	93.70	7.00	90.50	3.20
L 2500	4.00	93.50	7.00	90.50	3.00
L 2600	3.85	93.65	11.55	85.95	7.70
M 800	8.70	88.80	9.60	87.90	0.90
M 900	8.60	88.90	9.30	88.20	0.70
M 1000	8.50	89.00	9.70	87.80	1.20
M 1100	8.70	88.80	10.00	87.50	1.30
M 1200	8.80	88.70	9.00	88.50	0.20
M 1300	8.80	88.70	9.70	87.80	0.90
M 1400	8.80	88.70	9.70	87.80	0.90

TABLE 2-1

Februrary 1998 Probing Data
Cumberland Bay Sludge Bed Site

Datum	97.50	(Top of Ice)			
ID	Depth of Water (1)	Elev. Top of Sludge (2)	Depth to Hard Sand (3)	Elev. Top of Hard Sand (4)	Soft Material Thick. (5)
M 1500	8.20	89.30	8.90	88.60	0.70
M 1600	8.00	89.50	9.00	88.50	1.00
M 1700	7.80	89.70	9.80	87.70	2.00
M 1800	7.80	89.70	10.10	87.40	2.30
M 1900	7.10	90.40	8.00	89.50	0.90
M 2000	6.80	90.70	9.20	88.30	2.40
M 2100	6.40	91.10	9.70	87.80	3.30
M 2200	5.20	92.30	9.30	88.20	4.10
M 2300	4.20	93.30	7.80	89.70	3.60
M 2400	6.70	90.80	18.20	79.30	11.50
M 2500	8.30	89.20	19.00	78.50	10.70
N 800	9.10	88.40	9.60	87.90	0.50
N 900	9.10	88.40	9.50	88.00	0.40
N 1000	9.10	88.40	9.40	88.10	0.30
N 1100	8.90	88.60	10.10	87.40	1.20
N 1200	8.90	88.60	10.00	87.50	1.10
N 1300	8.90	88.60	10.20	87.30	1.30
N 1400	9.20	88.30	10.40	87.10	1.20
N 1500	8.90	88.60	9.60	87.90	0.70
N 1600	8.90	88.60	9.50	88.00	0.60
N 1700	8.60	88.90	10.00	87.50	1.40
N 1800	8.20	89.30	9.20	88.30	1.00
N 1900	7.10	90.40	8.55	88.95	1.45
N 2000	7.30	90.20	8.90	88.60	1.60
N 2100	7.40	90.10	9.70	87.80	2.30
N 2200	6.90	90.60	10.10	87.40	3.20
N 2300	5.70	91.80	9.40	88.10	3.70
N 2400	9.20	88.30	18.25	79.25	9.05
O 1000	9.40	88.10	10.30	87.20	0.90
O 1100	9.30	88.20	10.00	87.50	0.70
O 1200	9.20	88.30	10.70	86.80	1.50
O 1300	9.30	88.20	10.60	86.90	1.30
O 1400	8.90	88.60	10.30	87.20	1.40
O 1500	9.20	88.30	10.30	87.20	1.10
O 1600	9.10	88.40	9.90	87.60	0.80
O 1700	9.00	88.50	10.80	86.70	1.80
O 1800	8.70	88.80	9.80	87.70	1.10
O 1900	7.80	89.70	9.00	88.50	1.20
O 2000	7.40	90.10	9.10	88.40	1.70
O 2100	8.40	89.10	9.80	87.70	1.40
O 2200	10.60	86.90	12.45	85.05	1.85
O 2300	10.70	86.80	18.70	78.80	8.00
O 2700	18.50	79.00	19.60	77.90	1.10
O 2800	8.40	89.10	9.90	87.60	1.50
P 1200	9.70	87.80	9.90	87.60	0.20
P 1300	9.80	87.70	9.90	87.60	0.10
P 1400	9.10	88.40	9.30	88.20	0.20
P 1500	9.60	87.90	10.40	87.10	0.80
P 1600	9.50	88.00	10.20	87.30	0.70
P 1700	9.50	88.00	11.90	85.60	2.40
P 1800	9.30	88.20	10.30	87.20	1.00
P 1900	9.00	88.50	11.95	85.55	2.95
P 2000	8.10	89.40	12.10	85.40	4.00
P 2100	10.80	86.70	17.70	79.80	6.90
P 2200	11.80	85.70	17.20	80.30	5.40
P 2300	14.50	83.00	19.35	78.15	4.85
P 2700	16.10	81.40	18.50	79.00	2.40
P 2800	7.70	89.80	11.30	86.20	3.60

TABLE 2-1

Februrary 1998 Probing Data
Cumberland Bay Sludge Bed Site

Datum	97.50	(Top of Ice)			
ID	**Depth of Water (1)**	**Elev. Top of Sludge (2)**	**Depth to Hard Sand (3)**	**Elev. Top of Hard Sand (4)**	**Soft Material Thick. (5)**
Q 1100	10.60	86.90	12.20	85.30	1.60
Q 1600	9.70	87.80	9.90	87.60	0.20
Q 1700	10.10	87.40	12.10	85.40	2.00
Q 1800	9.90	87.60	10.90	86.60	1.00
Q 1900	9.70	87.80	12.50	85.00	2.80
Q 2000	11.10	86.40	17.50	80.00	6.40
Q 2100	12.60	84.90	17.90	79.60	5.30
Q 2200	13.30	84.20	18.80	78.70	5.50
Q 2300	13.50	84.00	18.20	79.30	4.70
Q 2400	13.00	84.50	18.10	79.40	5.10
Q 2600	18.70	78.80	18.70	78.80	0.00
Q 2700	14.90	82.60	18.50	79.00	3.60
Q 2800	7.00	90.50	12.10	85.40	5.10
R 1600	10.00	87.50	10.20	87.30	0.20
R 1700	10.30	87.20	11.00	86.50	0.70
R 1800	10.30	87.20	10.90	86.60	0.60
R 1900	9.90	87.60	10.60	86.90	0.70
R 2000	9.80	87.70	13.90	83.60	4.10
R 2100	11.70	85.80	16.10	81.40	4.40
R 2200	14.10	83.40	18.80	78.70	4.70
R 2300	14.10	83.40	19.70	77.80	5.60
R 2400	13.30	84.20	19.70	77.80	6.40
R 2500	16.40	81.10	21.10	76.40	4.70
R 2600	17.40	80.10	18.60	78.90	1.20
R 2700	13.00	84.50	18.10	79.40	5.10
R 2800	6.50	91.00	13.10	84.40	6.60
S 1800	10.30	87.20	11.30	86.20	1.00
S 1900	10.10	87.40	10.60	86.90	0.50
S 2000	9.50	88.00	11.00	86.50	1.50
S 2100	11.20	86.30	15.50	82.00	4.30
S 2200	13.90	83.60	18.90	78.60	5.00
S 2300	14.50	83.00	18.70	78.80	4.20
S 2400	14.70	82.80	19.70	77.80	5.00
S 2500	15.90	81.60	19.50	78.00	3.60
S 2600	16.50	81.00	18.80	78.70	2.30
S 2700	10.40	87.10	17.40	80.10	7.00
S 2800	5.00	92.50	9.20	88.30	4.20
T 1800	10.90	86.60	11.60	85.90	0.70
T 1900	10.40	87.10	11.10	86.40	0.70
T 2000	10.70	86.80	11.30	86.20	0.60
T 2100	11.10	86.40	11.70	85.80	0.60
T 2200	12.10	85.40	17.00	80.50	4.90
T 2300	13.90	83.60	19.40	78.10	5.50
T 2400	14.40	83.10	19.30	78.20	4.90
T 2500	16.20	81.30	21.20	76.30	5.00
T 2600	16.50	81.00	18.50	79.00	2.00
T 2700	10.10	87.40	15.30	82.20	5.20
T 2800	4.40	93.10	4.80	92.70	0.40
U 1900	11.00	86.50	11.10	86.40	0.10
U 2000	10.60	86.90	10.90	86.60	0.30
U 2100	10.10	87.40	11.50	86.00	1.40
U 2200	10.60	86.90	11.80	85.70	1.20
U 2300	12.30	85.20	14.20	83.30	1.90
U 2400	14.40	83.10	19.30	78.20	4.90
U 2500	15.30	82.20	18.20	79.30	2.90
U 2600	15.50	82.00	18.40	79.10	2.90
U 2700	10.20	87.30	11.70	85.80	1.50
V 2000	10.80	86.70	11.10	86.40	0.30

TABLE 2-1

Februrary 1998 Probing Data
Cumberland Bay Sludge Bed Site

Datum	97.50	(Top of Ice)			
ID	Depth of Water (1)	Elev. Top of Sludge (2)	Depth to Hard Sand (3)	Elev. Top of Hard Sand (4)	Soft Material Thick. (5)
V 2100	10.10	87.40	10.80	86.70	0.70
V 2200	9.60	87.90	10.00	87.50	0.40
V 2300	10.30	87.20	11.20	86.30	0.90
V 2400	12.80	84.70	15.50	82.00	2.70
V 2500	13.60	83.90	17.50	80.00	3.90
V 2600	13.30	84.20	19.10	78.40	5.80
V 2700	10.20	87.30	11.50	86.00	1.30
W 2000	11.50	86.00	11.90	85.60	0.40
W 2100	11.00	86.50	11.40	86.10	0.40
W 2200	10.60	86.90	11.10	86.40	0.50
W 2300	10.40	87.10	10.90	86.60	0.50
W 2400	12.60	84.90	16.80	80.70	4.20
W 2500	13.50	84.00	16.00	81.50	2.50
W 2600	13.60	83.90	17.30	80.20	3.70
W 2700	13.30	84.20	17.80	79.70	4.50
W 2800	8.80	88.70	9.20	88.30	0.40
X 2000	12.10	85.40	12.40	85.10	0.30
X 2100	11.90	85.60	12.30	85.20	0.40
X 2200	11.10	86.40	12.00	85.50	0.90
X 2300	10.60	86.90	11.50	86.00	0.90
X 2400	10.20	87.30	11.10	86.40	0.90
X 2500	10.50	87.00	12.20	85.30	1.70
X 2600	12.50	85.00	13.50	84.00	1.00
X 2700	13.10	84.40	16.50	81.00	3.40
X 2800	12.40	85.10	14.90	82.60	2.50
Y 2400	11.00	86.50	12.00	85.50	1.00
Y 2500	10.50	87.00	11.70	85.80	1.20
Y 2600	10.80	86.70	12.60	84.90	1.80
Y 2700	12.30	85.20	14.20	83.30	1.90
Y 2800	13.20	84.30	15.10	82.40	1.90
Z 2400	12.40	85.10	12.70	84.80	0.30
Z 2500	11.90	85.60	12.40	85.10	0.50
Z 2600	11.50	86.00	12.20	85.30	0.70
Z 2700	11.10	86.40	12.40	85.10	1.30
Z 2800	12.70	84.80	13.40	84.10	0.70
NOTES:	Bold indicates core collected at this location.				
	(1) Depth of ice and water measured from top of ice.				
	(2) Elevation of water/sediment (sludge or sand) interface				
	(3) Depth to resistance (could not longer push with hands, no hammer used except where cores were collected); interpreted as top of hard sand surface.				
	(4) Elevation of hard sand surface				
	(5) Elevation of top of sludge - elevation top of hard surface.				

TABLE 2-2

Sludge Core and Probing Data
Cumberland Bay Sludge Bed Site

All measurements are in feet, elevation are above mean sea level.

Location		Core Data												Adjusted Core Data		Probe Data							Final Sludge Bed Data		
Station ID *	Previous Station ID	Date Core Collected	Lake Water Surface Elev.	Depth of Water	Elev. Top of Sludge/ Lake Bot.	Core Sludge Thick.	Elev. Bottom of Sludge	Core Bnded Sand Thick.	Depth to "Hard" Material	Elev. Top of "Hard" Material	Core Recovery	Drive Depth	Core Loss	Adjusted Sludge Thickness	Adjusted Elevation Bottom of Sludge	Date Probe Data Collected	Top of Ice Elevation	Depth of Water	Elev. Top of Sludge/ Lake Bot.	Depth to "Hard" Material	Elev. Top of "Hard" Material	Soft Material Thick.	Elev. Top of Sludge/ Lake Bot./ Bathymet.	Elev. Bottom of Sludge	Sludge Thick.
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)	(s)	(t)	(u)	(v)	(w)	(x)	(y)	(z)
E 1700	F-9	8/16/95	95.16	0.0	95.2	0.5	94.7	> 1.3	na	na	1.8	3.0	1.2	1.1	94.1								not used; position questionable		
E 1900	E-9	8/15/95	95.20	0.0	95.2	0.9	94.3	> 1.0	na	na	1.9	3.0	1.1	1.5	93.8								not used; position questionable		
E 2100	D-9	8/15/95	95.20	1.2	94.0	0.8	93.2	> 1.3	1.0	93.0	2.1	2.8	0.7	1.2	92.9								96.5	92.9	3.7
G 1300	H-8	8/15/95	95.20	0.7	94.5	0.0	94.5	> 2.0	na	na	2.0	2.2	0.2	na	na	2/18/98	97.50	3.1	94.4	3.1	94.4	0.0	94.4	94.4	0.0
G 1500	G-8	8/16/95	95.16	1.4	93.8	0.9	92.9	> 2.1	1.3	92.5	3.1	3.3	0.2	1.0	92.8	2/18/98	97.50	3.4	94.1	4.3	93.2	0.9	94.1	92.8	1.3
G 1700	F-8	8/15/95	95.20	1.6	93.6	1.2	92.4	> 1.0	0.8	92.8	2.2	3.7	1.5	2.0	91.7	2/18/98	97.50	3.7	93.8	6.2	91.3	2.5	93.8	91.7	2.1
G 1900	E-8	8/15/95	95.20	1.9	93.3	0.6	92.7	> 0.8	2.5	90.8	1.4	3.3	1.9	1.6	91.8	2/18/98	97.50	3.8	93.7	5.5	92.1	1.7	93.7	91.8	2.0
G 2100	D-8	8/16/95	95.16	1.1	94.1	2.8	91.3	0.0	1.9	92.2	2.8	3.7	0.9	3.3	90.8								95.1	90.8	4.3
G 2300	C-8	8/15/95	95.20	0.0	95.2	0.7	94.5	> 1.4	na	na	2.1	3.0	0.9	1.2	94.1								96.0	94.1	2.0
G 2500	B-8	8/15/95	95.20	0.0	95.2	0.7	94.5	> 1.6	na	na	2.3	3.0	0.7	1.1	94.2								96.8	94.2	2.6
G 2700	A-8	8/15/95	95.20	0.0	95.2	1.1	94.1	0.0	na	na	1.5	3.0	1.5	1.9	93.4								not used; position questionable		
H 1900		2/18/98	97.5	4.1	93.4	> 1.6	na	0.0	2.0	91.5	1.6	2.0	0.4	2.0	91.4	2/18/98	97.50	4.1	93.4	6.1	91.4	2.0	93.4	91.4	2.0
H 2100		2/18/98	97.5	3.6	93.9	> 1.4	na	1.4	1.4	92.5	1.6	1.6	0.0	1.6	92.3	2/18/98	97.50	3.6	93.9	5.0	92.5	1.4	93.9	92.3	1.6
H 2600	A,B-7,8	8/17/95	95.24	0.0	95.2	1.0	94.2	0.0	na	na	1.5	4.5	3.0	2.5	92.7								96.0	92.7	3.3
I 0900	J-7	8/16/95	95.16	1.0	94.2	0.0	94.2	1.3	0.9	93.3	1.8	2.0	0.2	na	na	2/18/98	97.50	3.2	94.3	3.2	94.3	0.0	94.3	94.3	0.0
I 1100	I-7	8/9/95	95.10	2.1	93.0	0.3	92.7	0.8	0.4	92.6	1.6	1.8	0.2	0.4	92.6	2/18/98	97.50	3.7	93.8	3.7	93.8	0.0	93.8	92.6	1.2
I 1300	H-7	8/9/95	95.10	3.8	91.3	0.7	90.6	>1.7	0.9	90.4	2.4	2.8	0.4	0.9	90.4	2/18/98	97.50	5.3	92.2	8.0	89.5	2.7	92.2	90.4	1.8
I 1500	G-7	8/9/95	95.10	2.2	92.9	1.6	91.3	0.0	2.3	90.6	1.6	3.7	2.1	2.7	90.3	2/18/98	97.50	5.1	92.4	6.9	90.6	1.8	92.4	90.3	2.2
I 1700	F-7	8/9/95	95.10	2.4	92.7	1.3	91.4	0.7	1.9	90.8	2.7	3.6	0.9	1.8	91.0	2/18/98	97.50	4.4	93.1	7.3	90.2	2.9	93.1	91.0	2.1
I 1900	E-7	8/8/95	95.06	2.4	92.7	0.8	91.9	1.8	na	na	3.3	4.6	1.3	1.5	91.2	2/18/98	97.50	4.4	93.1	6.8	90.7	2.4	93.1	91.2	1.9
I 2100	D-7	8/14/95	95.24	1.5	93.7	1.9	91.8	> 0.8	1.2	92.5	2.7	3.6	0.9	2.4	91.4	2/18/98	97.50	3.7	93.8	5.3	92.2	1.6	93.8	91.4	2.4
I 2300	C-7	8/14/95	95.24	1.2	94.0	1.5	92.5	> 0.3	2.8	91.2	1.8	3.3	1.5	2.3	91.8	2/18/98	97.50	3.3	94.2	5.9	91.7	2.6	94.2	91.8	2.4
I 2500	B-7	8/14/95	95.24	1.0	94.2	1.4	92.8	0.5	2.3	91.9	2.1	3.3	1.2	2.0	92.2	2/18/98	97.50	2.7	94.8	5.6	92.0	2.9	94.8	92.2	2.6
I 2700	A-7	8/15/95	95.20	0.0	95.2	0.7	94.5	> 0.9	na	na	1.6	3.0	1.4	1.4	93.8								95.9	93.8	2.1
J 1200		2/18/98	97.50	5.8	91.7	1.1	90.6	0.3	1.8	89.9	1.4	1.8	0.4	1.3	90.4	2/18/98	97.50	5.8	91.7	7.6	89.9	1.8	91.7	90.4	1.3
J 1400		2/18/98	97.5	6.2	91.3	> 1.6	na	0.0	1.4	89.9	1.6	1.6	0.0	1.6	89.7	2/18/98	97.50	6.2	91.3	7.6	89.9	1.4	91.3	89.7	1.6
J 1700		2/18/98	97.5	5.5	92.0	1.5	90.5	0.3	2.7	89.3	1.8	2.7	0.9	2.0	90.1	2/18/98	97.50	5.5	92.0	8.2	89.3	2.7	92.0	90.1	2.0
J 2300	C-7/100E	8/8/95	95.06	1.8	93.3	0.9	92.4	0.9	na	na	2.7	5.2	2.5	2.2	91.1	2/18/98	97.50	3.8	93.8	6.2	91.4	2.4	93.8	91.1	2.7
J 2300		2/18/98	97.5	3.8	93.8	1.7	92.1	0.2	2.4	91.4	1.9	2.4	0.5	2.0	91.8	2/18/98	97.50	3.8	93.8	6.2	91.3	2.5	not used; duplicate more conservativ		
J 2500		2/18/98	97.5	3.5	94.0	> 1.0	na	0.0	1.9	92.1	1.0	1.9	0.9	1.9	92.1	2/18/98	97.50	3.5	94.0	5.4	92.1	1.9	94.0	92.1	1.9
K 0900	J-6	8/10/95	95.12	2.3	92.8	0.0	92.8	1.6	0.5	92.3	2.6	2.8	0.2	na	na	2/18/98	97.50	4.9	92.6	4.9	92.6	0.0	92.6	92.6	0.0
K 1100	I-6	8/10/95	95.12	5.1	90.0	0.9	89.1	1.0	0.8	89.2	2.6	3.0	0.4	1.1	88.9	2/18/98	97.50	7.5	90.0	8.5	89.0	1.0	90.0	88.9	1.1
K 1300	H-6	8/10/95	95.12	5.2	89.9	1.2	88.7	0.0	0.8	89.1	2.3	2.8	0.5	1.5	88.5	2/18/98	97.50	7.6	89.9	8.7	88.8	1.1	89.9	88.5	1.4
K 1500	G-6	8/10/95	95.12	5.2	89.9	0.4	89.5	0.5	0.7	89.2	2.8	3.0	0.2	0.5	89.4	2/18/98	97.50	7.3	90.2	8.2	89.3	0.9	90.2	89.4	0.8
K 1700	F-6	8/10/95	95.12	4.6	90.5	0.5	90.0	0.5	0.8	89.7	2.8	3.1	0.3	0.7	89.9	2/18/98	97.50	6.7	90.8	8.0	89.5	1.3	90.8	89.9	0.9
K 1900	E-6	8/8/95	95.06	3.8	91.3	1.0	90.3	0.4	na	na	3.0	6.7	3.7	2.9	88.4	2/18/98	97.50	5.4	92.1	8.8	88.8	3.4	92.1	88.4	3.7
K 2100	D-6	8/8/95	95.06	2.4	92.7	0.5	92.2	1.5	na	na	3.3	4.6	1.3	1.2	91.5	2/18/98	97.50	4.5	93.1	7.6	89.9	3.2	93.1	91.5	1.5
K 2300	C-6	8/10/95	95.12	1.5	93.6	1.4	92.2	1.4	2.2	91.4	3.3	4.3	1.0	1.9	91.7	2/18/98	97.50	3.7	93.8	6.9	90.6	3.2	93.8	91.7	2.1
K 2500	B-6	8/17/95	95.24	1.5	93.7	1.7	92.0	> 0.2	3.0	90.7	1.9	3.8	1.9	2.7	91.1	2/18/98	97.50	3.7	93.8	6.0	91.5	2.3	93.8	91.1	2.7
K 2700	A-6	8/16/95	95.16	1.1	94.1	2.5	91.6	0.8	1.6	92.5	4.0	4.8	0.8	2.9	91.2	2/18/98	97.50	3.0	94.5	5.5	92.0	2.5	94.5	91.2	3.3
L 1400		2/18/98	97.5	8.3	89.2	0.0	89.2	0.8	1.6	87.6	1.6	1.7	0.1	0.0	89.2	2/18/98	97.50	8.3	89.2	9.9	87.6	1.6	89.2	89.2	0.0
L 1900		2/18/98	97.5	6.6	91.0	0.0	91.0	0.0	1.0	90.0	1.0	1.0	0.0	0.0	91.0	2/18/98	97.50	6.6	90.9	7.6	89.9	1.0	90.9	90.9	0.0
L 2100		2/18/98	97.5	5.3	92.2	1.4	90.8	1.6	1.6	90.6	3.1	na	na	na	na	2/18/98	97.50	5.3	92.2	6.9	90.6	1.6	92.2	90.8	1.4
L50E 2350*		4/15/98	100.8	9.1	91.7	10.1	81.6	0.0	11.6	80.1	10.1	11.6	1.5	10.9	80.9								91.7	80.9	10.9
L 2600		2/18/98	97.5	3.9	93.6	2.0	91.6	3.0	7.7	85.9	3.2	7.7	4.5	4.3	89.4	2/18/98	97.50	3.9	93.6	11.6	85.9	7.7	93.6	89.4	4.3
M 0900	J-5	8/16/95	95.16	6.5	88.7	0.2	88.5	1.1	0.5	88.2	3.2	4.7	1.5	na	na	2/18/98	97.50	8.6	88.9	9.3	88.2	0.7	88.9	88.5	0.4
M 1100	I-5	8/16/95	95.16	6.3	88.9	0.6	88.3	1.5	na	na	2.6	4.0	1.4	1.3	87.6	2/18/98	97.50	8.7	88.8	10.0	87.5	1.3	88.8	87.6	1.2
M 1300	H-5	8/15/95	95.20	6.4	88.8	0.3	88.5	>3.1	0.8	88.0	3.4	3.5	0.1	0.4	88.5	2/18/98	97.50	8.8	88.7	9.7	87.8	0.9	88.7	88.5	0.3
M 1500	G-5	8/15/95	95.20	6.9	88.3	0.3	88.0	2.2	0.6	87.7	3.3	3.5	0.2	0.4	87.9	2/18/98	97.50	8.2	89.3	8.9	88.6	0.7	89.3	87.9	1.4
M 1700	F-5	8/15/95	95.20	6.0	89.2	0.3	89.0	>2.8	0.0	89.2	3.1	4.0	0.9	na	na	2/18/98	97.50	7.8	89.7	9.8	87.7	2.0	89.7	89.0	0.8
M 1900	E-5	8/11/95	95.12	4.8	90.3	0.8	89.5	0.5	1.1	89.2	3.0	4.0	1.0	1.3	89.0	2/18/98	97.50	7.1	90.4	8.0	89.5	0.9	90.4	89.0	1.4
M 1900?	E-5/AS-4?	10/17/96	94.62	~ 3.0	91.6	> 2.0	na	0.0	na	na	2.0	2.0	0.0	2.0	89.6								not used; position questionable		
M 2100	D-5	8/11/95	95.12	4.6	90.5	1.4	89.1	>1.4	1.8	88.7	2.8	4.0	1.2	2.0	88.5	2/18/98	97.50	6.4	91.1	9.7	87.8	3.3	91.1	88.5	2.6
M 2100?	D-5/AS-3?	10/17/96	94.62	~ 3.0	91.6	> 2.0	na	0.0	na	na	2.0	2.0	0.0	2.0	89.6	2/18/98	97.50	6.4	91.1	9.7	87.8	3.3	not used; position questionable		

TABLE 2-2

Sludge Core and Probing Data
Cumberland Bay Sludge Bed Site

All measurements are in feet, elevation are above mean sea level.

Location		Core Data												Adjusted Core Data		Probe Data							Final Sludge Bed Data		
Station ID *	Previous Station ID	Date Core Collected	Lake Water Surface Elev.	Depth of Water	Elev. Top of Sludge/ Lake Bot.	Core Sludge Thick.	Elev. Bottom of Sludge	Core Bnded Sand Thick.	Depth to "Hard" Material	Elev. Top of "Hard" Material	Core Recovery	Drive Depth	Core Loss	Adjusted Sludge Thickness	Adjusted Elevation Bottom of Sludge	Date Probe Data Collected	Top of Ice Elevation	Depth of Water	Elev. Top of Sludge/ Lake Bot.	Depth to "Hard" Material	Elev. Top of "Hard" Material	Soft Material Thick.	Elev. Top of Sludge/ Lake Bot./ Bathymet.	Elev. Bottom of Sludge	Sludge Thick.
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)	(s)	(t)	(u)	(v)	(w)	(x)	(y)	(z)
M 2300	C-5	8/10/95	95.12	3.3	91.8	1.8	90.0	>0.5	3.6	88.2	2.3	4.1	1.8	2.7	89.1	2/18/98	97.50	4.2	93.3	7.8	89.7	3.6	93.3	89.1	4.2
M 2400		2/18/98	97.5	6.7	90.8	10.2	80.6	0.5	11.5	79.3	10.9	11.5	0.6	10.5	80.3	2/18/98	97.50	6.7	90.8	18.2	79.3	11.5	90.8	80.3	10.5
M 2500	B-5	8/17/95	95.24	5.3	89.9	>1.8	na	0.0	5.7	84.2	1.8	5.7	3.9	5.7	84.2	2/18/98	97.50	8.3	89.2	19.0	78.5	10.7	89.2	84.2	5.0
M 2500?	B-5/AS-2?	10/16/96	94.7	~ 4.0	91.7	> 4.3	na	0.0	4.3	87.4	4.3	4.3	0.0	na	na	2/18/98	97.50	8.3	89.2	19.0	78.5	10.7	not used; position questionable		
N50E 2250*		4/15/98	100.8	10.1	90.7	2.7	88.0	0.0	3.2	87.5	2.7	3.2	0.5	3.0	87.8								90.7	87.8	3.0
N 2400		2/18/98	97.5	9.2	88.3	> 7.2	na	0.0	9.1	79.3	7.2	9.1	1.9	9.1	79.2	2/18/98	97.50	9.2	88.3	18.3	79.2	9.1	88.3	79.2	9.1
O 1100	I-4	8/16/95	95.16	7.3	87.9	0.2	87.7	1.0	0.7	87.2	3.3	4.0	0.7	na	na	2/18/98	97.50	9.3	88.2	10.0	87.5	0.7	88.2	87.7	0.5
O 1300	H-4	8/16/95	95.16	7.1	88.1	0.3	87.8	2.3	0.0	88.1	3.1	4.1	1.0	na	na	2/18/98	97.50	9.3	88.2	10.6	86.9	1.3	88.2	87.8	0.4
O 1500	G-4	8/16/95	95.16	7.1	88.1	0.3	87.8	2.2	0.9	87.2	3.1	3.7	0.6	na	na	2/18/98	97.50	9.2	88.3	10.3	87.2	1.1	88.3	87.8	0.5
O 1700	F-4	8/16/95	95.16	7.0	88.2	0.0	88.2	2.0	0.9	87.3	2.8	3.3	0.5	na	na	2/18/98	97.50	9.0	88.5	10.8	86.7	1.8	88.5	88.5	0.0
O 1900	E-4	8/16/95	95.16	6.2	89.0	0.4	88.6	>2.6	0.9	88.1	3.0	3.8	0.8	0.8	88.2	2/18/98	97.50	7.8	89.7	9.0	88.5	1.2	89.7	88.2	1.5
O 2100	D-4	8/16/95	95.16	5.7	89.5	1.5	88.0	0.0	1.7	87.8	1.8	3.6	1.8	2.4	87.1	2/18/98	97.50	8.4	89.1	9.8	87.7	1.4	89.1	87.1	2.0
O 2200		2/18/98	97.5	10.6	86.9	> 4.6	na	0.0	1.9	85.0	4.6	4.6	0.0	4.6	82.3	2/18/98	97.50	10.6	86.9	12.5	85.0	1.9	86.9	82.3	4.6
O 2300	C-4	8/15/95	95.20	8.4	86.8	> 1.8	na	0.0	15.2	71.6	1.8	16.0	14.2	8.0	78.8	2/18/98	97.50	10.7	86.8	18.7	78.8	8.0	86.8	71.6	15.2
O 2300?	C-4/AS-1?	10/16/96	94.70	~ 4.0	91.7	> 3.3	na	0.0	3.3	88.4	3.3	3.3	0.0	na	na	2/18/98	97.50	10.7	86.8	18.7	78.8	8.0	not used; position questionable		
P 1700*		4/15/98	100.8	12.6	88.2	0.0	88.2	1.0	1.2	87.0	1.0	1.2	0.2	na	na	2/18/98	97.50	9.5	88.0	11.9	85.6	2.4	88.0	88.0	0.0
P 1900		2/18/98	97.5	9.0	88.5	> 2.5	na	0.0	3.0	85.5	2.5	3.0	0.5	2.8	85.8	2/18/98	97.50	9.0	88.5	12.0	85.5	3.0	88.5	85.8	2.8
P 2100*		4/15/98	100.8	13.7	87.1	5.2	81.9	0.0	7.1	80.0	5.2	7.1	1.9	6.2	81.0	2/18/98	97.50	10.8	86.7	17.7	79.8	6.9	86.7	81.0	5.8
P 2300		2/18/98	97.5	14.5	83.0	4.4	78.6	0.3	4.9	78.1	4.7	4.9	0.2	4.5	78.5	2/18/98	97.50	14.5	83.0	19.4	78.1	4.9	83.0	78.5	4.5
P 2600*		4/14/98	100.9	20.7	80.2	0.6	79.6	0.0	1.1	79.1	0.6	1.1	0.5	0.9	79.4								80.2	79.4	0.8
Q 1100	I-3	8/16/95	95.16	8.5	86.7	0.7	86.0	1.1	0.5	86.2	3.2	3.7	0.5	1.0	85.7	2/18/98	97.50	10.6	86.9	12.2	85.3	1.6	86.9	85.7	1.2
Q 1700	F-3	8/16/95	95.16	7.7	87.5	0.1	87.4	1.1	na	na	3.0	3.7	0.7	na	na	2/18/98	97.50	10.1	87.4	12.1	85.4	2.0	87.4	87.4	0.0
Q 2000A*		4/15/98	100.8	14.5	86.3	4.3	82.0	0.0	5.5	80.8	4.3	5.5	1.2	4.9	81.4	2/18/98	97.50	11.1	86.4	17.5	80.0	6.4	86.4	81.4	5.0
Q 2000B*		4/15/98	100.8	14.6	86.2	4.1	82.1	0.0	5.4	80.8	4.1	5.4	1.3	4.8	81.5	2/18/98	97.50	11.1	86.4	17.5	80.0	6.4	not used; duplicate more conservativ		
Q 2300*		4/14/98	100.9	17.1	83.8	4.1	79.7	0.0	4.1	79.7	4.1	4.5	0.4	4.3	79.5	2/18/98	97.50	13.5	84.0	18.2	79.3	4.7	84.0	79.5	4.5
Q 2400		2/18/98	97.5	13.0	84.5	4.3	80.2	0.3	5.1	79.4	4.6	4.6	0.0	4.3	80.2	2/18/98	97.50	13.0	84.5	18.1	79.4	5.1	84.5	80.2	4.3
Q 2700	A-3	8/17/95	95.24	16.8	78.4	0.8	77.6	0.0	na	na	0.8	1.0	0.2	0.9	77.5	2/18/98	97.50	14.9	82.6	18.5	79.0	3.6	not used; position questionable		
Q 2800*		4/14/98	100.9	8.2	92.7	0.5	92.2	0.4	1.2	91.5	0.9	1.2	0.3	0.7	92.1	2/18/98	97.50	7.0	90.5	12.1	85.4	5.1	92.7	92.1	0.7
R 2100		2/18/98	97.5	11.7	85.8	3.0	82.8	0.1	4.4	81.4	3.1	4.4	1.3	3.7	82.2	2/18/98	97.50	11.7	85.8	16.1	81.4	4.4	85.8	82.2	3.6
R 2300?	C-3/CH-1?	10/16/96	94.7	11.0	83.7	> 3.3	na	0.0	na	na	3.3	3.3	0.0	na	na	2/18/98	97.50	14.1	83.4	19.7	77.8	5.6	not used; position questionable		
R 2500*		4/14/98	100.9	17.0	83.9	5.1	78.8	0.0	5.3	78.6	5.1	5.3	0.2	5.2	78.7	2/18/98	97.50	16.4	81.1	21.1	76.4	4.7	83.9	78.7	5.2
R 2600*		4/16/98	100.6	22.1	78.5	0.0	78.5	0.0	0.6	77.9	0.3	0.6	0.3	na	na	2/18/98	97.50	17.4	80.1	18.6	78.9	1.2	78.5	78.5	0.0
S 1900	E-2	8/17/95	95.24	8.2	87.0	0.3	86.7	2.7	0.8	86.2	3.7	4.8	1.1	na	na	2/18/98	97.50	10.1	87.4	10.6	86.9	0.5	87.4	86.7	0.7
S 2000*		4/15/98	100.8	13.0	87.8	0.1	87.7	0.4	na	na	0.5	na	na	na	na	2/18/98	97.50	9.5	88.0	11.0	86.5	1.5	87.8	87.7	0.1
S 2300	C-2	8/17/95	95.24	10.4	84.8	> 1.8	na	0.0	5.3	79.5	1.8	5.3	3.5	5.3	79.5	2/18/98	97.50	14.5	83.0	18.7	78.8	4.2	83.0	79.5	3.5
S2300*		4/15/98	100.8	17.8	83.0	4.1	78.9	0.0	4.7	78.3	4.1	4.7	0.6	4.4	78.6	2/18/98	97.50	14.5	83.0	18.7	78.8	4.2	83.0	78.6	4.4
S 2700	A-2	8/17/95	95.24	11.7	83.5	> 1.8	na	0.0	4.0	79.5	1.8	4.0	2.2	4.0	79.5	2/18/98	97.50	10.4	87.1	17.4	80.1	7.0	87.1	79.5	7.6
S 2700*		4/14/98	100.9	18.0	82.9	3.8	79.1	0.0	3.8	79.1	3.8	3.8	0.0	3.8	79.1								82.9	79.1	3.8
S 2800*		4/14/98	100.9	9.9	91.0	0.5	90.5	0.2	1.0	90.0	0.7	1.0	0.3	0.7	90.4	2/18/98	97.50	5.0	92.5	9.2	88.3	4.2	91.0	90.4	0.7
T50E 2150*		4/16/98	100.6	15.5	85.1	3.7	81.4	0.4	5.0	80.1	4.1	5.0	0.9	4.2	81.0								85.1	81.0	4.1
U 2300	C-1	8/17/95	95.24	7.4	87.8	0.0	87.8	2.9	0.8	87.0	4.0	4.1	0.1	na	na	2/18/98	97.50	12.3	85.2	14.2	83.3	1.9	85.2	85.2	0.0
U 2700*		4/14/98	100.9	19.9	81.0	3.4	77.6	0.0	3.3	77.7	3.4	3.3	-0.1	3.4	77.7	2/18/98	97.50	10.2	87.3	11.7	85.8	1.5	81.0	77.7	3.3
V 2600*		4/15/98	100.8	17.8	83.0	3.5	79.5	0.0	4.0	79.0	3.5	4.0	0.5	3.8	79.3	2/18/98	97.50	13.3	84.2	19.1	78.4	5.8	83.0	79.3	3.8
W 2400A*		4/15/98	100.8	16.0	84.8	1.8	83.0	0.0	2.7	82.1	1.8	2.7	0.9	2.3	82.6	2/18/98	97.50	12.6	84.9	16.8	80.7	4.2	84.8	82.6	2.3
W 2400B*		4/15/98	100.8	15.5	85.3	1.0	84.3	0.2	1.2	84.1	1.2	1.2	0.0	1.0	84.3	2/18/98	97.50	12.6	84.9	16.8	80.7	4.2	not used; duplicate more conservativ		
W 2650*		4/16/98	100.6	16.5	84.1	0.0	84.1	0.0	1.2	82.9	0.5	1.2	0.7	na	na								84.1	84.1	0.0
X 2700*		4/15/98	100.8	17.1	83.7	0.0	83.7	3.9	4.7	79.0	3.9	4.7	0.8	na	na	2/18/98	97.50	13.1	84.4	16.5	81.0	3.4	83.7	83.7	0.0
X 2900*		4/15/98	100.8	12.1	88.7	0.0	88.7	1.5	2.0	86.7	1.5	2.0	0.5	na	na								88.7	88.7	0.0
Y 2700?	CH-1?	10/17/96	94.62	11.0	83.6	1.5	82.1	0.5	na	na	2.0	2.5	0.5	1.8	81.9	2/18/98	97.50	12.3	85.2	14.2	83.3	1.9	not used; position questionable		
Z 2900*		4/15/98	100.8	17.0	83.8	2.1	81.7	0.0	2.9	80.9	2.1	2.9	0.8	2.5	81.3								83.8	81.3	2.5
BB 3100*		4/15/98	100.8	15.2	85.6	0.0	85.6	0.0	1.4	84.2	1.5	1.4	-0.1	na	na								85.6	85.6	0.0

Sludge Core and Probing Data
Cumberland Bay Sludge Bed Site

All measurements are in feet, elevation are above mean sea level.

Location		Core Data												Adjusted Core Data		Probe Data							Final Sludge Bed Data		
Station ID *	Previous Station ID	Date Core Collected	Lake Water Surface Elev.	Depth of Water	Elev. Top of Sludge/ Lake Bot.	Core Sludge Thick.	Elev. Bottom of Sludge	Core Bnded Sand Thick.	Depth to "Hard" Material	Elev. Top of "Hard" Material	Core Recovery	Drive Depth	Core Loss	Adjusted Sludge Thickness	Adjusted Elevation Bottom of Sludge	Date Probe Data Collected	Top of Ice Elevation	Depth of Water	Elev. Top of Sludge/ Lake Bot.	Depth to "Hard" Material	Elev. Top of "Hard" Material	Soft Material Thick.	Elev. Top of Sludge/ Lake Bot./ Bathymet.	Elev. Bottom of Sludge	Sludge Thick.
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)	(s)	(t)	(u)	(v)	(w)	(x)	(y)	(z)

Notes: na = Not available

Footnotes: *(Column escription)*

(a) - Station ID based on current grid system nomenclature established in 1998. Asterix (*) indicates that core location is not actually at implied gridnode (see location map). Question mark (?) indicates that location was not surveyed and is approximate.

(b) - Station IDs based on grid nomenclature in 1995 Site Characterization Report. In 1998 the grid was expanded to incorporate a larger site area and the nomenclature was modified.

(c) - The date of core collection.

(d) - The lake water surface elevation measured at USGS gauge at Rousse's Point on the date of core collection. Cores collected on 2/18/98 were measured from the top of ice elevation (97.5) surveyed on 2/19/98.

(e) - Depth of water in feet measured from the lake water surface (or top of ice) to the lake bottom (i.e., top of sludge bed).

(f) - Elevation of lake bottom (i.e., bathymetry) calculated by subtracting the Depth of Water (e) from the Lake Water Surface Elev. (d). This represents Top of Sludge where present.

(g) - Thickness of sludge bed measured in the core collected at this location. Greater than sign (>) indicates that sludge filled entire core and the sludge thickness at this location may exceed that measured in the core.

(h) - Elevation of bottom of sludge calculated by subtracting the Core Sludge Thickness (g) from the Elevation of Top of Sludge/Lake Bottom (f).

(i) - Thickness of banded sand measured in the core collected at this location. Greater than sign(>) indicates that the core did not penetrate underlying native sand and the banded sand thickness at this location may exceed that measured in the core.

(j) - Depth to hard material is the length of core penetration from below mudline to depth that significant resistance was encountered by sampler (i.e., additional advance of the core would require hammering or increased pressure). This measurement may be indicative of the bottom of the sludge bed or soft sand.

(k) - Elevation of Top of Hard Material calculated by subtracting the Depth to Hard Material (j) from the Elevation of Top of Sludge (f).

(l) - Core recovery is the length of core measured after core is cut open to be logged.

(m) - Drive depth is the penetration depth of the core measured at the time of core collection.

(n) - Core loss is calculated by subtracting the Core Recovery (l) from the Drive Depth (m). The core "loss" could be attributed to compression or consolidation of the low density sludge, loss of material from the bottom of the core tube from gravity, or rodding effects (friction of material in the core tube prevents additional material from entering the core tube). A negative number may indicate that raising of the piston drew additional material into core tube or sample expanded.

(o) - Adjusted sludge thickness is calculated by adding half (50%) of the Core Loss (n) to the measured Core Sludge Thickness (g). This adjustment helps account for possible compression of the sludge or the rodding effect and provides a more conservative estimate of the sludge thickness. The sludge thickness is not adjusted if the measured thickness is very thin (< 0.3 feet) because in these cores the core loss is more likely related to sand falling out of the bottom of the core (core loss from compression would be negligible).

(p) - Adjusted elevation of bottom of sludge is calculated by subtracting the Adjusted Sludge Thickness (o) from the Elevation of Top of Sludge (f).

(q) - Date that probe data was collected.

(r) - Elevation of the top of ice measured on 2/19/98.

(s) - Depth of water measured through the ice (Feb 1998).

(t) - Elevation of the top of sludge (lake bottom/bathymetry) calculated by subtracting the Probe Depth of Water (s) from the Top of Ice Elevation (r).

(u) - Depth from lake bottom to hard material that resists hand pushing of a 1" diameter, capped PVC riser.

(v) - Elevation of the top of hard material calculated by subtracting the Depth of Hard Material (u) from the Top of Ice Elevation (r).

(w) - Soft material thickness calculated by subtracting Probe Depth of Water (s) from the probe Depth to Hard Material (u).

(x) - Final elevation of top of sludge/lake bottom/bathymetry used in contour maps. The top of sludge/lake bottom/bathymetry value is the most recent measured.

(y) - Final elevation of bottom of sludge value selected by using best judgement based on all available information.

(z) - Final sludge thickness calculated by subtracting Elevation Bottom of Sludge (y) from Elevation Top of Sludge (x).

Table 2-3

Sludge Bed Volume Evaluation Summary

Cumberland Bay Sludge Bed Site

Design Work Areas	Surface Area		Average Sludge Bed Thickness*					Volume		
	FS	Design	FS		Design			FS	Design	
			core thickness	bed thickness	core thickness	bed thick. Unadjusted	bed w/ 50% core loss		unadjust.	w/ 50% core loss
Mudflats	26	31	0.9	0.8	0.9	1.1	1.5	41,300	55,800	75,600
Dock	9	9	3.4	2.9	4	4	5.2	41,300	50,900	60,900
Breakwater	3	12	0.58	1.3	1.6	1.9	2.2	6,000	23,500	28,300
Total	38	51						88,600	130,200	164,800
						Layer 1	Layer 1 and 2		Layer 1	Layer 1 and 2
Shoreline**	5	7		1		2.1	2.7	7,900	15,000	21,800
Total w/shoreline		58						96,500	145,200	186,600

* FS thickness is average bed thickness based on sludge thickness measured in the 1995 cores.

core thickness only - using the sludge thickness measured in the 1995 cores

bed thickness - average of computer 100 foot grid file based on sludge thickness measured in 1995 cores

Design thickness was estimated in three ways:

core thickness only - using the sludge thickness measured in the 1995 and 1998 cores

unadjusted - sludge bed thickness calculated using sludge thickness in the 1995 and 1998 cores and 1998 bathymetry.

50% core loss - sludge bed thickness using core thickness plus 50% core loss and 1998 bathymetry.

**Shoreline	Layer 1 = Organic Mat	Layer 3 = Sludge in which no PCBs were detected.
	Layer 2 = Banded Sand	Layer 4 = Native Sand

TABLE 2-4
Laboratory PCB Analytical Results
1994 and 1995 Sampling Events

Cumberland Bay Sludge Bed Site

Sample Location	Sample Date	Collected/ Analyzed by	Sampling Interval	PCBs (mg/kg)				
				1221	1242	1248	1254	1260
CB1 (approximately Q2800)	3/17/94	NYSDEC	0-1 cm	ND 0.025	30	ND 0.025	ND 0.025	ND 0.025
			1-3 cm	ND 0.025	25	ND 0.025	ND 0.025	ND 0.025
			3-5 cm	ND 0.025	20	ND 0.025	ND 0.025	ND 0.025
			5-7 cm	ND 0.0875	14	ND 0.0875	ND 0.0875	ND 0.0875
			7-9 cm	ND 0.025	13	ND 0.025	ND 0.025	ND 0.025
			9-11 cm	ND 0.025	18	ND 0.025	ND 0.025	ND 0.025
			11-13 cm	ND 0.025	16	ND 0.025	ND 0.025	ND 0.025
			13-15 cm	ND 0.025	29	ND 0.025	ND 0.025	ND 0.025
			15-17 cm	ND 0.025	27	ND 0.025	ND 0.025	ND 0.025
			17-19 cm	ND 0.025	30	ND 0.025	ND 0.025	ND 0.025
			19-21 cm	ND 0.025	29	ND 0.025	ND 0.025	ND 0.025
			21-23 cm	ND 0.025	23	ND 0.025	ND 0.025	ND 0.025
			23-25 cm	ND 0.025	22	ND 0.025	ND 0.025	ND 0.025
CB7a (approximately P2300)	3/17/94	NYSDEC	0-1 cm	ND 0.025	96	ND 0.025	ND 0.025	ND 0.025
			1-3 cm	ND 0.025	101	ND 0.025	ND 0.025	ND 0.025
			3-5 cm	ND 0.025	24	ND 0.025	ND 0.025	ND 0.025
			5-7 cm	ND 0.025	31	ND 0.025	ND 0.025	ND 0.025
			7-10 cm	ND 0.025	34	ND 0.025	ND 0.025	ND 0.025
			10-14 cm	ND 0.025	38	ND 0.025	ND 0.025	ND 0.025
			14-18 cm	ND 0.025	123	ND 0.025	ND 0.025	ND 0.025
			18-22 cm	ND 0.025	136	ND 0.025	ND 0.025	ND 0.025
			22-26 cm	ND 0.025	182	ND 0.025	ND 0.025	ND 0.025
CB9 (approximately (N2200)	3/17/94	NYSDEC	0-1 cm	ND 0.025	147	ND 0.025	ND 0.025	ND 0.025
			1-3 cm	ND 0.0625	63	ND 0.0625	ND 0.0625	ND 0.0625
			3-5 cm	ND 1.25	61.6	ND 1.25	ND 1.25	ND 1.25
			5-7 cm	ND 1.25	1850	ND 1.25	ND 1.25	ND 1.25
			7-10 cm	ND 1.25	1500	ND 1.25	ND 1.25	ND 1.25
			10-14 cm	ND 0.125	295	ND 0.125	ND 0.125	ND 0.125
			14-18 cm	ND 1.25	368	ND 1.25	ND 1.25	ND 1.25
			18-22 cm	ND 1.25	158	ND 1.25	ND 1.25	ND 1.25
			22-26 cm	ND 0.0025	0.7	ND 0.0025	ND 0.0025	ND 0.0025
			26- 30 cm	ND 0.0025	ND 0.0025	ND 0.0025	ND 0.0025	ND 0.0025
CB-12 (approximately K1900)	3/17/94	NYSDEC	0-1 cm	ND 0.025	13	ND 0.025	ND 0.025	ND 0.025
			1-3 cm	ND 0.0025	1.7	ND 0.0025	ND 0.0025	ND 0.0025
			3-5 cm	ND 0.0025	0.0025	ND 0.0025	ND 0.0025	ND 0.0025
CB-18 (approximately G1900)	3/17/94	NYSDEC	0-1 cm	ND 0.025	14	ND 0.025	ND 0.025	ND 0.025
			1-3 cm	ND 0.025	43	ND 0.025	ND 0.025	ND 0.025
			3-5 cm	ND 0.025	44	ND 0.025	ND 0.025	ND 0.025
			5-7 cm	ND 0.025	74	ND 0.025	ND 0.025	ND 0.025
			7-10 cm	ND 0.025	105	ND 0.025	ND 0.025	ND 0.025
			10-14 cm	ND 0.025	99	ND 0.025	ND 0.025	ND 0.025
			14-18 cm	ND 1.25	322	ND 1.25	ND 1.25	ND 1.25
			18-22 cm	ND 1.25	344	ND 1.25	ND 1.25	ND 1.25
			22-26 cm	ND 0.0025	0.35	ND 0.0025	ND 0.0025	ND 0.0025
			26- 30 cm	ND 0.0025	ND 0.0025	ND 0.0025	ND 0.0025	ND 0.0025
CB-19 (approximately I1700)	3/17/94	NYSDEC	0-1 cm	ND 0.25	153	ND 0.25	ND 0.25	ND 0.25
			1-3 cm	ND 0.25	195	ND 0.25	ND 0.25	ND 0.25
			3-5 cm	ND 0.25	231	ND 0.25	ND 0.25	ND 0.25
			5-7 cm	ND 0.25	63	ND 0.25	ND 0.25	ND 0.25
			7-10 cm	ND 0.025	5.9	ND 0.025	ND 0.025	ND 0.025
			10-14 cm	ND 0.025	9.6	ND 0.025	ND 0.025	ND 0.025
			14-18 cm	ND 0.0025	ND 0.0025	ND 0.0025	ND 0.0025	ND 0.0025
1 (approximately K1300)	8/9/94	NYSDEC/ RECRA	0-3 cm	ND 0.415	0.2	ND 0.205	0.17	0.13
			3-5 cm	ND 0.65	1.9	ND 0.32	ND 0.32	ND 0.32
			5-25 cm	ND 0.415	0.079	ND 0.205	ND 0.205	ND 0.205
			25-48 cm	ND 0.048	0.0087	ND 0.0235	ND 0.0235	ND 0.0235
2 (approximately M1700)	8/9/94	NYSDEC/ RECRA	0-7 cm	ND 0.65	27	ND 0.33	ND 0.33	ND 0.33
			16-20 cm	ND 0.75	38	ND 0.33	ND 0.33	ND 0.33

TABLE 2-4
Laboratory PCB Analytical Results
1994 and 1995 Sampling Events

Cumberland Bay Sludge Bed Site

Sample Location	Sample Date	Collected/ Analyzed by	Sampling Interval	PCBs (mg/kg)				
				1221	1242	1248	1254	1260
3	8/9/94	NYSDEC/	0-15 cm	ND 0.355	1.7	ND 0.175	ND 0.175	ND 0.175
(approximately I1500)		RECRA	15-39 cm	ND 0.215	0.034	ND 0.105	ND 0.105	ND 0.105
4	8/9/94	NYSDEC/	0-9 cm	ND 0.85	8.9	ND 0.41	ND 0.41	ND 0.41
(approximately I1900)		RECRA	9-11 cm	ND 0.8	25	ND 0.395	ND 0.395	ND 0.395
			11-15 cm	ND 0.23	0.43	ND 0.115	ND 0.115	ND 0.115
			26-31 cm	ND 0.135	ND 0.065	ND 0.065	ND 0.065	ND 0.065
5	8/9/94	NYSDEC/	0-18 cm	ND 1.0	2.2	ND 0.48	ND 0.48	ND 0.48
(approximately I1300)		RECRA	18-44 cm	ND 0.17	ND 0.085	ND 0.085	ND 0.085	ND 0.085
9	8/9/94	NYSDEC/	0-3 cm	ND 0.95	2.5	ND 0.475	ND 0.475	ND 0.475
(approximately M2300)		RECRA	3-11 cm	ND 2.05	71	ND 1.0	ND 1.0	ND 1.0
			11-16 cm	ND 1.95	160	ND 0.95	ND 0.95	ND 0.95
			16-20 cm	ND 26.5	550	ND 13	ND 13	ND 13
			20-23 cm	ND 8.5	49	ND 4.1	ND 4.1	ND 4.1
			23-31 cm	ND 0.75	5.9	ND 0.36	ND 0.36	ND 0.36
			31-35 cm	ND 0.6	0.3	ND 0.3	ND 0.3	ND 0.3
			35 - 39.5	ND 0.95	ND 0.48	ND 0.48	ND 0.48	ND 0.48
A-6	8/17/95	Rust/	0 - 0.5'	ND 3.5	38	ND 1.7	ND 1.7	ND 1.7
(approximately K2700)		Aquatec	0.5 - 1.0'	ND 0.095	0.75	ND 0.046	ND 0.046	ND 0.046
			1.0 - 1.5'	ND 0.08	ND 0.0395	ND 0.0395	ND 0.0395	ND 0.0395
C-6	8/17/95	Rust/	0 - 0.5'	ND 8	270	ND 3.95	ND 3.95	ND 4.2
(approximately K2300)		Aquatec	0.5 - 1.0'	ND 1.95	2.1	ND 0.95	ND 0.95	ND 0.95
			1.0 - 1.5'	ND 0.465	0.59	ND 0.23	ND 0.23	ND 0.23
			1.5 - 2.0'	ND 0.0425	ND 0.021	ND 0.021	ND 0.021	ND 0.021
C-7	8/17/95	Rust/	0.33 - 0.8'	---	0.73	---	---	---
(approximately I2300)		NYSDEC	0.8 - 1.33'	---	---	---	---	---
D-6	8/17/95	Rust/	0 - 0.5'	---	11	---	---	---
(approximately K2100)		NYSDEC	0.5 - 1.0'	---	---	---	---	---
F-7	8/17/95	Rust/	0 - 0.66'	ND 0.235	3.6	ND 0.115	ND 0.115	ND 0.6
(approximately I1700)		Aquatec	0.66 - 1.25'	ND 0.1	ND 0.0495	ND 0.0495	ND 0.0495	ND 0.0495
			1.25 - 2.0'	ND 0.0415	ND 0.0205	ND 0.0205	ND 0.0205	ND 0.0205
G-6	8/17/95	Rust/	0 - 0.5'	ND 1.65	57	ND 0.8	ND 0.8	ND 1.2
(approximately K1500)		Aquatec	0.5 - 1.0'	ND 0.0485	0.21	ND 0.024	ND 0.024	ND 0.024
			1.0 - 1.5'	ND 0.041	0.023	ND 0.021	ND 0.021	ND 0.021
G-8	8/17/95	Rust/	0 - 0.5'	ND 0.44	1.7	ND 0.215	ND 0.215	ND 0.215
(approximately G1500)		Aquatec	0.5 - 1.0'	ND 0.47	0.28	ND 0.026	ND 0.026	ND 0.026
			1.0 - 1.5'	ND 0.485	ND 0.024	ND 0.024	ND 0.024	ND 0.024

* For March 1994 samples, only first non-detect bottom sample is reported. There may have been additional core collected and analyzed but it was no so it was not reported on this table.

--- Detection limit is not available

TABLE 2-5
Laboratory PCB Analytical Results
October 1996 Sampling Event

Cumberland Bay Sludge Bed Site

Sludge Bed Cores Sample Description			Approximate Location	PCBs (mg/kg; ppm)				PCBs - TCLP (ug/l; ppb)
				NYSDEC	Inchcape Laboratory (Aquatech)			Inchcape
				Aroclor - 1242	Aroclor -1242	Aroclor - 1254	Aroclor - 1260	Aroclor -1242
96-AS-1(jar)	0" - 39"	Sludge	O2300	NA	210 D	- -	4.1	NA
96-AS-1(bucket)	0" - 39"	Sludge		NA	58 D	- -	- -	2.4 PVN
96-AS-2 (jar)	0" - 51"	Composite of Sludge	M2500	NA	250 D	- -	3.7	NA
96-AS-2 (bucket)	0" - 51"	Composite of Sludge		NA	290 D	- -	- -	16
96-AS-2 (jar)	0" - 13"	Sludge		60	NA	NA	NA	NA
96-AS-2 (jar)	13" - 28"	Sludge		103	NA	NA	NA	NA
96-AS-2 (jar)	28" - 40"	Sludge		1800	NA	NA	NA	NA
96-AS-2 (jar)	40" - 51"	Sludge		490	NA	NA	NA	NA
96-AS-3 (jar)	0" - 24"	Sludge	M2100	NA	74 D	- -	1	NA
96-AS-3 (bucket)	0" - 24"	Sludge		NA	46	- -	- -	4.4 PVN
96-AS-4 (jar)	0" - 24"	Sludge	M1900	NA	65 D	- -	1	NA
96-AS-4 (bucket)	0" - 24"	Sludge		NA	18 PV	- -	- -	3.0 PVN
96-CH-1 (jar)	0" - 39"	Sludge	R2300	NA	72 D	- -	1.7	NA
96-CH-1 (bucket)	0" - 39"	Sludge		NA	15 D	- -	- -	1.3 V
96-CH-2 (jar)	0" - 9"	Sludge	W-2800	NA	0.79	0.59	0.18	NA
96-CH-2 (jar)	9" - 18"	Sludge		NA	3.1 D	1.5 PV	0.38	NA
96-CH-2 (jar)	18" - 24"	Sand		NA	0.57	0.55	0.1	NA

Note:

- - = Not detected.
N = Indicates presumptive evidence for compound identification.
P = Indicates that the percent difference between the results from the two analytical columns is greater than 25%.
D = Reported value is from the analysis of a diluted sample.
V = The reported value is considered estimated due to variance from the quality control criteria.
NA = Not analyzed

TABLE 2-6
Laboratory PCB Analytical Results
1998 Sampling Events

Cumberland Bay Sludge Bed Site

Sample Location	Sampling Date	Sampling Interval	% Solids	PCBs (mg/kg)		
				Aroclor -1242	Aroclor -1254	Total PCBs
L50E 2350*	Apr-98	0' - 4.5'	13.4	130	160	290
		4.5' - 6.2'	14.4	490	420	910
		6.5'-10.1'	24.3	81	90	171
M-2400	Feb-98	0' - 4'	12.3	65	ND 41	65
		4' - 5.5'	15	710	ND 320	710
		5.5' - 10.9'	39.2	51	ND 12	51
N-2400	Feb-98	0' - 5'	13.3	97	ND 37	97
		5' - 8'	11.4	270	ND 42	270
		8' - 10'	76.2	0.22	ND 0.02	0.22
P-2100*	Apr-98	0' - 2.1'	25.5	23	27	50
		2.1' - 4.5'	23.6	190	210	400
		4.5' - 5.1'	44	11	10	21
P-2600*	Apr-98	0' - 0.5'	32	5.9	6.6	12.5
Q-2000*	Apr-98	0' - 3.1'	46.5	8.2	14	22.2
		3.1' - 3.5'	27.6	260	250	510
		3.5' 4.3'	44.5	55	51	106
Q-2300*	Apr-98	0' - 4.3'	20.3	47	21	68
Q-2800*	Apr-98	0' - 0.4'	33.1	19	14	33
		0.4' - 1'	75.2	2.1	1.1	3.2
R-2500*	Apr-98	0.3' - 4.1'	20.4	24	14	38
		4.1' - 4.7'	27.7	12	8.3	20.3
S-2300*	Apr-98	0' - 4.4'	28.6	14	7.2	21.2
S-2700*	Apr-98	0' - 3.8'	23.3	9.9	8.0	17.9
S-2800*	Apr-98	0' - 0.5'	69.7	ND 0.7	ND 0.7	ND 0.7
		0.5' - 0.7'	73.6	1.0	ND 0.60	1.0
U-2700*	Apr-98	0' - 3.4'	40.1	4.1	2.3	6.4
V-2600*	Apr-98	0' - 0.8'	23.7	5.0	12	17
		0.8' - 3.5'	28.4	ND 2.0	ND 2.0	ND 2.0
W-2400*	Apr-98	0' - 1.8'	43.2	ND 1.1	ND 1.1	ND 1.1
X-2700*	Apr-98	0' - 1.8'	41.3	ND 0.7	1.9	1.9
		1.8' - 4'	45.2	5.4	3.0	8.4
Z-2900*	Apr-98	0' - 0.8'	43.4	1.9	2.1	4.0
		0.8' - 2.1'	52.9	5.0	6.8	11.8

Note: * Samples were collected near the grid location implied by the sample identification.
See a site location map for actual locations.
Concentrations are in parts per million (ppm).
ND = Not detected (followed by practical quantitation limit).
Analyzed at Scilab Albany, Inc., Latham, NY

Table 3-1

Sludge Separation Study

Cumberland Bay Sludge Bed Site

Sludge Fraction (Fraction Retained on Referenced Sieve)		TOC ppm	PCBs (mg/kg - ppm)			
			Aroclor -1242	Aroclor -1254	Aroclor -1260	Total PCBs
#10	2 millimeters	9,600	4.3	3.1	0.82	8.22
#20	800 microns	5,300	3.1	1.7	1.3	6.1
#40	400 microns	61,000	3.3	0.9	1.3	5.5
#60	250 microns	33,000	1.4	ND 0.17	ND 0.17	1.4
#140	100 microns	8,200	1.4	ND 0.17	ND 0.17	1.4
#200	75 microns	12,000	1.1	ND 0.17	ND 0.17	1.4
Passing #200	< 75 microns	30,000	2.3	0.4	0.74	3.44

Note: Concentrations are in parts per million (ppm).
ND = Not detected (followed by practical quantitation limit).
Gradational Analysis performed by Kiber Environmental Laboratory, Atlanta, GE
PCB Analysis performed by Scilab Albany, Inc., Latham, NY

TABLE 3-2

Results of Real-Time Turbidity Instrument Bench Test

Cumberland Bay Sludge Bed Site
Supplemental Site Investigation

	TSS_{target} (mg/L)	wt_i (g)	V_f (mL)	TSS_{actual} (mg/L)	YSI (NTU)	OBS (volts)
1	Blank	N/A	500	Blank	-0.01	0.168
2	100 mg/L	0.0502	500	100.4 mg/L	26.3	1.008
3	80 mg/L	0.0414	500	82.8 mg/L	25.9	0.692
4	60 mg/L	0.0332	500	66.4 mg/L	18.9	0.527
5	40 mg/L	0.0211	500	42.2 mg/L	21.4	0.509
6	20 mg/L	0.0109	500	21.8 mg/L	16.4	0.391
7	10 mg/L	*	500	10.9 mg/L*	21.3	0.360
8	5 mg/L	*	500	5.45 mg/L*	15.7	0.316
9	2.5 mg/L	*	500	2.725 mg/L*	15.8	0.288
10	Blank	N/A	500	Blank	-0.01	0.182
11	40 NTU STD			40 NTU STD	52.6	2.239

**Prepared by taking a thoroughly mixed 250 mL aliquot of the previous sample and mixing it with 250 mL of distilled water.*

Table 7-1
Summary of Analytical Data
Surface Water Sampling
Cumberland Bay
April 30 1998

PCB Aroclor Analysis (ug/L)	SW - 1	SW - 2	SW - 3	NYSDEC Surface Water Standard
PCB - 1016	<0.50	<0.50	<0.50	0.001
PCB - 1221	<0.50	<0.50	<0.50	0.001
PCB - 1232	<0.50	<0.50	<0.50	0.001
PCB - 1242	<0.50	<0.50	<0.50	0.001
PCB - 1248	<0.50	<0.50	<0.50	0.001
PCB - 1254	<0.50	<0.50	<0.50	0.001
PCB - 1260	<0.50	<0.50	<0.50	0.001
Metals (mg/L)				
Aluminum	<0.10	<0.10	<0.10	0.1
Copper	<0.02	<0.02	<0.02	0.0086*
Iron	0.089	0.093	0.12	0.3
Manganese	0.012	<0.01	0.02	0.3
Zinc	0.065	0.19	<0.02	0.061*
Leachate Parameters (mg/L)				
Alkalinity	42	38	74	N/S
Chemical Oxygen Demand	8.6	8.8	15	N/S
Ammonia	<0.10	<0.10	<0.10	2
Nitrate-Nitrite	0.15	0.13	<0.05	10 **
Total Phosphorus	<0.10	<0.10	<0.10	N/S
Sulfate	9	10	10	250
Biochemical Oxygen Demand	3.1	3.2	3.8	N/S
Total Dissolved Solids	90	86	140	500
Total Suspended Solids	<4.0	<4.0	<4.0	N/S
Total Organic Carbon	5.7	6.3	7.7	N/S
Hardness	58	54	97	N/S
Field Parameters				
Conductance (umhos/cm)	150	140	240	N/S
pH (units)	7.8	7.8	7.6	6.5 - 8.5
Temperature (deg. Celcius)				N/S
Turbidity (NTU)	<1.0	<1.0	<1.0	5

Notes

* Standard is based on hardness of water body and was calculated using the average hardness from the three samp

** Value applies only to nitrate.

Table 7-2
Summary of Analytical Data
Surface Water Sampling
Cumberland Bay
July 1, 1998

PCB Aroclor Analysis (ug/L)	**SW - 1**	**SW - 2**	**SW - 3**	**NYSDEC Surface Water Standard**
PCB - 1016	<0.50	<0.50	<0.50	0.001
PCB - 1221	<0.50	<0.50	<0.50	0.001
PCB - 1232	<0.50	<0.50	<0.50	0.001
PCB - 1242	<0.50	<0.50	<0.50	0.001
PCB - 1248	<0.50	<0.50	<0.50	0.001
PCB - 1254	<0.50	<0.50	<0.50	0.001
PCB - 1260	<0.50	<0.50	<0.50	0.001
Metals (mg/L)				
Aluminum	0.078	0.062	0.052	0.1
Copper	<0.02	<0.02	<0.02	0.01*
Iron	0.19	0.23	0.24	0.3
Manganese	0.022	0.02	0.04	0.3
Zinc	0.028	<0.02	<0.02	0.073*
Leachate Parameters (mg/L)				
Alkalinity	58	61	95	N/S
Chemical Oxygen Demand	19	16	18	N/S
Ammonia	<0.3	<0.3	<0.3	2
Nitrate-Nitrite	0.1	0.07	0.06	10**
Total Phosphorus	<0.10	<0.10	<0.10	N/S
Sulfate	10.2	8.8	9.9	250
Biochemical Oxygen Demand	3.4	3.5	3.8	N/S
Total Dissolved Solids	88	97	140	500
Total Suspended Solids	<4.0	6	<4.0	N/S
Total Organic Carbon	5.7	6.5	8.5	N/S
Hardness	76	72	110	N/S
Field Parameters				
Conductance (umhos/cm)	76	81	105	N/S
pH (units)	7.36	7.65	7.13	6.5 - 8.5
Temperature (deg. Celcius)	20.3	19.8	19.8	N/S
Turbidity (NTU)	10	10	17	5

Notes

* Standard is based on hardness of water body and was calculated using the average hardness from the three samp

** Value applies only to nitrate.

Table7-3
Summary of Analytical Data
Surface Water Sampling
Cumberland Bay
September 29, 1998

PCB Aroclor Analysis (ug/L)	SW - 1	SW - 2	SW - 3	NYSDEC Surface Water Standard
PCB - 1016	<0.50	<0.50	<0.50	0.001
PCB - 1221	<0.50	<0.50	<0.50	0.001
PCB - 1232	<0.50	<0.50	<0.50	0.001
PCB - 1242	<0.50	<0.50	<0.50	0.001
PCB - 1248	<0.50	<0.50	<0.50	0.001
PCB - 1254	<0.50	<0.50	<0.50	0.001
PCB - 1260	<0.50	<0.50	<0.50	0.001
Metals (mg/L)				
Aluminum	0.08	0.091	<0.075	0.1
Copper	<0.020	<0.020	<0.020	0.01*
Iron	0.26	0.24	0.19	0.3
Manganese	0.018	0.019	0.018	0.3
Zinc	<0.02	0.021	<0.02	0.073*
Leachate Parameters (mg/L)				
Alkalinity	45	45	70	N/S
Chemical Oxygen Demand	<10	17	20	N/S
Ammonia	<0.1	<0.1	<0.1	2
Nitrate-Nitrite	<0.1	0.2	0.1	10**
Total Phosphorus	<0.1	<0.1	<0.1	N/S
Sulfate	10	11	26	250
Biochemical Oxygen Demand	<2	<2	2.2	N/S
Total Dissolved Solids	97	89	110	500
Total Suspended Solids	4	39	4	N/S
Total Organic Carbon	NS	NS	NS	N/S
Hardness	58	61	85	N/S
Field Parameters				
Conductance (umhos/cm)	70	69	99	N/S
pH (units)	8.06	7.94	7.76	6.5 - 8.5
Temperature (deg. Celcius)	16.9	17.2	16.5	N/S
Turbidity (NTU)	***	***	***	5

Notes
* Standard is based on hardness of water body and was calculated using the average hardness from the three samples.
** Value applies only to nitrate.
*** Turbidity meter was not functioning within the manufacturers specified parameters on the day of sampling.

Table 7-4
Average Surface Water Concentrations
Cumberland Bay

	SW-1	SW-2	SW-3
PCB Aroclor Analysis (ug/L)			
PCB - 1016	<0.50	<0.50	<0.50
PCB - 1221	<0.50	<0.50	<0.50
PCB - 1232	<0.50	<0.50	<0.50
PCB - 1242	<0.50	<0.50	<0.50
PCB - 1248	<0.50	<0.50	<0.50
PCB - 1254	<0.50	<0.50	<0.50
PCB - 1260	<0.50	<0.50	<0.50
Metals (mg/L)			
Aluminum	0.069	0.068	0.047
Copper	<0.02	<0.02	<0.02
Iron	0.180	0.188	0.183
Manganese	0.017	0.015	0.026
Zinc	0.034	0.074	<.02
Leachate Parameters (mg/L)			
Alkalinity	48	48	80
Chemical Oxygen Demand	10.9	13.9	17.7
Ammonia	*<0.2	*<0.2	*<0.2
Nitrate-Nitrite	0.10	0.13	0.06
Total Phosphorus	<0.10	<0.10	<0.10
Sulfate	9.7	9.9	15.3
Biochemical Oxygen Demand	2.5	2.6	3.3
Total Dissolved Solids	92	91	130
Total Suspended Solids	3	16	3
Total Organic Carbon	5.7	6.4	8.1
Hardness	64	62	97
Field Parameters			
Conductance (umhos/cm)	99	97	148
pH (units)	7.74	7.80	7.50
Temperature (deg. Celcius)	18.6	18.5	18.2
Turbidity (NTU)	5.250	5.250	8.750

Notes
1. Averages calculated from three sampling rounds collected July1, April 30 and September 29, 1998.
2. If an analyte exhibited non-detect results in two or less of the sampling rounds one half the laboratory reporting limit was used to calculate the average concentration.
3. Where an analyte was not detected in any sampling round the laboratory reporting limit is used for the average concentration (eg., <0.2).
4. * Represents the average of the laboratory reporting limits.

Table 7-5
Summary of Cumberland Bay
Wilcox Dock/GP Intake
PCB/TSS Analytical Data

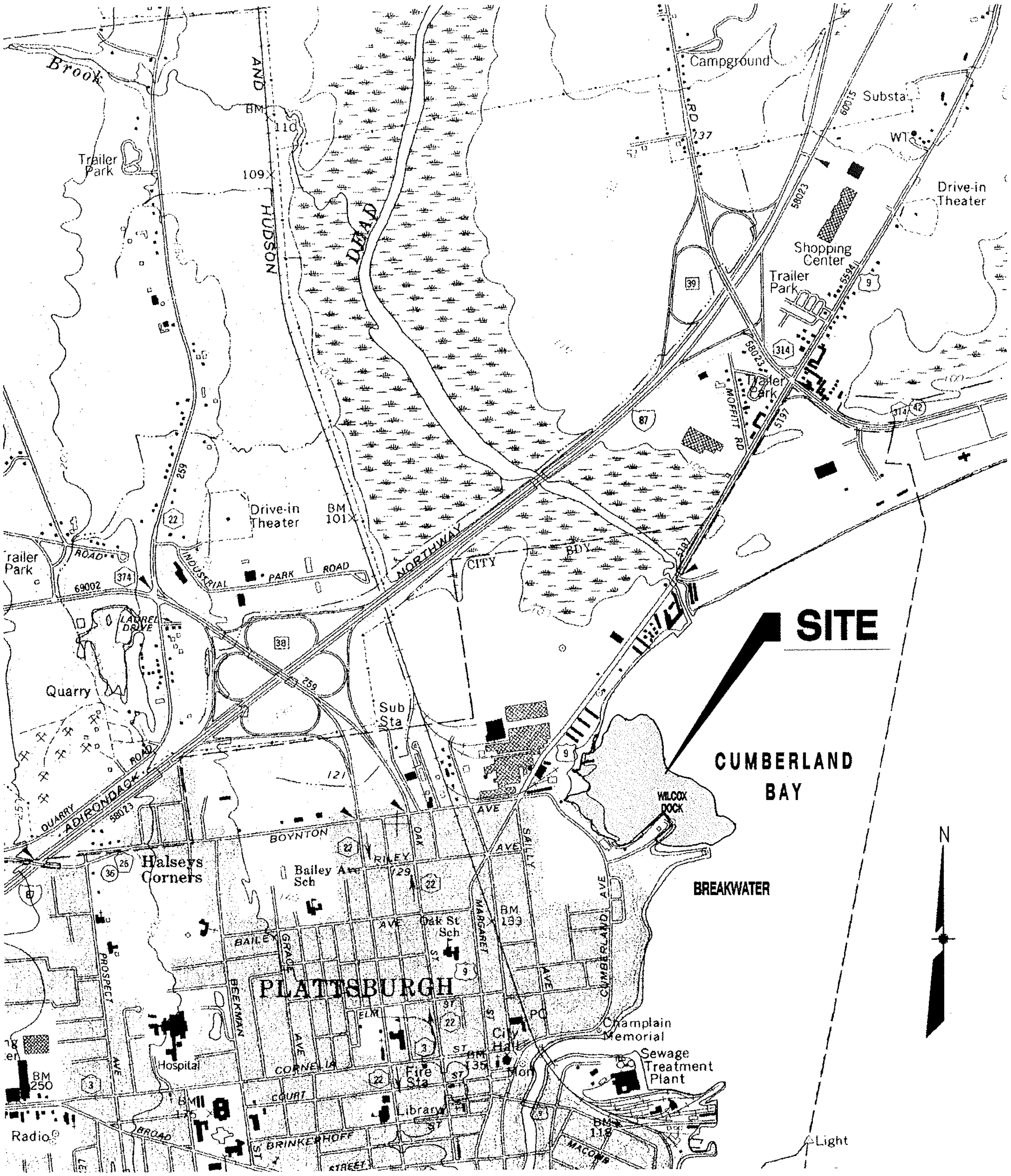
Collection/ Week	Sample Date	Turbidity* (NTU)	PCBs ** (ug/L)	TSS (mg/L)
Week 1 - Collected on 8-July	7/2/96	8	<0.7	<4
	7/6/96	6	<0.8	<4
Week 2 - Collected on 15-July	7/9/98	12	<0.5	14
	7/10/98	4	<0.5	<4
Week 3 - Collected on 23-July	7/20/98	23	<0.5	<4
	7/21/98	2	<0.5	<8
Week 4 - Collected on 30-July	7/25/98	6	<0.5	<4
	7/28/98	4	<0.5	<4
Week 5 - Collected on 7-Aug.	7/31/98	6	<0.05	<4
	8/3/98	3	<0.05	<4
Week 6 - Collected on 14-Aug.	8/7/98	0	<0.05	<4
	8/12/98	4	<0.05	<4
Week 7 - Collected on 21-Sept.	9/11/98	8	<0.05	4
	9/14/98	1	<0.05	4
Week 8 - Collected on 29-Sept.	9/26/98	47	<0.5	5
	9/28/98	10	<0.5	7

Notes

* Samples exhibiting the highest and lowest turbidity values for each week were collected for analysis.

** All PCB Aroclors (USEPA SW-846 Method 8082) were non-detect at the listed reporting limit.

FIGURES



RUST

Rust Environment & Infrastructure Inc.

OCT. 1998 202352

0' 500' 1000' 2000' 4000'

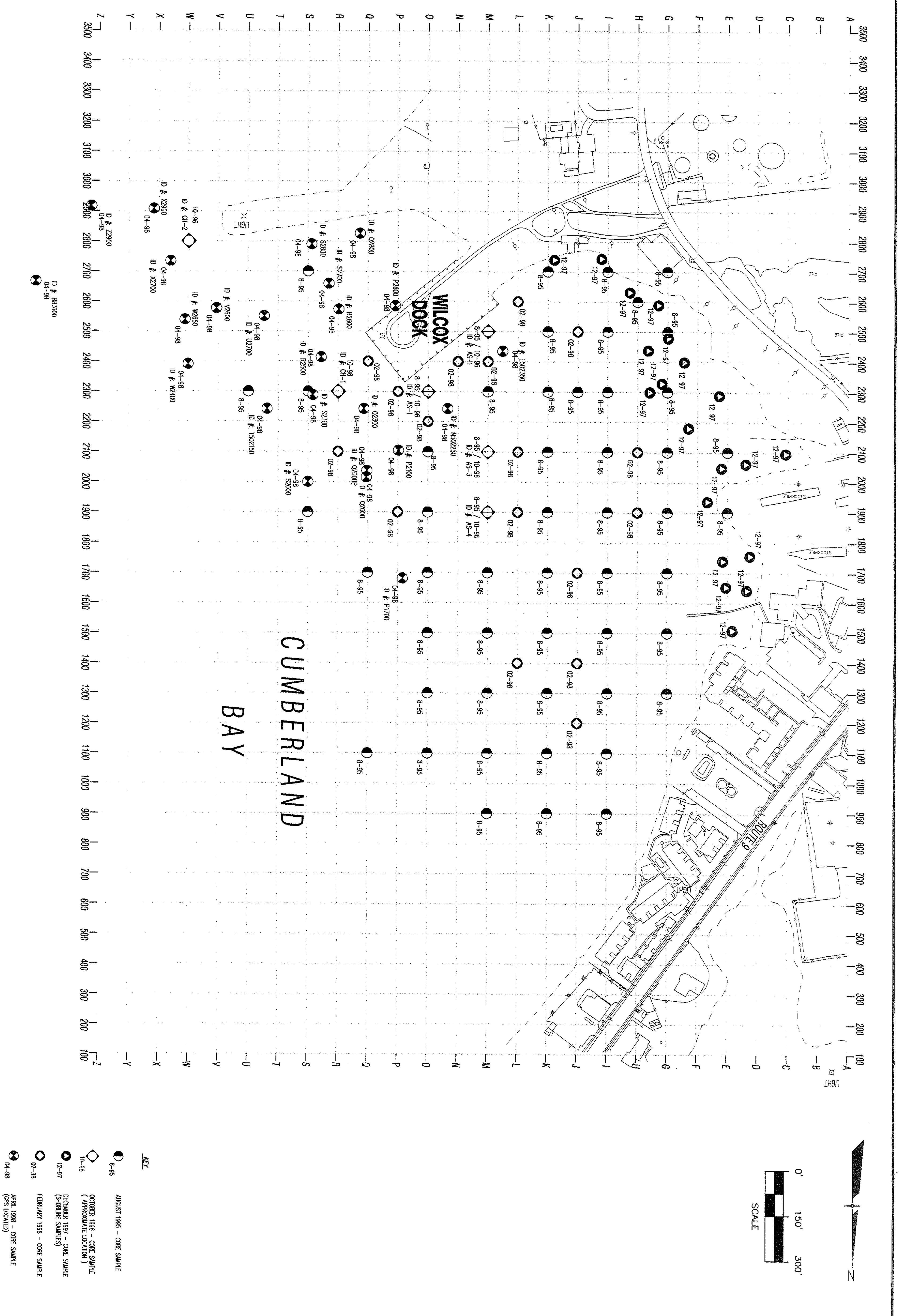
SCALE

FIGURE 1-1

SITE LOCATION MAP

PRE - DESIGN INVESTIGATION REPORT
CUMBERLAND BAY SLUDGE BED SITE
PLATTSBURGH - CLINTON COUNTY, N.Y.
NYSDEC SITE No. 510017

PDR-2-01.DWG XREF: (NONE) 10-22-98

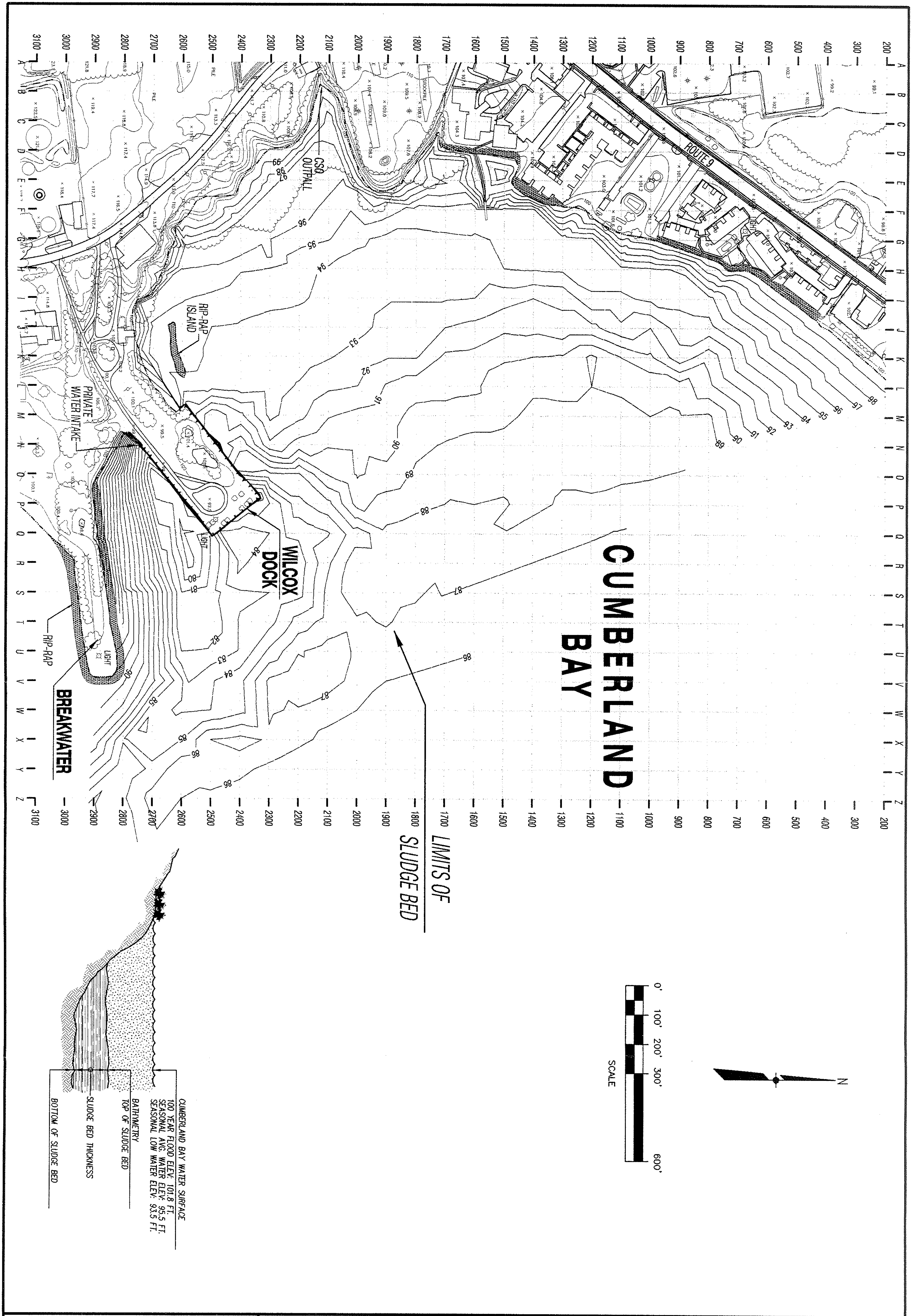


Rust Environment & Infrastructure Inc.

PRE - DESIGN INVESTIGATION REPORT
CUMBERLAND BAY SLUDGE BED SITE
PLATTSBURGH - CLINTON COUNTY, N.Y.
NYSDEC SITE No. 510017
OCT. 1998 202352

FIGURE 2 - 1
CORE SAMPLING LOCATIONS

PDR-2-02.DWG 10-20-98



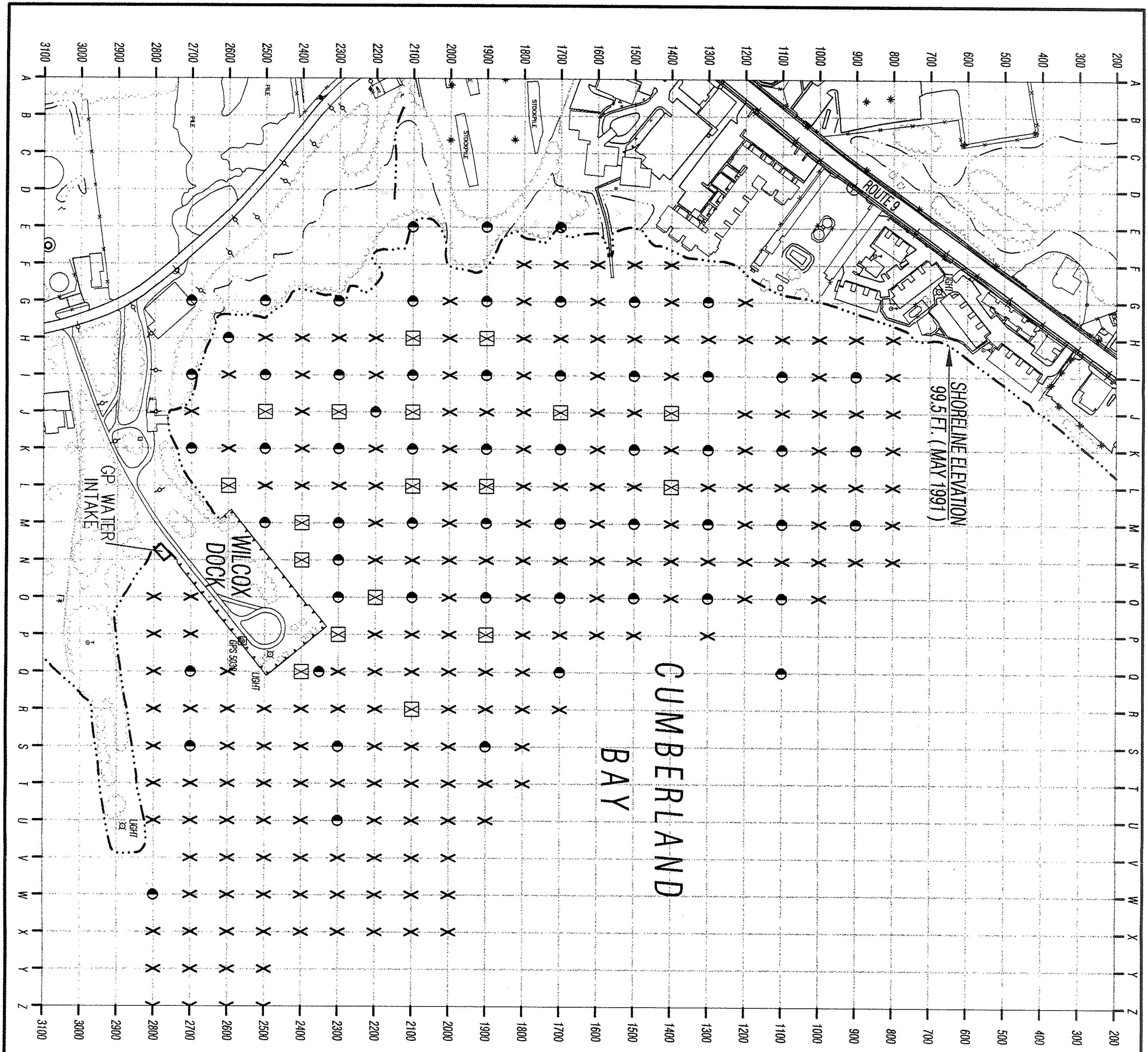
Rust Environment & Infrastructure Inc.

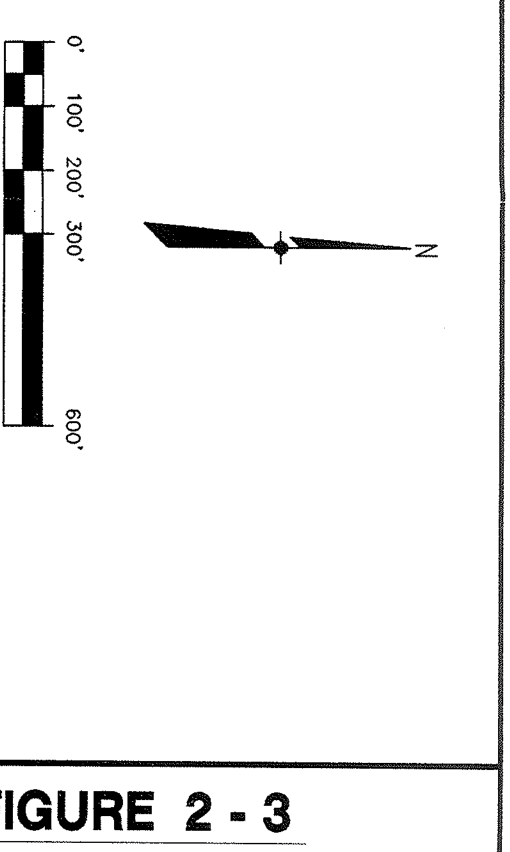
PRE - DESIGN INVESTIGATION REPORT
CUMBERLAND BAY SLUDGE BED SITE
PLATTSBURGH - CLINTON COUNTY, N.Y.
NYSDEC SITE No. 510017

OCT. 1998 202352

FIGURE 2 - 2

BATHYMETRY





LEGEND

LIGHT ☒ NAVIGATIONAL MARKER

1.25 SLUDGE BED THICKNESS CONTOUR

◐ PREVIOUS CORE OR PROBE LOCATION 1995, 1996

× 1998 PROBE LOCATION

☒ ANALYSIS OF SLUDGE GRAIN SIZE DISTRIBUTION

NOTE:

1. NORTH REFERENCE IS BASED ON NEW YORK STATE PLANE COORDINATE SYSTEM NAD 83 (1992).
2. REFERENCE NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION GPS CONTROL POINT STATION NAME 5030, & STATION NAME 5031 – (ALUMINUM DISK MONUMENTS)

GPS 5030 – NORTH: 2142321.3905 / EAST: 233720.4101
GPS 5031 – NORTH: 2144868.7282 / EAST: 233627.2669
(NOT SHOWN)

GRID POINT A–200
NORTH: 2144681.2725 / EAST: 765279.2435
GRID POINT Z–3100
NORTH: 2141781.27725 / EAST: 767779.2435

RUST
Rust Environment & Infrastructure Inc.

PRE - DESIGN INVESTIGATION REPORT
CUMBERLAND BAY SLUDGE BED SITE
PLATTSBURGH - CLINTON COUNTY, N.Y.
NYSDEC SITE No. 510017
OCT. 1998 202352

FIGURE 2 - 3

PROBING & CORE LOCATIONS

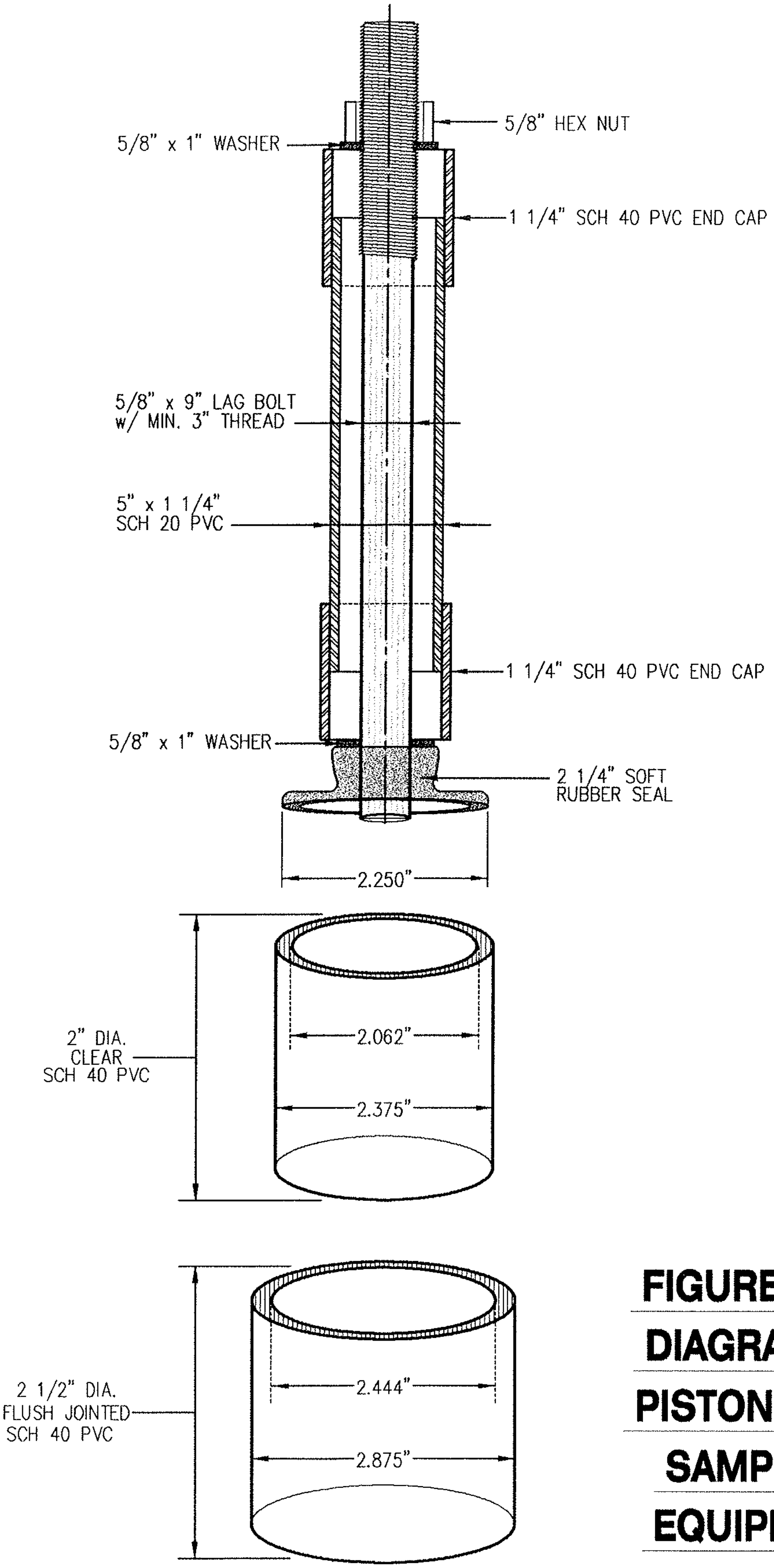


FIGURE 2 - 4
DIAGRAM OF PISTON CORE SAMPLING EQUIPMENT

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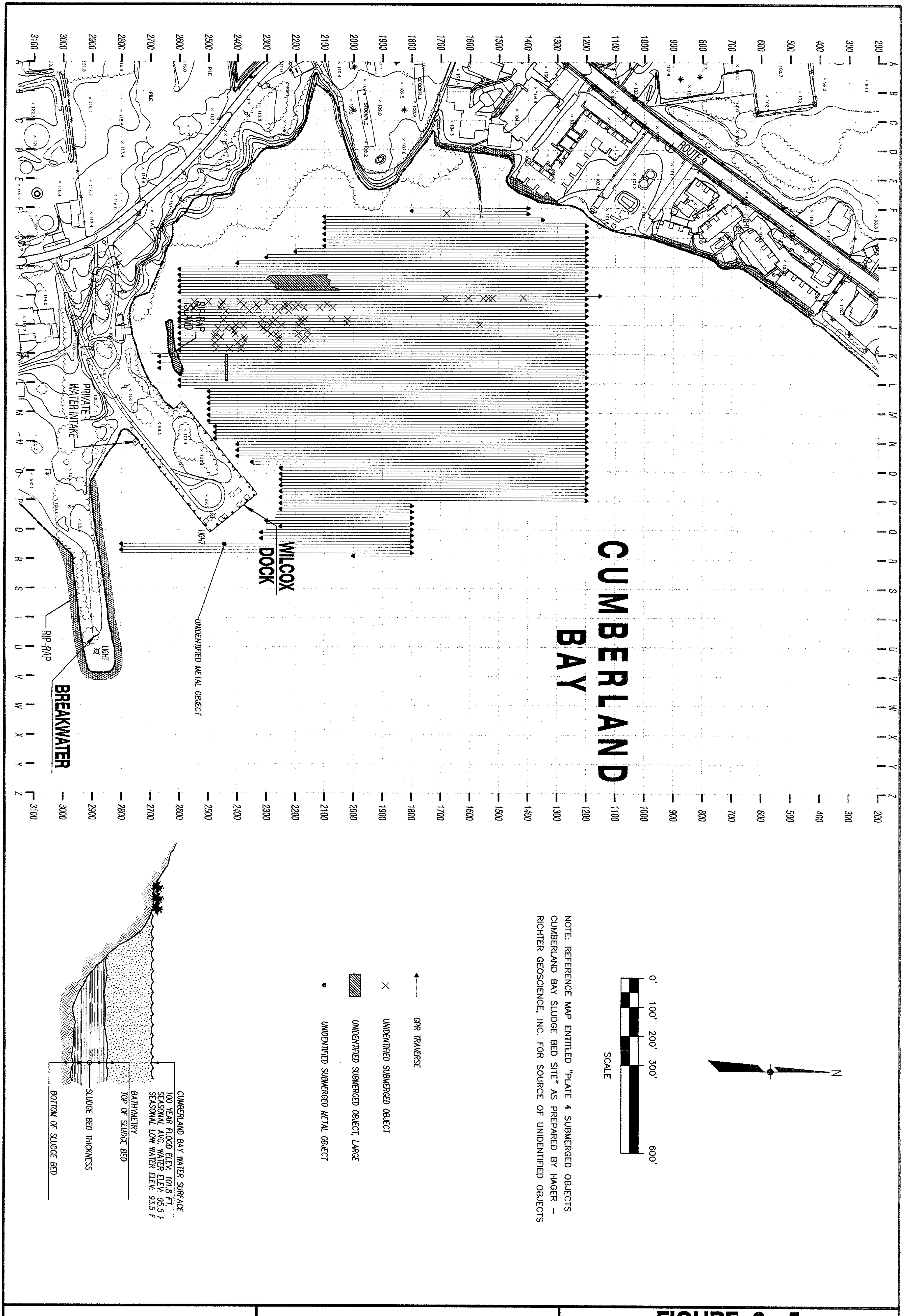
PRE - DESIGN INVESTIGATION REPORT
CUMBERLAND BAY SLUDGE BED SITE
PLATTSBURGH - CLINTON COUNTY, N.Y.
NYSDEC SITE No. 510017
OCT. 1998
202352

10-22-98
PDR-2-04.DWG

PDR-2-05.DWG 10-20-98



NOTE: REFERENCE MAP ENTITLED "PLATE 4 SUBMERGED OBJECTS CUMBERLAND BAY SLUDGE BED SITE" AS PREPARED BY HAGER – RICHTER GEOSCIENCE, INC. FOR SOURCE OF UNIDENTIFIED OBJECTS

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PLATTSBURGH - CLINTON COUNTY, N.Y.
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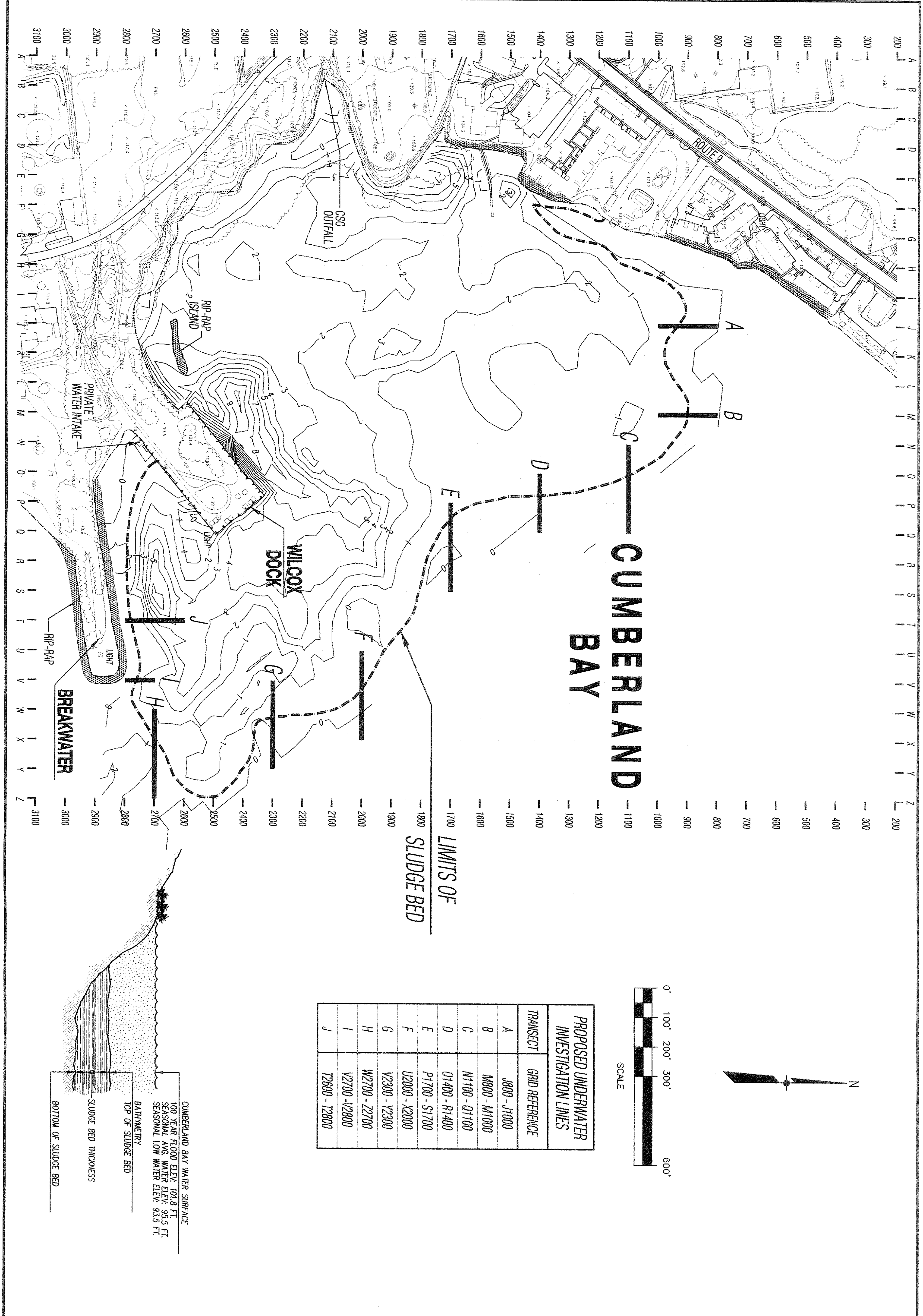
FIGURE 2 - 5
GPR GEOPHYSICAL SURVEY



PROPOSED UNDERWATER INVESTIGATION LINES

TRANSECT	GRID REFERENCE
A	J800 - J1000
B	M800 - M1000
C	N1100 - Q1100
D	O1400 - R1400
E	P1700 - S1700
F	U2000 - X2000
G	V2300 - Y2300
H	W2700 - Z2700
I	V2700 - V2800
J	T2600 - T2800

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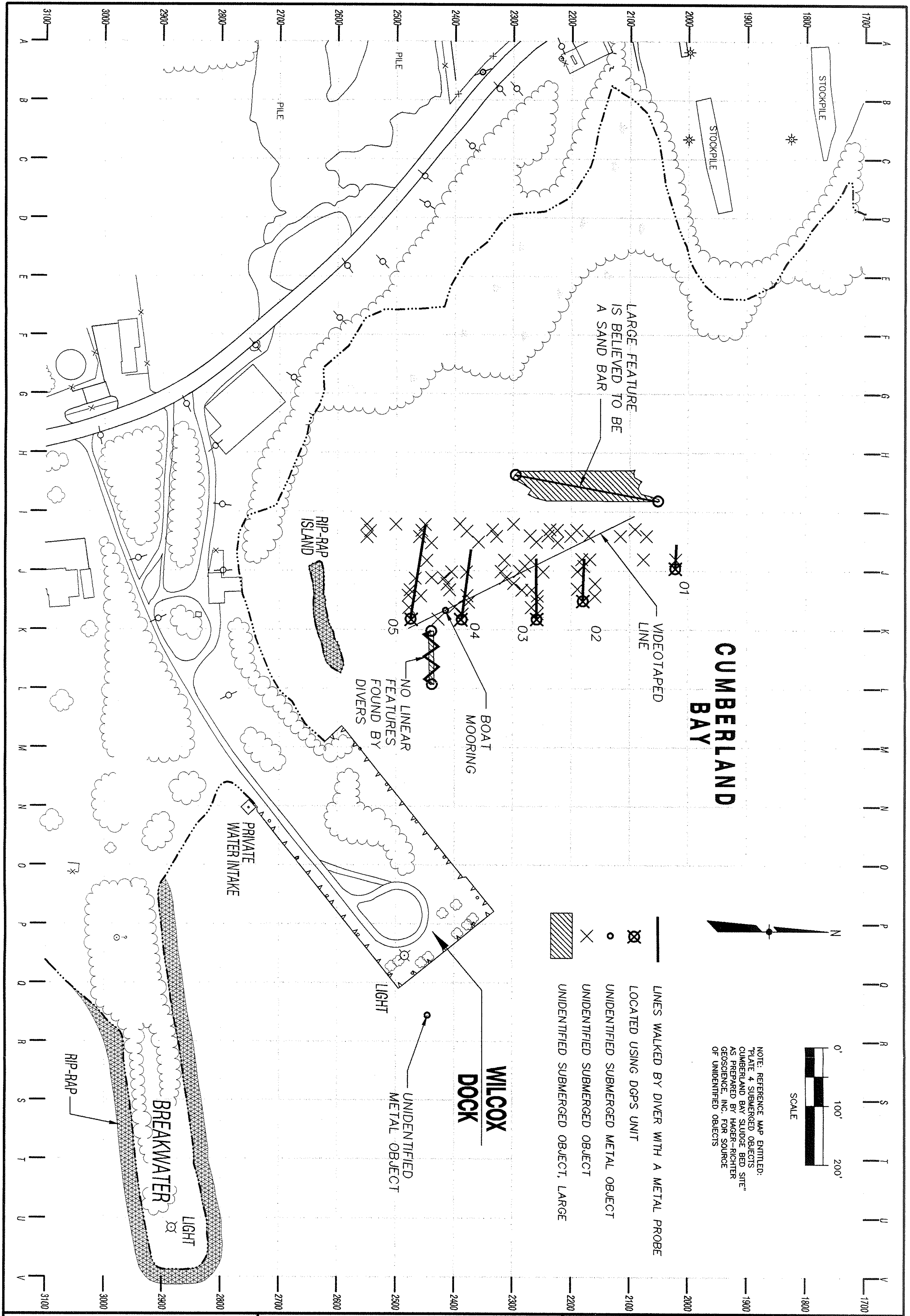
FIGURE 2 - 6
UNDERWATER INVESTIGATION LINES

PDR-2-07.DWG XREF: FIG_5-B.DWG 10-22-98



NOTE: REFERENCE MAP ENTITLED: "PLATE 4 SUBMERGED OBJECTS CUMBERLAND BAY SLUDGE BED SITE" AS PREPARED BY HAGER-RICHTER GEOSCIENCE, INC. FOR SOURCE OF UNIDENTIFIED OBJECTS

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PLATTSBURGH - CLINTON COUNTY, N.Y.
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FIGURE 2 - 7
DIVER DEBRIS SEARCH

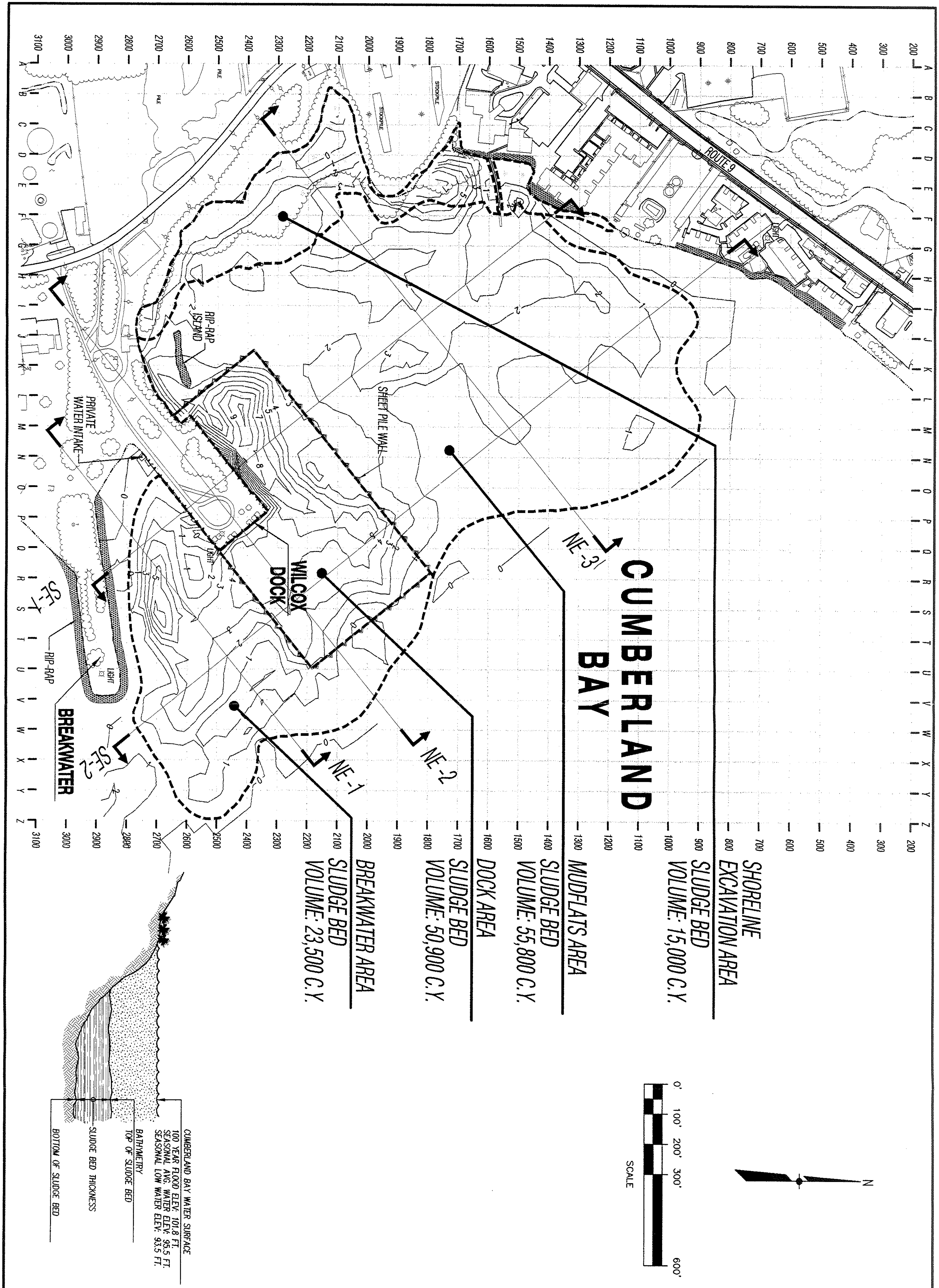

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FIGURE 2 - 8

SLUDGE BED THICKNESS AND WORK AREAS

PDR-2-09.DWG XREF: (NONE) 10-22-98

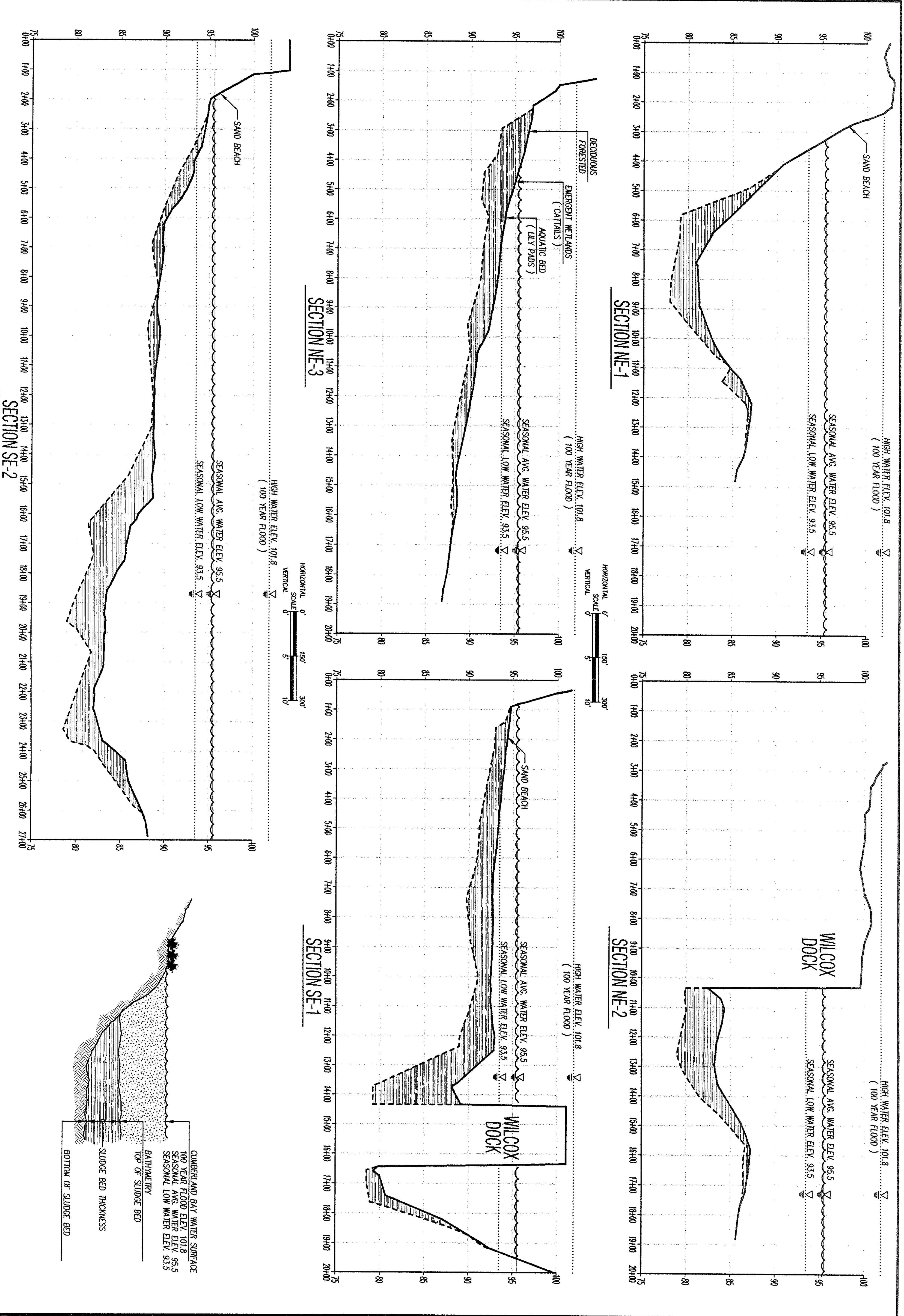

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FIGURE 2 - 9

SLUDGE BED SECTIONS

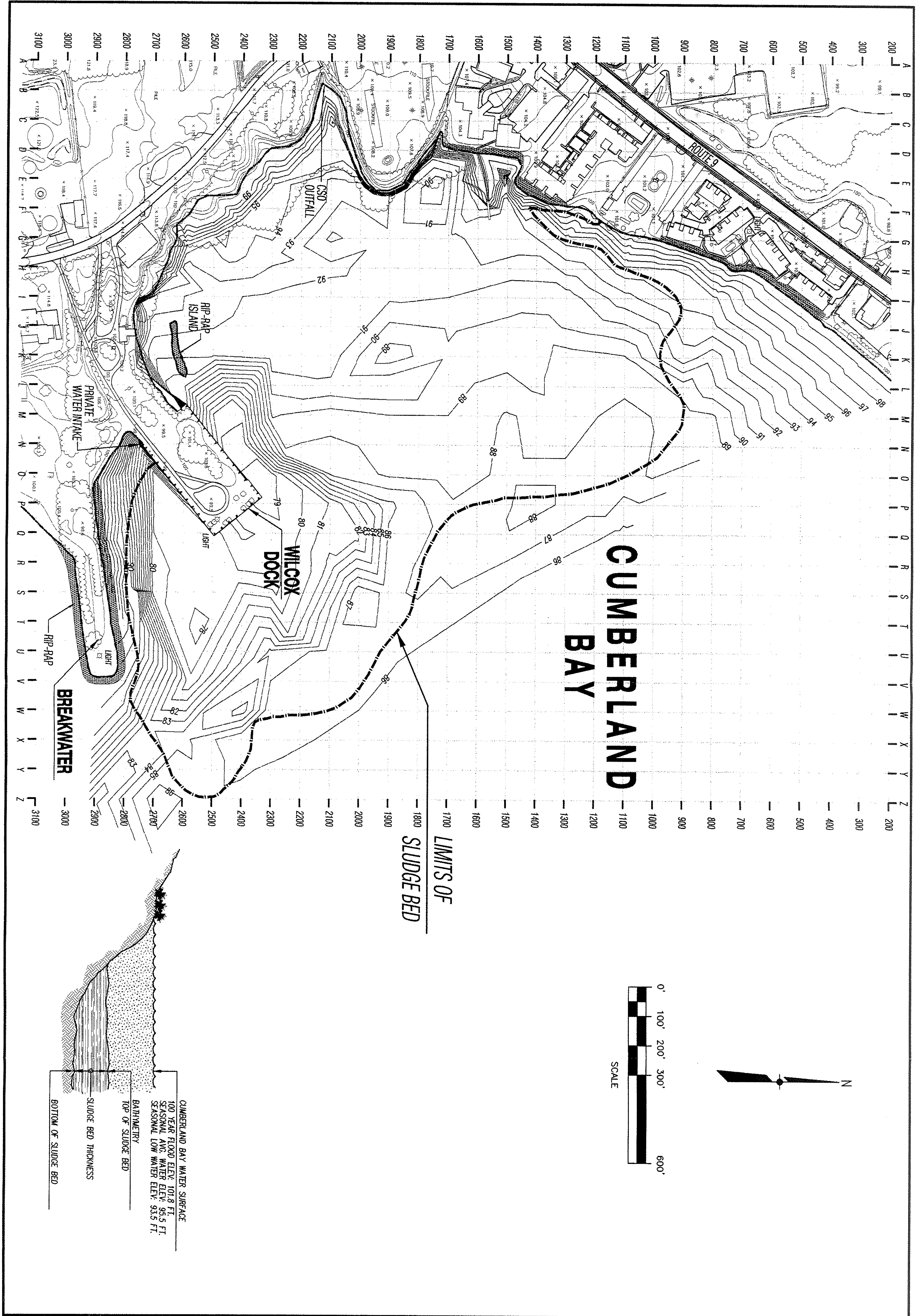

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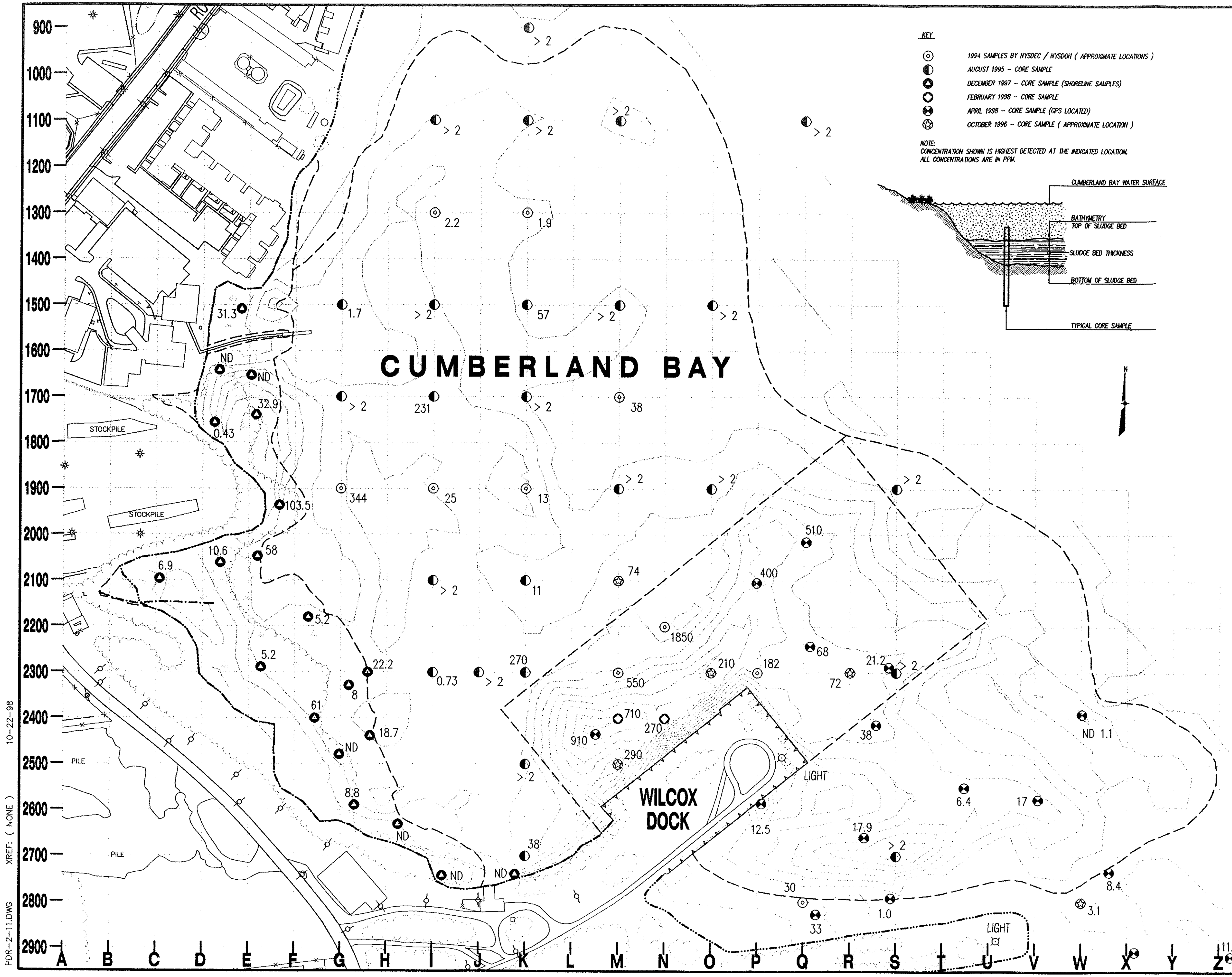
FIGURE 2 - 10

BOTTOM OF SLUDGE BED

PDR-2-11.DWG XREF: (NONE) 10-22-98



KEY

◎ 1994 SAMPLES BY NYSDEC / NYSDOH (APPROXIMATE LOCATIONS)
◐ AUGUST 1995 - CORE SAMPLE
▲ DECEMBER 1997 - CORE SAMPLE (SHORELINE SAMPLES)
◇ FEBRUARY 1998 - CORE SAMPLE
⊗ APRIL 1998 - CORE SAMPLE (GPS LOCATED)
✪ OCTOBER 1996 - CORE SAMPLE (APPROXIMATE LOCATION)

NOTE:
CONCENTRATION SHOWN IS HIGHEST DETECTED AT THE INDICATED LOCATION.
ALL CONCENTRATIONS ARE IN PPM.

1997-1998 ANALYTICAL RESULTS

SAMPLE LOCATION ***	SAMPLE INTERVAL (FT.)	TOTAL PCBs (mg/kg)
G-1500	0.0 - 0.5	1
	0.5 - 1.0	1.1
	1.0 - 1.5	ND
	1.5 - 2.0	ND
	2.0 - 3.1	ND
I-1700	0.0 - 0.7	4.2
	0.7 - 1.2	ND
	1.2 - 2.0	ND
	2.0 - 2.8	ND
I-2300	0.3 - 0.8	0.73
	0.8 - 1.3	ND
K-1500	0.0 - 0.5	58.2
	0.5 - 1.0	0.21
	1.0 - 1.5	0.023
	1.5 - 2.5	ND
K-2100	0.0 - 0.5	11.0
	0.5 - 1.0	ND
K-2300	0.0 - 0.5	274.2
	0.5 - 1.0	2.1
	1.0 - 1.5	0.59
	1.5 - 2.0	ND
	2.0 - 2.7	ND
K-2700	0.0 - 0.5	67
	0.5 - 1.0	0.75
	1.0 - 1.5	ND
	1.5 - 2.0	ND
	2.0 - 2.5	ND
	2.5 - 3.0	ND
	3.0 - 3.5	ND
	3.5 - 4.0	ND
*** L50E 2350	0.0 -4.5	290
	4.5 - 6.2	910
	6.2 - 10.1	171
M-2400	0.0 - 4.0	65
	4.0 - 5.5	710
	5.5 - 10.9	51
N-2400	0.0 - 5.0	97
	5.0 - 8.0	270
	8.0 - 10.0	0.22
*** P-2100	0.0 - 2.1	50
	2.1 - 4.5	400
	4.5 - 5.1	21
*** P-2600	0.0 - 0.5	12.5
*** Q-2000	0.0 - 3.1	22.2
	3.1 - 3.5	510
	3.5 - 4.3	106
*** Q-2300	0.0 - 4.3	68
*** Q-2800	0.0 - 0.4	33
	0.4 - 1.0	3.2
*** R-2500	0.3 - 4.1	38
	4.1 - 4.7	20.3
*** S-2300	0.0 - 4.4	21.2
*** S-2700	0.0 - 3.8	17.9
*** S-2800	0.0 - 0.5	ND 0.7
	0.5 - 0.7	1.0
*** U-2700	0.0 - 3.4	6.4
*** V-2700	0.0 - 0.8	17
	0.8 - 3.5	ND 2.0
*** W-2400	0.0 - 1.8	ND 1.1
*** X-2600	0.0 - 1.8	1.9
	1.8 - 4.0	8.4
*** Z-2900	0.0 - 0.8	4.0
	0.8 - 2.1	11.8

*** INDICATES SAMPLE COLLECTED NEAR IMPLIED GRID LOCATION . SEE PLAN FOR ACTUAL LOCATION.

FIGURE 2 - 11

SLUDGE BED CONCENTRATIONS

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PLATTSBURGH - CLINTON COUNTY, N.Y.
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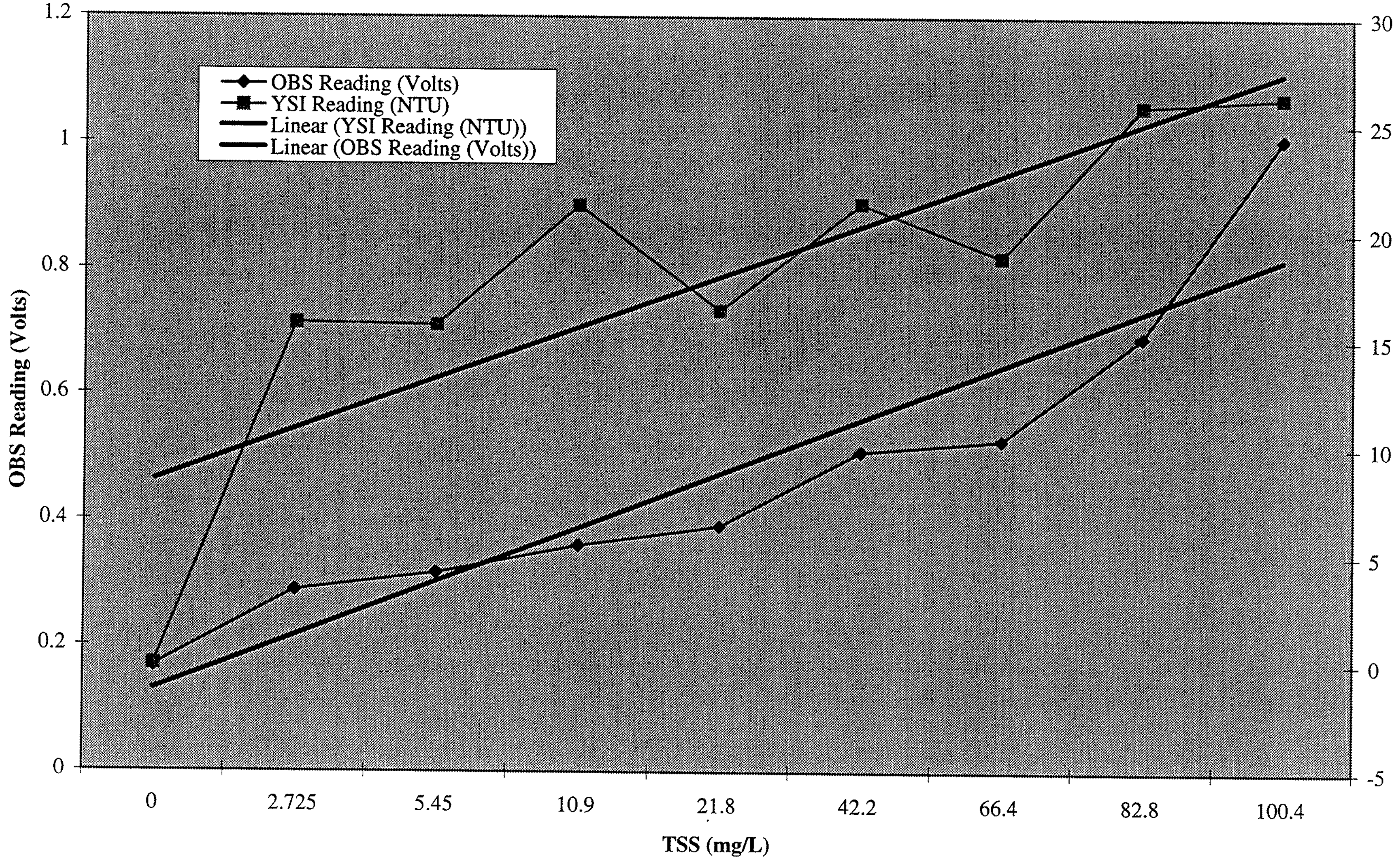
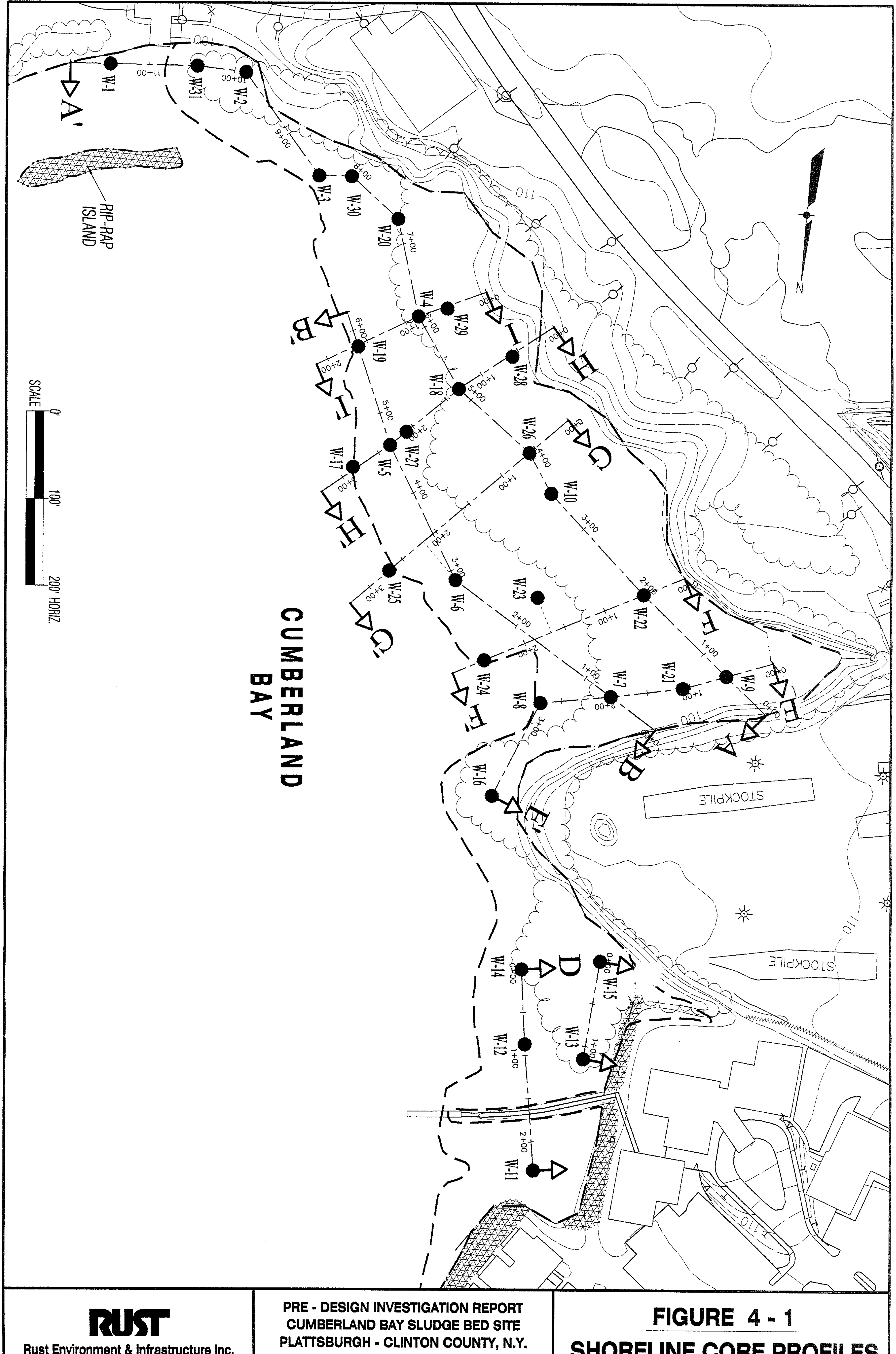
Figure 3-1
Results of Real-Time Turbidity Instrument Bench Test
Cumberland Bay Sludge Bed Site



Bnchtst/Graph 2 (amn)

10/22/98

PDR-4-1.DWG XREF: (NONE) 10-22-98



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PLATTSBURGH - CLINTON COUNTY, N.Y.
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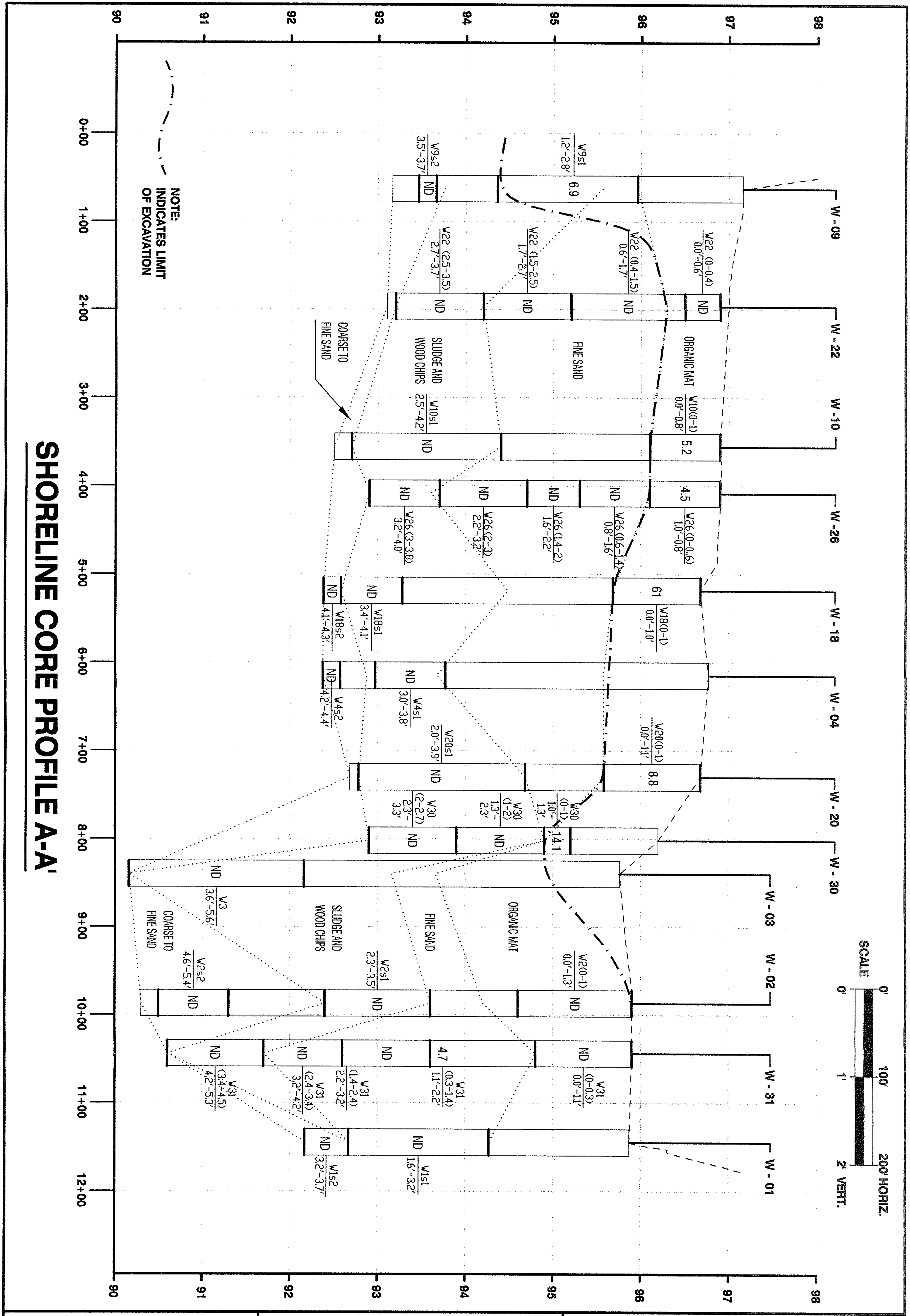
FIGURE 4 - 1

SHORELINE CORE PROFILES

PDR-4-2.DWG 10-20-98


SHORELINE CORE PROFILE A-A'

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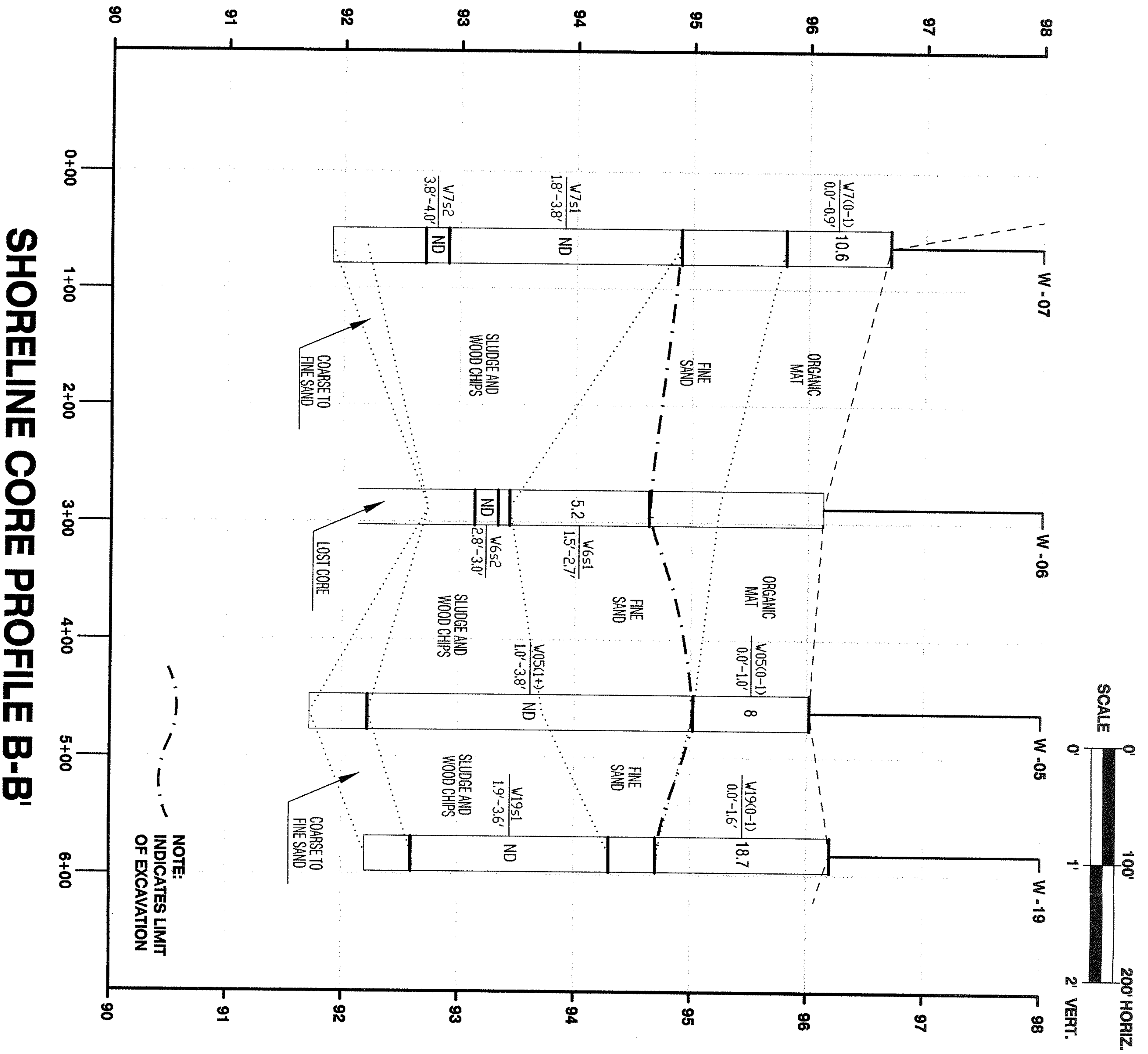
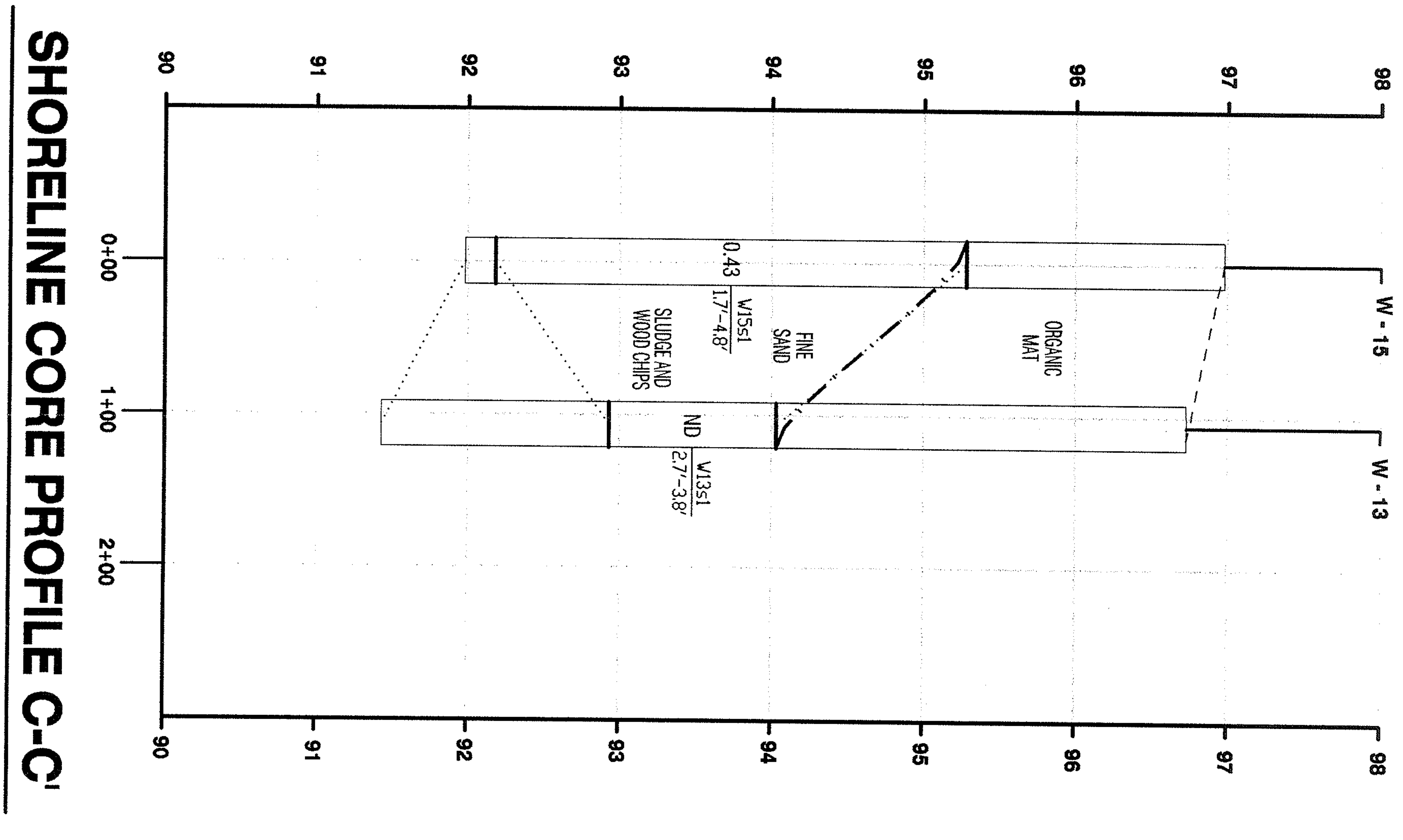
PLATTSBURGH - CLINTON COUNTY, N.Y.
NYSDEC SITE No. 510017
OCT. 1998 202352

FIGURE 4-2
SHORELINE CORE PROFILES



SHORELINE CORE PROFILE B-B'



SHORELINE CORE PROFILE C-C'

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PLATTSBURGH - CLINTON COUNTY, N.Y.
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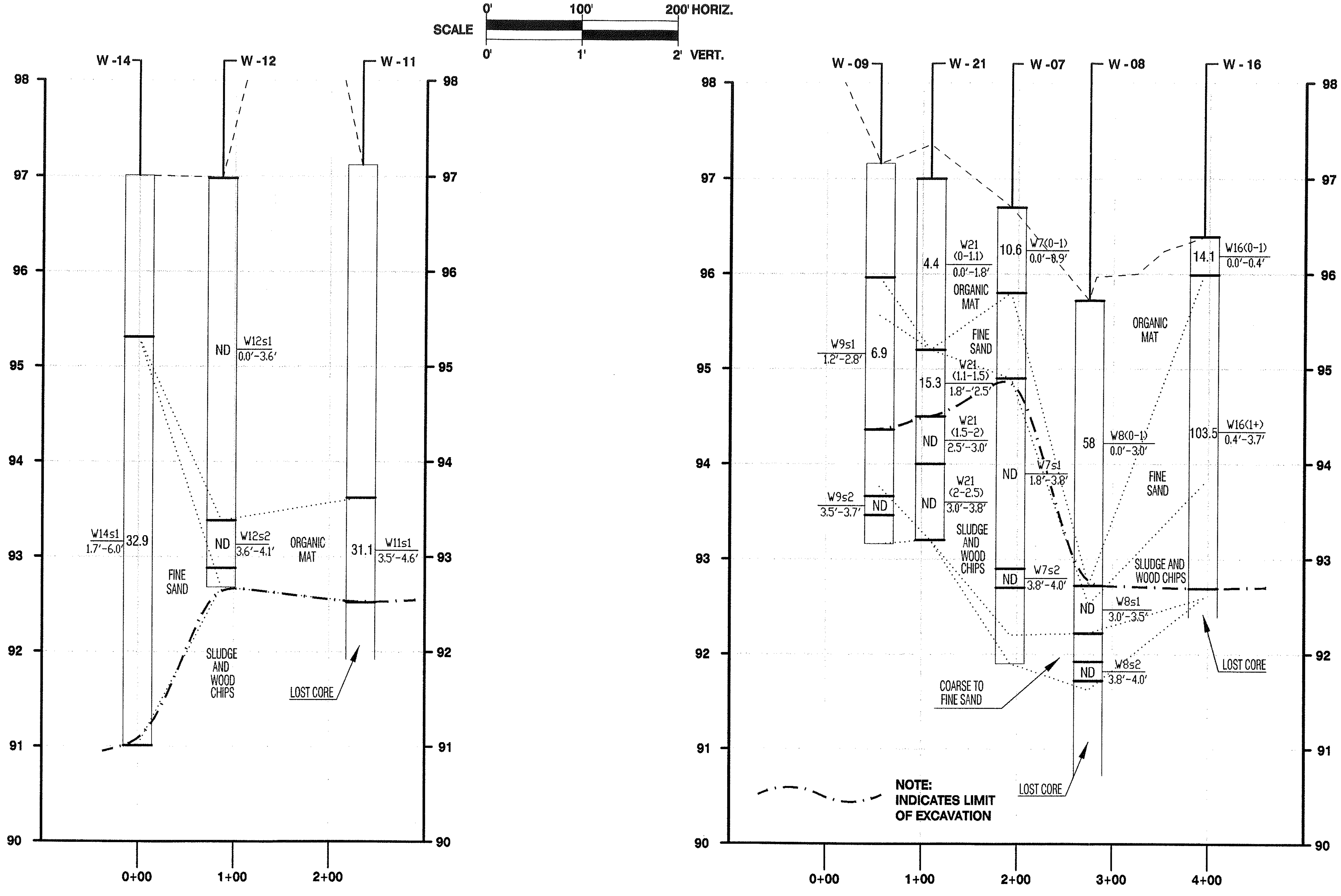
FIGURE 4-3
SHORELINE CORE PROFILES

PDR-4-4.DWG 10-20-98



SHORELINE CORE PROFILE D-D'

SHORELINE CORE PROFILE E-E'

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CUMBERLAND BAY SLUDGE BED SITE
PLATTSBURGH - CLINTON COUNTY, N.Y.
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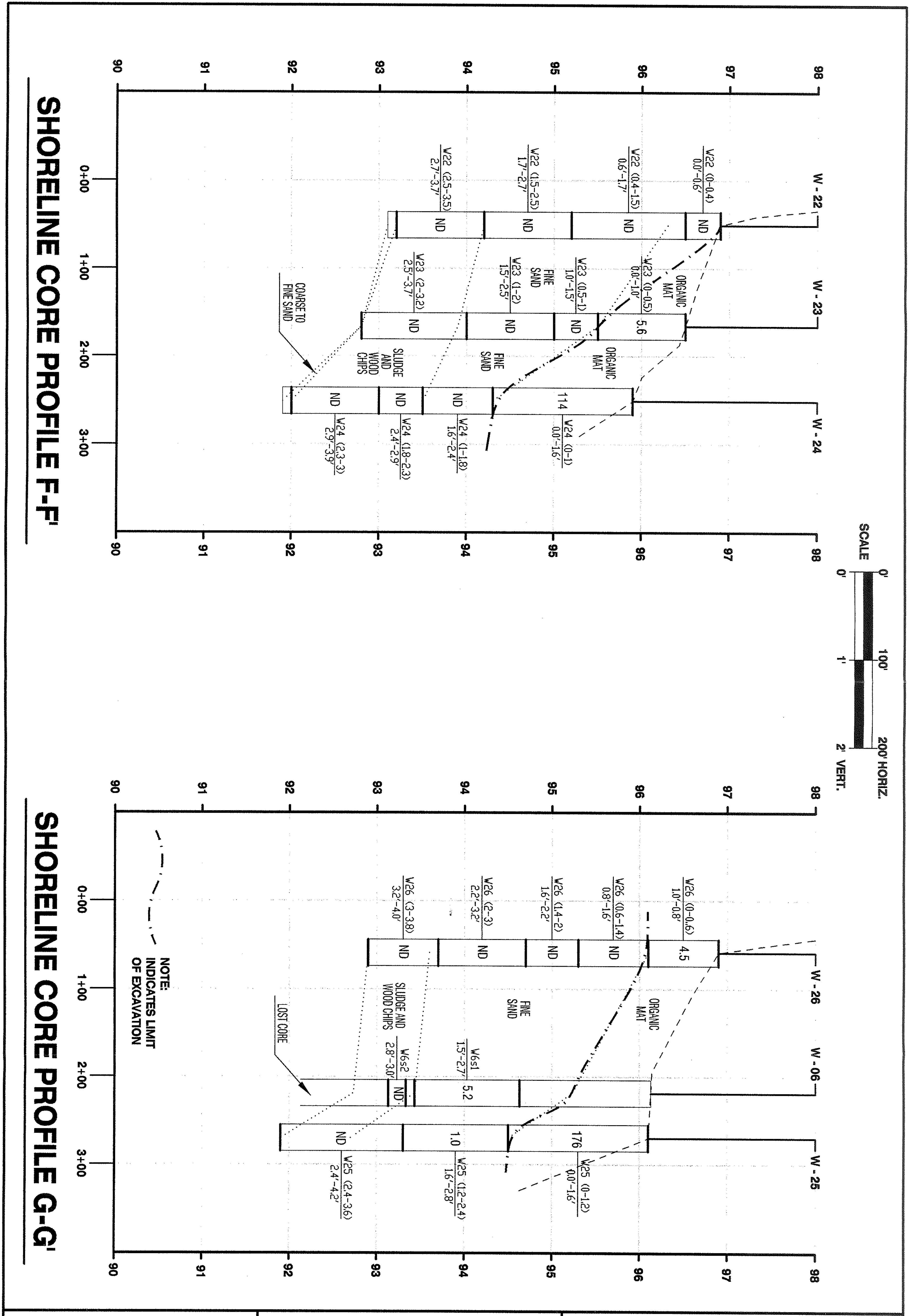
FIGURE 4 - 4

SHORELINE CORE PROFILES

PDR-4-5.DWG 10-20-98



SHORELINE CORE PROFILE F-F'

SHORELINE CORE PROFILE G-G'

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FIGURE 4 - 5

SHORELINE CORE PROFILES

PDR-5-01.DWG 10-20-98

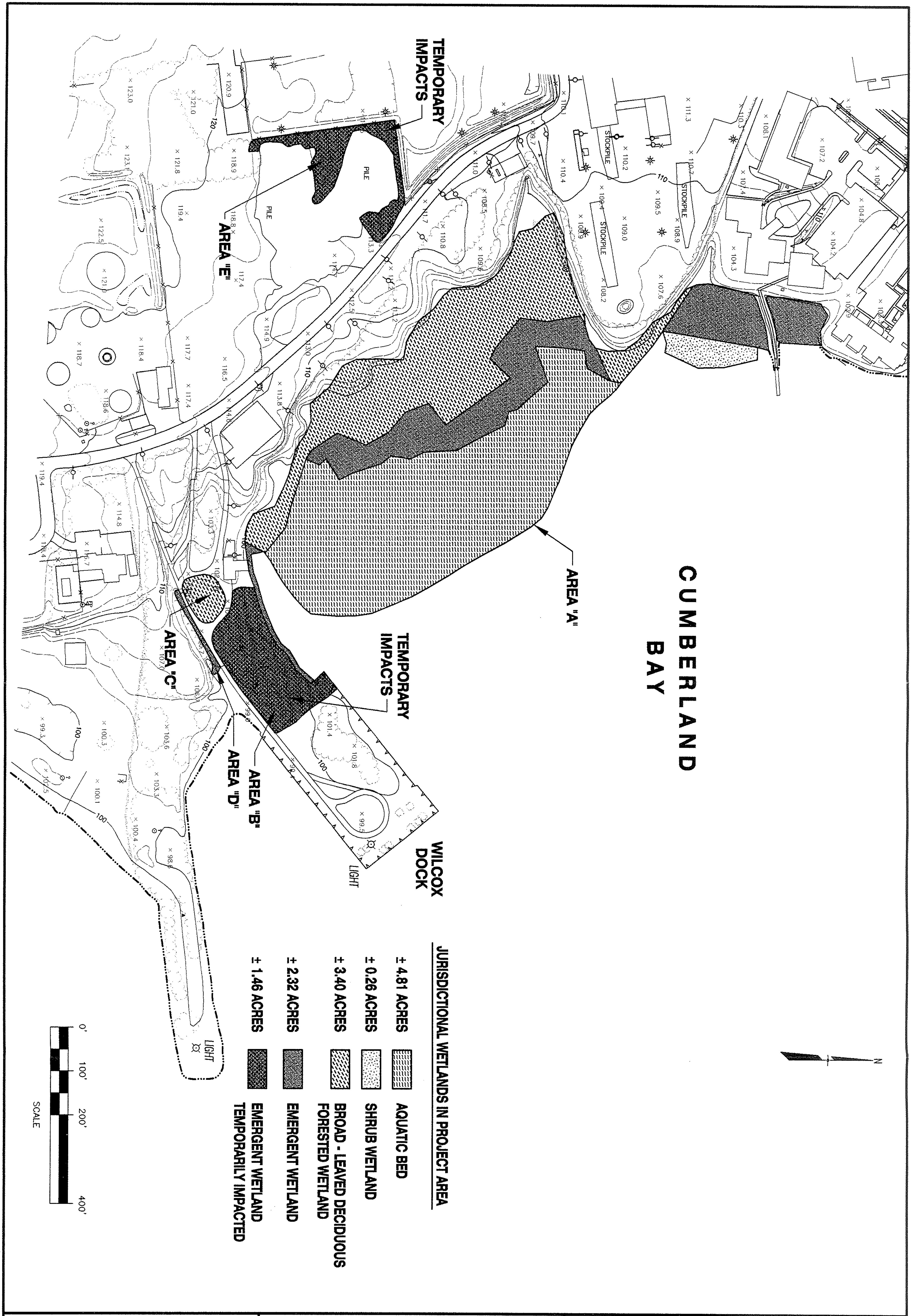

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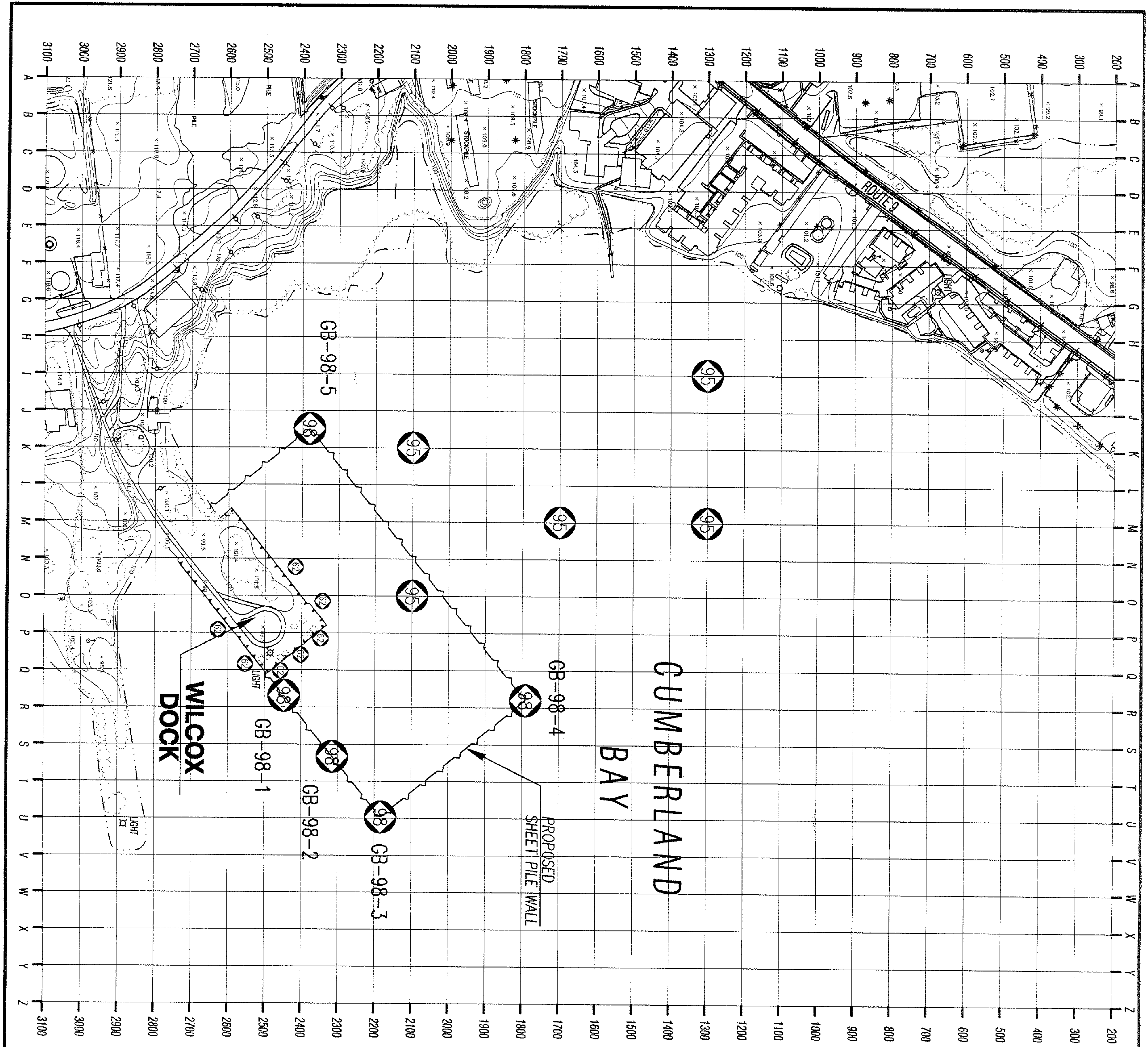
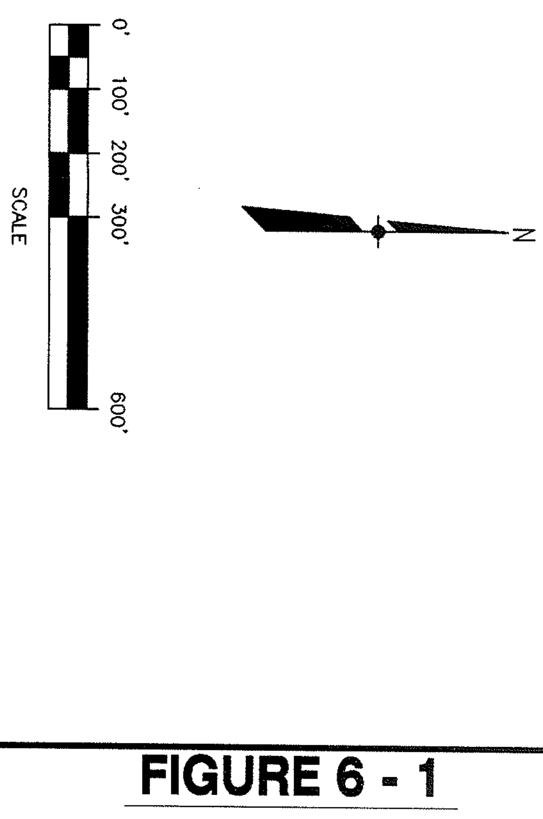
FIGURE 5 - 1
WETLAND DELINEATION MAP

PDR-6 - 01.DWG XREF: FIG_BASE.DWG 10-22-98





LEGEND

62	1962 GEOTECHNICAL BORING LOCATION FOR REHABILITATION OF CANAL TERMINAL DOCK
95	1995 GEOTECHNICAL BORING LOCATION
98	PROPOSED GEOTECHNICAL BORING LOCATION
LIGHT ☼	NAVIGATIONAL MARKER

NOTE:

1. NORTH REFERENCE IS BASED ON NEW YORK STATE PLANE COORDINATE SYSTEM NAD 83 (1992).
2. REFERENCE NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION GPS CONTROL POINT STATION NAME 5030, & STATION NAME 5031 - (ALUMINUM DISK MONUMENTS)

GPS 5030 - NORTH: 2142321.3905 / EAST: 233720.4101
GPS 5031 - NORTH: 2144868.7282 / EAST: 233627.2669
(NOT SHOWN)

GRID POINT A-200
NORTH: 2144681.2725 / EAST: 765279.2435
GRID POINT Z-3100
NORTH: 2141781.2725 / EAST: 767779.2435

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PLATTSBURGH - CLINTON COUNTY, N.Y.
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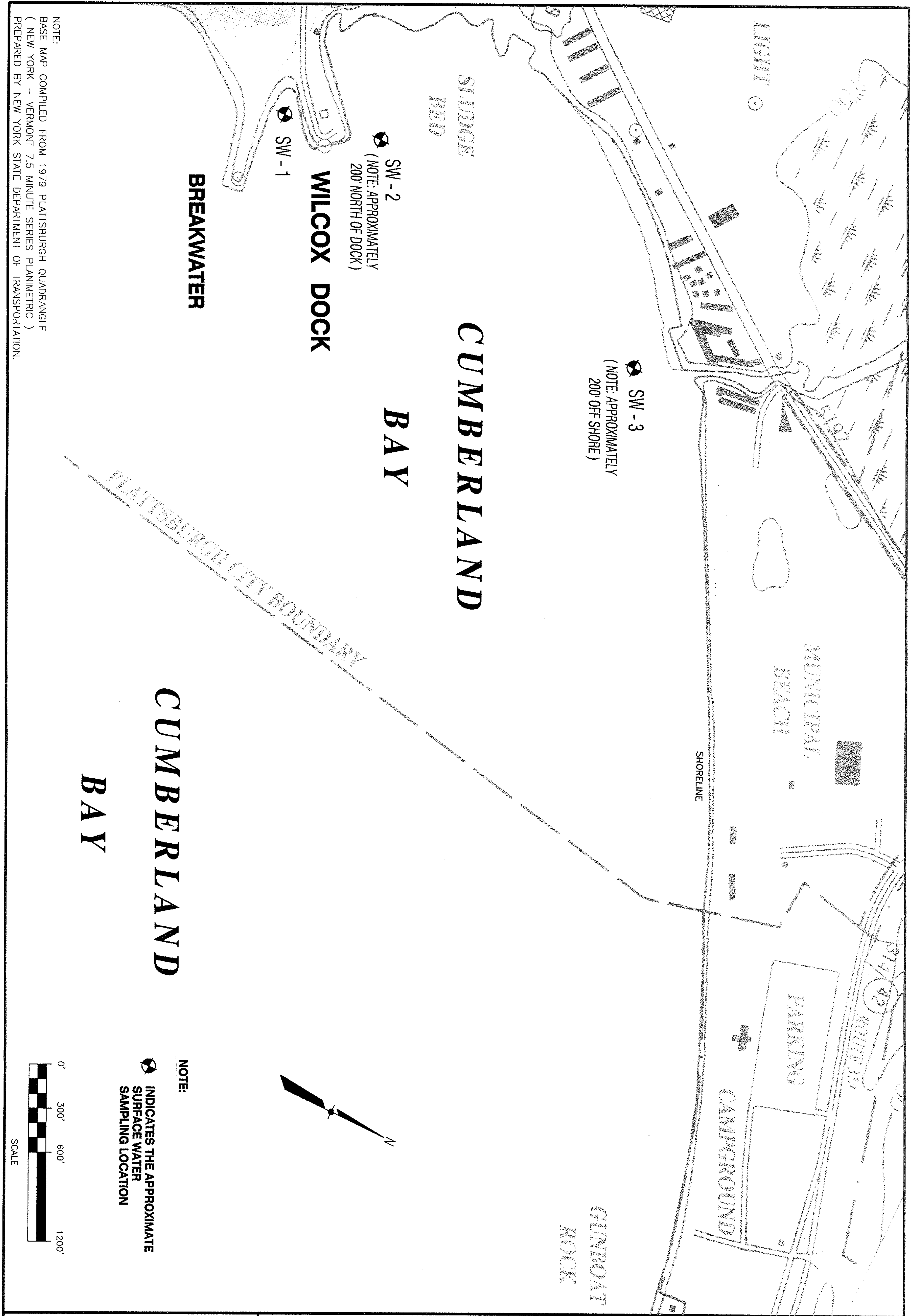
202352

FIGURE 6 - 1
GEOTECHNICAL BORING LOCATION MAP



NOTE:
BASE MAP COMPILED FROM 1979 PLATTSBURGH QUADRANGLE
(NEW YORK - VERMONT 7.5 MINUTE SERIES PLANIMETRIC)
PREPARED BY NEW YORK STATE DEPARTMENT OF TRANSPORTATION.

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FIGURE 7 - 1
SURFACE WATER SAMPLING LOCATIONS

APPENDICES

APPENDIX A

NYSDEC Control Survey Data

NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

CONTROL SURVEY DATA

Based on the
New York State Plane Coordinate System
NAD 83 (1992)

PROJECT Cumberland Bay Sludge Beds

ORDER OF SURVEY: 2-1

S.P.C.S. ZONE: NY East

CHIEF OF PARTY: FAM

USGS QUAD: "Plattsburgh" 8-27-[illegible]

NYSDEC REGION: 5

CITY/TOWN & COUNTY	STATION NAME	MONUMENT TYPE
Plattsburgh/Clinton	5030	Aluminum Disk

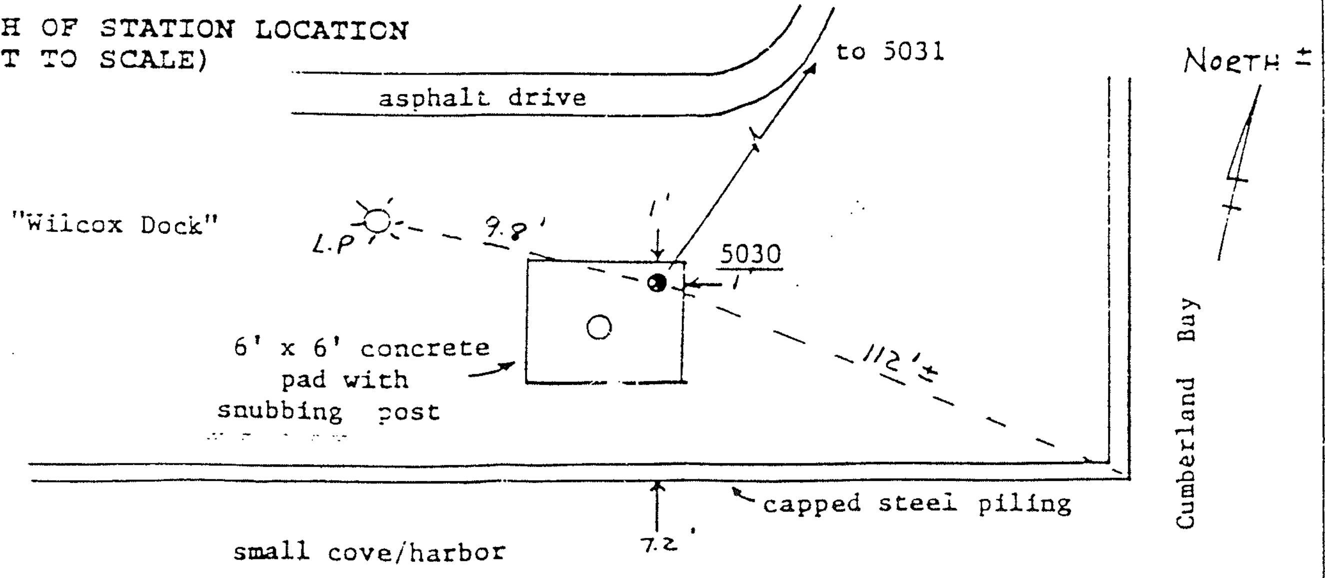
HORIZONTAL DATUM: NAD 83 (1992)	UNITS	NORTHING	EASTING
CONVERGENCE ANGLE: +0°44'36.0"	METERS	652980.8658	233720.4101
POINT SCALE FACTOR: 0.9999861683	FEET	2142321.3905	766797.7120

VERTICAL DATUM:	LATITUDE: N 44°42'29.12323"	LONGITUDE: W 73°26'36.36578"
ELEVATION: M/F	ESTABLISHED BY: NYSDEC YR. 1995	RECOVERED BY: YR.

DETAILED STATION DESCRIPTION:

A 3 1/4" "New York State" "Environmental Conservation", "Control Marker" Aluminum Disk, set in the NE corner of a concrete pad w/snubbing post. To reach the station from the intersection of Boynton Avenue and Margaret Street (Rt. 9) go easterly on Boynton Avenue which turns into Cumberland Avenue a total of 0.25 miles to an abandoned treatment plant structure on the left. Turn left on dirt road and go toward the Lake approximately 0.2 miles to station on the right. Station is located on State land at what is called the Wilcox Dock.

SKETCH OF STATION LOCATION
(NOT TO SCALE)



NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

CONTROL SURVEY DATA

Based on the
New York State Plane Coordinate System
NAD 83 (1992)

PROJECT Cumberland Bay Sludge Beds
ORDER OF SURVEY: C-1
S.P.C.S. ZONE: NY East
CHIEF OF PARTY: RAM
USGS QUAD "Plattsburgh" [illegible]
NYSDEC REGION: 5

CITY/TOWN & COUNTY	STATION NAME	MONUMENT TYPE
Plattsburgh/Clinton	5031	Aluminum Disk

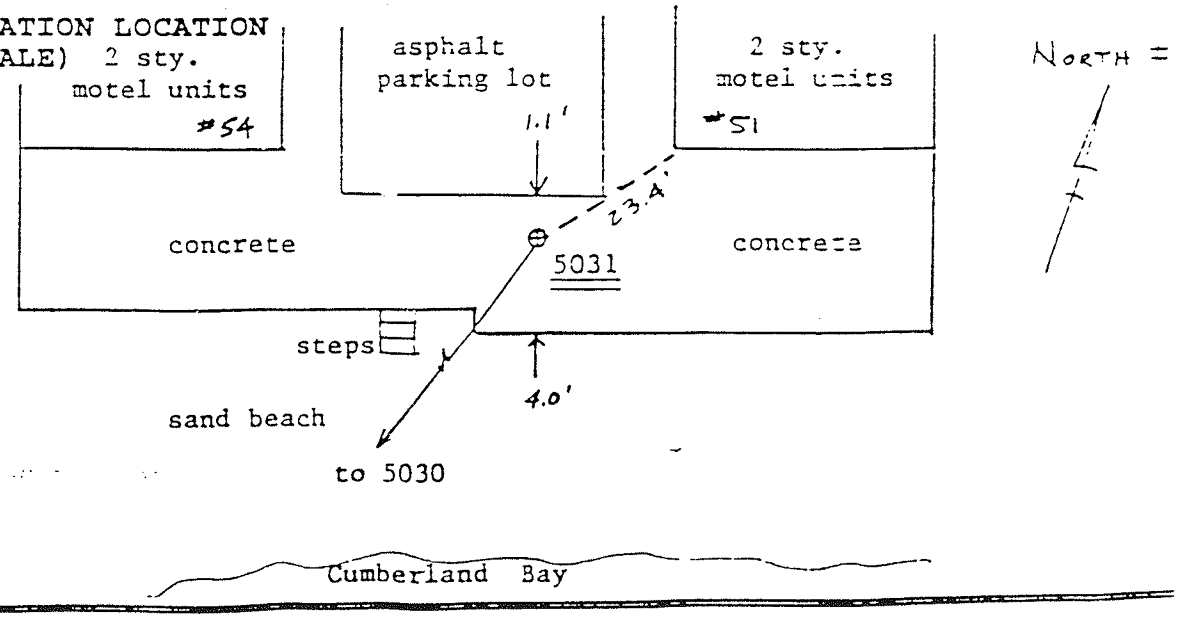
	UNITS	NORTHING	EASTING
HORIZONTAL DATUM: NAD 83 (1992)	UNITS	NORTHING	EASTING
CONVERGENCE ANGLE: +0°44'33.7"	METERS	653757.2959	233627.2669
POINT SCALE FACTOR: 0.9999859765	FEET	2144868.7282	766492.1249

VERTICAL DATUM:	LATITUDE: N 44°42'54.31352"	LONGITUDE: W 73°26'40.13963"
ELEVATION: M/F	ESTABLISHED BY: NYSDEC YR. 1995	RECOVERED BY: YR.

DETAILED STATION DESCRIPTION:

A 3 1/4" "New York State" "Environmental Conservation", "Control Marker" Aluminum Disk, set in a concrete walk or wall. To reach the station from the intersection of Margaret St. (Rt. 9) and Boynton Avenue, go NE on Margaret St. for 0.5 miles to 432 Margaret St., "Golden Gate Motel". Turn right into the motel and proceed toward the Lake, to the back of the parking lot. Disk is set in the concrete walk which borders the beach.

SKETCH OF STATION LOCATION
(NOT TO SCALE)



APPENDIX B

October 1996 Sludge Bed Cores

TAMS CONSULTANTS, Inc. **BORING LOG** **Boring No.: 96-AS-1**

PROJECT: CUMBERLAND BAY IRM	CONTRACTOR: RUST E&I	PAGE 1 OF 1
PROJECT NO.: 5799-600	LOCATION: Cumberland Bay, Plattsburgh, NY	DATE: 10/16/96
WATER ELEVATION: 94.70 feet	DATUM: Lake Champlain - Ferry Dock	TAMS REP.: J. Kaczor

Depth from ML (Inches)	PCB Field Screen	Stratum	Recovered Thickness (Inches)	SAMPLE DESCRIPTION, REMARKS, AND STRATUM CHANGES
		water		Water Column = 4 feet (approximate) Mud Line (ML)
-- 3				
-- 6				
-- 9		wood pulp sludge		0 to 39" - Grey wood pulp and paper sludge, fibrous, plastic matrix, wet.
-- 12				
-- 15				
-- 18				
-- 21				
-- 24				
-- 27				
-- 30				
-- 33				
-- 36				
-- 39				(Refusal of vibra-core sampler at native sediments at 39" BML.) 3.3'
-- 42				Bottom of recovery at 39".
-- 45				Collect 8-oz. composite sample over entire interval for PCB field screen. Collect bulk composite sample for turbidity/PCB correlation, and for TCLP analyses.
-- 48				
-- 51				
-- 54				Drive = 3.3' = 39" Recovery = 3.3' = 39"
-- 57				
-- 60				

TAMS CONSULTANTS, Inc. **BORING LOG** **Boring No.: 96-AS-2**

PROJECT: CUMBERLAND BAY IRM	CONTRACTOR: RUST E&I	PAGE 1 OF 1
PROJECT NO.: 5799-600	LOCATION: Cumberland Bay, Plattsburgh, NY	DATE: 10/16/96
WATER ELEVATION: 94.70 feet	DATUM: Lake Champlain - Ferry Dock	TAMS REP.: J. Kaczor

Depth from ML (Inches)	PCB Field Screen	Stratum	Recovered Thickness (Inches)	SAMPLE DESCRIPTION, REMARKS, AND STRATUM CHANGES
		water		Water Column = 4 feet (approximate) Mud Line (ML)
-- 3				
-- 6			13	0 to 13" - Brown pulpy sludge, organics, saturated.
-- 9				
-- 12				
-- 15				
-- 18				
-- 21		paper and wood pulp sludge	15	13 to 28" - Grey pulpy sludge, pasty texture, wet.
-- 24				
-- 27				
-- 30				
-- 33			12	28 to 40" - White pulpy sludge, pasty texture, wet.
-- 36				
-- 39				
-- 42				
-- 45			11	40 to 51" - Grey fibrous pulp, plastic matrix, wet; occasional gravel on bottom.
-- 48				
-- 51				(Refusal of vibra-core sampler on native sediments at 51" BML.)
-- 54				Collect one, 4-oz jar sample of each interval for PCB lab analysis by DEC lab. Collect 8-oz. composite sample over entire sludge interval for PCB field screen. Collect bulk composite sample of sludge for turbidity/PCB correlation, and for TCLP analyses.
-- 57				
-- 60				Bottom of recovery at 51". Drive = 4.3' = 51" Recovery = 4.3' = 51"

TAMS CONSULTANTS, Inc. **BORING LOG** **Boring No.: 96-AS-3**

PROJECT: CUMBERLAND BAY IRM	CONTRACTOR: RUST E&I	PAGE 1 OF 1
PROJECT NO.: 5799-600	LOCATION: Cumberland Bay, Plattsburgh, NY	DATE: 10/17/96
WATER ELEVATION: 94.62 feet	DATUM: Lake Champlain - Ferry Dock	TAMS REP.: J. Kaczor

Depth from ML (Inches)	PCB Field Screen	Stratum	Recovered Thickness (Inches)	SAMPLE DESCRIPTION, REMARKS, AND STRATUM CHANGES
		water		Water Column = 3 feet (approximate) **Mud Line (ML)**
-- 3				
-- 6				
-- 9				
-- 12		paper and wood pulp sludge	24	Dark grey fibrous sludge, organics, plastic matrix, very wet.
-- 15				
-- 18				
-- 21				
-- 24				
-- 27				Bottom of recovery at 24".
-- 30				Collect 8-oz. composite sample of entire interval for PCB field screen. Collect bulk composite sample of sludge for PCB/turbidity correlation, and for TCLP analyses.
-- 33				Drive = 2.0' = 24"
-- 36				Recovery = 2.0' = 24"
-- 39				
-- 42				
-- 45				
-- 48				
-- 51				
-- 54				
-- 57				
-- 60				

TAMS CONSULTANTS, Inc. **BORING LOG** **Boring No.: 96-AS-4**

PROJECT: CUMBERLAND BAY IRM	CONTRACTOR: RUST E&I	PAGE 1 OF 1
PROJECT NO.: 5799-600	LOCATION: Cumberland Bay, Plattsburgh, NY	DATE: 10/17/96
WATER ELEVATION: 94.62 feet	DATUM: Lake Champlain - Ferry Dock	TAMS REP.: J. Kaczor

Depth from ML (Inches)	PCB Field Screen	Stratum	Recovered Thickness (Inches)	SAMPLE DESCRIPTION, REMARKS, AND STRATUM CHANGES
		water		Water Column = 3 feet (approximate) Mud Line (ML)
-- 3				
-- 6				
-- 9				
-- 12		paper and wood pulp sludge	24	Dark grey fibrous sludge, organics, plastic matrix, very wet.
-- 15				
-- 18				
-- 21				
-- 24				
-- 27				Bottom of recovery at 24".
-- 30				Collect 8-oz. composite sample of entire interval for PCB field screen. Collect bulk composite sample of sludge for PCB/turbidity correlation, and for TCLP analyses.
-- 33				
-- 36				Drive = 2.0' = 24" Recovery = 2.0' = 24"
-- 39				
-- 42				
-- 45				
-- 48				
-- 51				
-- 54				
-- 57				
-- 60				

TAMS CONSULTANTS, Inc.

BORING LOG

Boring No.: 96-CH-1

PROJECT: CUMBERLAND BAY IRM

CONTRACTOR: RUST E&I

PAGE 1 OF 1

PROJECT NO.: 5799-600

LOCATION: Cumberland Bay, Plattsburgh, NY

DATE: 10/16/96

WATER ELEVATION: 94.70 feet

DATUM: Lake Champlain - Ferry Dock

TAMS REP.: J. Kaczor

Depth rom ML (Inches)	PCB Field Screen	Stratum	Recovered Thickness (Inches)	SAMPLE DESCRIPTION, REMARKS, AND STRATUM CHANGES
		water		Water Column = 11.0 feet
				Mud Line (ML)
- 3				
-- 6				
- 9		wood pulp sludge		0 to 39" - Grey wood pulp and paper sludge, fibrous, plastic matrix, wet.
-- 12				
15				
- 18				
- 21				
- 24				
- 27				
- 30				
33				
-- 36				
-- 39				(Refusal of vibra-core sampler at native sediments at 39" BML.) 3.3'
-- 42				Bottom of recovery at 39".
-- 45				Collect 8-oz. composite sample over entire interval for PCB field screen. Collect bulk composite sample for turbidity/PCB correlation, and for TCLP analyses.
-- 48				
-- 51				
-- 54				Drive = 3.3' = 39"
-- 57				Recovery = 3.3' = 39"
-- 60				

TAMS CONSULTANTS, Inc. **BORING LOG** **Boring No.: 96-CH-2**

PROJECT: CUMBERLAND BAY IRM
CONTRACTOR: RUST E&I
PAGE 1 OF 1
PROJECT NO.: 5799-600
LOCATION: Cumberland Bay, Plattsburgh, NY
DATE: 10/17/96
WATER ELEVATION: 94.62 feet
DATUM: Lake Champlain - Ferry Dock
TAMS REP.: J. Kaczor

Depth from ML (Inches)	PCB Field Screen	Stratum	Recovered Thickness (Inches)	SAMPLE DESCRIPTION, REMARKS, AND STRATUM CHANGES
		water		Water Column = 11.0 feet Mud Line (ML)
-- 3		paper and wood pulp sludge	9	Black fibrous sludge, organics, plastic matrix, very wet.
-- 6				
-- 9				
-- 12		banded sludge and sand	9	Alternating bands of Black fibrous sludge and Brown medium to fine SAND, trace Silt, wet; bands average 1" thick.
-- 15				
-- 18				
-- 21		beach sand	6	Light brown medium to fine SAND, trace Silt, wet.
-- 24				
-- 27				Bottom of recovery at 24".
-- 30				Collect 8-oz. composite sample of each interval (3) for PCB field screen.
-- 33				Drive = 2.0' = 24" Recovery = 2.0' = 24"
-- 36				
-- 39				
-- 42				
-- 45				
-- 48				
-- 51				
-- 54				
-- 57				
-- 60				

APPENDIX C

February 1998 Sludge Bed Cores

RUST E&I Albany, NY (518) 458-1313	**Test Boring Log**	**Boring No. H1900**
PROJECT: Cumberland Bay		Sheet 1 of 1
CLIENT: New York State Department of Environmental Conservation - SSP		Job No. 39304.10006
DRILLING CONTRACTOR: Rust/NYSDEC		Meas. Pt. Elev.: 97.5
PURPOSE: Lacustrine Sediment Core Sampling		Ground Elev.: 93.40

		SAMPLE	CORE	CASING	
DRILLING METHOD: Direct Push		SAMPLE	CORE	CASING	Datum: USGS (amsl)
DRILL RIG TYPE: None: Hand	TYPE	–	Sch 40 PVC	–	Date Started:
WATER DEPTH:	DIAM.	–	2 inch	–	Date Finished:
MEAS. PT.: Ice Surface	WEIGHT	–			Driller: McGrath/Williams
DATE OF MEAS.: --	FALL	–			Inspector: B. Edwards

Depth (Inch)	Sample Number	Blow Count	Graphic Log	Unified Classif- ication	GEOLOGIC DESCRIPTION	REMARKS
1				SP-SM	0-0.57: POORLY GRADED SAND WITH SILT. Medium dense, wet, dark brown, medium to mostly fine SAND; some grayish organic Silt, abundant organics.	Drive = 1.95 Rec = 1.63 Yield = 84%
2						
3						
4						
5						
6						
7					7.0" (MUCK) 0.58'	
8					0.58-0.92: ORGANIC SILT Soft, wet, gray SILT and wood chips, odor.	
9	S-1			OL		
10						
11					11.0" (SLUDGE) 0.92'	
12				NA	0.92-1.17: PULP Soft, wet, white, platy and pulpy paper; strong odor (PCB).	
13						
14					14.0" (SLUDGE) 1.17'	
15					(SLUDGE) PULP Very loose, medium to fine GRAVEL SIZE WOOD CHIPS, some fine Sand, organic Silt, stained black. OIL visible, slight petroleum odor.	
16				NA		
17						
18						
19					19.5" 1.63'	
20						

RUST E&I Albany, NY (518) 458-1313	**Test Boring Log**	**Boring No. H2100**
PROJECT: Cumberland Bay		Sheet 1 of 1
CLIENT: New York State Department of Environmental Conservation - SSP		Job No. 39304.10006
DRILLING CONTRACTOR: Rust/NYSDEC		Meas. Pt. Elev.: --
PURPOSE: Lacustrine Sediment Core Sampling		Ground Elev.: --

		SAMPLE	CORE	CASING	
DRILLING METHOD: Direct Push		SAMPLE	CORE	CASING	Datum: --
DRILL RIG TYPE: None: Hand	TYPE	–	Sch 40 PVC	–	Date Started:
WATER DEPTH:	DIAM.	–	2 inch	–	Date Finished:
MEAS. PT.: Ice Surface	WEIGHT	–			Driller: McGrath/Williams
DATE OF MEAS.: --	FALL	–			Inspector: B. Edwards

Depth (Inch)	Sample Number	Blow Count	Graphic Log	Unified Classif-ication	GEOLOGIC DESCRIPTION	REMARKS
1	↑			SP-SM	0-0.94: POORLY GRADED SAND WITH SILT. Medium dense, wet, black and gray medium to fine SAND; some organic Silt. Slight odor (decay).	Drive = 1.55 Rec = 1.55 Yield = 100%
2						
3						
4						
5						
6						
7						
8	S-1					
9						
10						
11					11.0" (BANDED SAND) 0.94'	
12				OL/OH	0.94-1.38: ORGANIC SILT WITH SAND Soft, wet, gray, highly organic SILT, trace(+) fine Sand; abundant bark chips and woody fibers.	
13						
14						
15						
16	↓				16.5" (SLUDGE) 1.38'	
17						
18						
19						
20						

RUST E&I
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Test Boring Log

Boring No. J1200

PROJECT: Cumberland Bay
Sheet 1 of 1

CLIENT: New York State Department of Environmental Conservation - SSP
Job No. 39304.10006

DRILLING CONTRACTOR: Rust/NYSDEC
Meas. Pt. Elev.: 97.5

PURPOSE: Lacustrine Sediment Core Sampling
Ground Elev.: 91.70

DRILLING METHOD: Direct Push		SAMPLE	CORE	CASING	Datum: USGS (amsl)
DRILL RIG TYPE: None: Hand	TYPE	–	Sch 40 PVC	–	Date Started:
WATER DEPTH: 5.80	DIAM.	–	2 inch	–	Date Finished:
MEAS. PT.: Ice Surface	WEIGHT	–			Driller: McGrath/Williams
DATE OF MEAS.: –	FALL	–			Inspector: B. Edwards

Depth (Inch)	Sample Number	Blow Count	Graphic Log	Unified Classif-ication	GEOLOGIC DESCRIPTION	REMARKS
1				SP-SM	0-0.29: POORLY GRADED SAND WITH SILT. Loose, wet, gray, medium to mostly fine SAND; frequent wood fiber, bark chips, plant stems, occasional fine Gravel.	Drive = 1.80 Rec = 1.38 Yield = 76%
2						
3					3.5" (SLUDGE) 0.29'	
4						
5					0.29-1.10: SILTY SAND (SM) Very loose, wet, gray & dark brown, mostly fine SAND with highly organic Silt, abundant wood fiber.	
6				SM		
7						
8						
9						
10						
11						
12						
13					13.25" (SLUDGE) 1.10'	
14					1.10-1.38: POORLY GRADED SAND Medium dense, wet, gray, medium to mostly fine SAND.	
15				SP		
16					16.5" (SAND) 1.38'	
17						
18					End Core @ 1.38'	
19						
20						

21.6" Drive depth 1.8' Lake bottom 1.8' dbg = 89.9 amsl

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Test Boring Log

Boring No. J1400

PROJECT: Cumberland Bay	Sheet 1 of 1
CLIENT: New York State Department of Environmental Conservation - SSP	Job No. 39304.10006
DRILLING CONTRACTOR: Rust/NYSDEC	Meas. Pt. Elev.: 97.5
PURPOSE: Lacustrine Sediment Core Sampling	Ground Elev.: 91.30

		SAMPLE	CORE	CASING	
DRILLING METHOD: Direct Push					Datum: --
DRILL RIG TYPE: None: Hand	TYPE	–	Sch 40 PVC	–	Date Started:
WATER DEPTH:	DIAM.	–	2 inch	–	Date Finished:
MEAS. PT.: Ice Surface	WEIGHT	–			Driller: McGrath/Williams
DATE OF MEAS.: --	FALL	–			Inspector: B. Edwards

Depth (Inch)	Sample Number	Blow Count	Graphic Log	Unified Classif-ication	GEOLOGIC DESCRIPTION	REMARKS
	↑				0-1.58: POORLY GRADED SAND WITH SILT.	
1				SP-SM or SM	SILTY SAND Loose, wet, orange-brown, medium to mostly fine SAND, with gray organic Silt, abundant wood fiber, bark chips. Strong odor of decay.	Drive = 1.6 Rec = 1.58 Yield = 99%
2						
3						
4						
5						
6						
7						
8						
9						
10	S-1					
11						
12						
13						
14						
15						
16						
17						
18	↓					
19					19.0" (SLUDGE) 1.58'	
20					End Core @ 1.58'	

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Test Boring Log

Boring No. J1700

PROJECT: Cumberland Bay
Sheet 1 of 1
CLIENT: New York State Department of Environmental Conservation - SSP
Job No. 39304.10006
DRILLING CONTRACTOR: Rust/NYSDEC
Meas. Pt. Elev.: 97.5
PURPOSE: Lacustrine Sediment Core Sampling
Ground Elev.: 5.50
DRILLING METHOD: Direct Push
Datum: USGS (amsl)
DRILL RIG TYPE: None: Hand
Date Started:
WATER DEPTH:
Date Finished:
MEAS. PT.: Ice Surface
Driller: McGrath/Williams
DATE OF MEAS.: --
Inspector: B. Edwards

	SAMPLE	CORE	CASING
TYPE	–	Sch 40 PVC	–
DIAM.	–	2 inch	–
WEIGHT	–		
FALL	–		

Depth (Inch)	Sample Number	Blow Count	Graphic Log	Unified Classification	GEOLOGIC DESCRIPTION	REMARKS
1				OL/OH	0-0.3: ORGANIC SILT WITH SAND. Soft, wet, dark gray, highly organic SILT, some fine Sand, strong odor of decay, abundant plant fiber. 0.3" (MUCK) 0.25'	Drive = 2.70 Rec = 1.75 Yield = 65%
2						
3						
4				OL	0.3-1.33 ORGANIC SILT Very soft, cohesiveless, wet (over saturated) dark gray organic SILT, abundant wood and plant fibers, occasional bark chips. 16" (SLUDGE) 1.33'	
5						
6						
7						
8						
9						
10	S-1					
11						
12						
13						
14						
15						
16						
17				NA (no class or OH)	1.33-1.5 Wood chips with fine black SAND. 18.0" (SLUDGE) 1.5'	
18						
19				SP	POORLY GRADED SAND Medium dense, wet, light brown and orange medium to fine SAND. 21.0" (SAND) 1.75'	
20						
21						

End Core @ 1.75'

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Test Boring Log

Boring No. J2300

PROJECT: Cumberland Bay	Sheet 1 of 2
CLIENT: New York State Department of Environmental Conservation - SSP	Job No. 39304.10006
DRILLING CONTRACTOR: Rust/NYSDEC	Meas. Pt. Elev.: 97.5
PURPOSE: Lacustrine Sediment Core Sampling	Ground Elev.: 93.75

		SAMPLE	CORE	CASING	
DRILLING METHOD: Direct Push					Datum: USGS (amsl)
DRILL RIG TYPE: None: Hand	TYPE	–	Sch 40 PVC	–	Date Started:
GROUNDWATER DEPTH: 3.75	DIAM.	–	2 inch	–	Date Finished:
MEAS. PT.: Ice Surface	WEIGHT	–			Driller: McGrath/Williams
DATE OF MEAS.: --	FALL	–			Inspector: B. Edwards

Depth (Inch)	Sample Number	Blow Count	Graphic Log	Unified Classif-ication	GEOLOGIC DESCRIPTION	REMARKS
1	S-1				0-0.56: ORGANIC SOIL (OL). Very soft, wet, dark brown, highly organic SILT (muck); frequent wood chips and plant fiber, strong organic decay odor non-plastic.	Drive = 2.40 Rec = 1.92 Yield = 80%
2						
3				OL		
4						
5						
6					6.75" (SLUDGE) 0.56'	
7						
8					ORGANIC SILT WITH SAND Soft, wet, dark gray organic SILT, with brown medium to mostly fine SAND, occasional thin laminae of black medium to fine SAND, abundant wood chips and plant fiber. Slight odor (PCB?).	
9						
10				OL/OH		
11						
12						
13						
14						
15						
16						
17						
18						
19						
20					20" (SLUDGE) 1.67'	

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Test Boring Log

Boring No. J2300

PROJECT: Cumberland Bay

Sheet 2 of 2

CLIENT: New York State Department of Environmental Conservation - SSP

Job No. 39304.10006

Depth (Inch)	Sample Number	Blow Counts	Graphic Log	Unified Classif-ication	Geologic Description	Remarks
21	↓				1.67-1.92: POORLY GRADED SAND (SP). Medium dense, wet, blue-gray and black medium to mostly fine SAND.	
22				SP		
23					23" (SAND) 1.92'	
24					End of Core @ 1.92'	
25						
26						
27						
28					28.8 2.40'	
29					End of Drive @ 2.4'	

RUST E&I Albany, NY (518) 458-1313	**Test Boring Log**			**Boring No. J2500**
PROJECT: Cumberland Bay				Sheet 1 of 2
CLIENT: New York State Department of Environmental Conservation - SSP				Job No. 39304.10006
DRILLING CONTRACTOR: Rust/NYSDEC				Meas. Pt. Elev.: 97.5
PURPOSE: Lacustrine Sediment Core Sampling				Ground Elev.: 94.0
DRILLING METHOD: Direct Push	SAMPLE	CORE	CASING	Datum: USGS (amsl)
DRILL RIG TYPE: None: Hand — TYPE	–	Sch 40 PVC	–	Date Started:
GROUNDWATER DEPTH: — DIAM.	–	2 inch	–	Date Finished:
MEAS. PT.: Ice Surface — WEIGHT	–			Driller: McGrath/Williams
DATE OF MEAS.: -- — FALL	–			Inspector: B. Edwards

Depth (Inch)	Sample Number	Blow Count	Graphic Log	Unified Classif-ication	GEOLOGIC DESCRIPTION	REMARKS
1					0-0.58: POORLY GRADED SAND WITH SILT OR SILTY SAND Loose, wet, dark red-brown, medium to mostly fine SAND, with gray SILT; abundant wood fiber. Decay odor.	
2				SW-SM or SM		Drive = 1.9 Rec = 1.0 Yield = 53%
3						
4						
5						
6						
7					7" (SLUDGE) 0.58'	
8					0.58-0.83: PULP Soft, white, platy paper pulp, very strong odor (PCB).	
9				OL		
10					10" (SLUDGE) 0.83' 0.83-1.0: ORGANIC SILT Loose, wet, dark red-brown, organic SILT, strong odor.	
11						
12					12" (SLUDGE) 1.0'	
13					End of Core @ 1.0'	
14					Loss = 0.90'	
15						
16						
17						
18						
19						
20						

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Test Boring Log

Boring No. J2500

PROJECT: Cumberland Bay

Sheet 2 of 2

CLIENT: New York State Department of Environmental Conservation - SSP

Job No. 39304.10006

Depth (Inch)	Sample Number	Blow Counts	Graphic Log	Unified Classification	Geologic Description	Remarks
21						
22						
23					22.8" 1.9'	
					End Drive @ 1.9'	

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Test Boring Log

Boring No. L1400

PROJECT: Cumberland Bay

Sheet 1 of 1

CLIENT: New York State Department of Environmental Conservation - SSP

Job No. 39304.10006

DRILLING CONTRACTOR: Rust/NYSDEC

Meas. Pt. Elev.: 97.50

PURPOSE: Lacustrine Sediment Core Sampling

Ground Elev.: 91.30

DRILLING METHOD: Direct Push		SAMPLE	CORE	CASING
DRILL RIG TYPE: None: Hand	TYPE	–	Sch 40 PVC	–
WATER DEPTH:	DIAM.	–	2 inch	–
MEAS. PT.: Ice Surface	WEIGHT	–		
DATE OF MEAS.: --	FALL	–		

Datum: USGS (amsl)
Date Started:
Date Finished:
Driller: McGrath/Williams
Inspector: B. Edwards

Depth (Inch)	Sample Number	Blow Count	Graphic Log	Unified Classif-ication	GEOLOGIC DESCRIPTION	REMARKS
					0-0.83:	
1				SP	<u>POORLY GRADED SAND (SP).</u> Loose, wet, blue-gray medium to mostly fine SAND, occasional large bark chips and wood fiber.	Drive = 1.71 Rec = 1.60 Yield = 94%
2						
3						
4						
5						
6						
7						
8						
9						
10	S-1				10" (BANDED SAND) 0.83'	
11					0.83-1.71:	
12				SP	<u>POORLY GRADED SAND (SP).</u> Medium dense, wet, orange-brown, and dark tan SAND, frequent laminae of medium black Sand.	
13						
14						
15						
16						
17						
18						
19						
20					20.5" (SAND) 1.7'	
21					End Core @ 20.5"	

End Drive @ 20.5'

RUST E&I Albany, NY (518) 458-1313	**Test Boring Log**			**Boring No. L1900**
PROJECT: Cumberland Bay				Sheet 1 of 1
CLIENT: New York State Department of Environmental Conservation - SSP				Job No. 39304.10006
DRILLING CONTRACTOR: Rust/NYSDEC				Meas. Pt. Elev.: 97.50
PURPOSE: Lacustrine Sediment Core Sampling				Ground Elev.: 90.95
DRILLING METHOD: Direct Push		SAMPLE	CORE	CASING	Datum: USGS (amsl)
DRILL RIG TYPE: None: Hand	TYPE	–	Sch 40 PVC	–	Date Started:
WATER DEPTH:	DIAM.	–	2 inch	–	Date Finished:
MEAS. PT.: Ice Surface	WEIGHT	–			Driller: McGrath/Williams
DATE OF MEAS.: --	FALL	–			Inspector: B. Edwards

Depth (Inch)	Sample Number	Blow Count	Graphic Log	Unified Classif-ication	GEOLOGIC DESCRIPTION	REMARKS
1	↑			SP-SM or SM	0-1.0: POORLY GRADED SAND WITH SILT OR SILTY SAND. Loose, wet, dark gray fine SAND and organic SILT.	Drive = 1.0 Rec = 1.0 Yield = 100%
2						
3						
4						
5						
6	S-1					
7						
8						
9						
10						
11	↓					
12					12.0" (SAND) 1.0'	
13						
14						
15						
16						
17						
18						
19						
20						

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Test Boring Log

Boring No. L2100

PROJECT: Cumberland Bay

Sheet 1 of 2

CLIENT: New York State Department of Environmental Conservation - SSP

Job No. 39304.10006

DRILLING CONTRACTOR: Rust/NYSDEC

Meas. Pt. Elev.: 97.50

PURPOSE: Lacustrine Sediment Core Sampling

Ground Elev.: 92.20

DRILLING METHOD: Direct Push		SAMPLE	CORE	CASING	Datum: USGS (amsl)
DRILL RIG TYPE: None: Hand	TYPE	–	Sch 40 PVC	–	Date Started:
WATER DEPTH: 5.30	DIAM.	–	2 inch	–	Date Finished:
MEAS. PT.: Ice Surface	WEIGHT	–			Driller: McGrath/Williams
DATE OF MEAS.: --	FALL	–			Inspector: B. Edwards

Depth (Inch)	Sample Number	Blow Count	Graphic Log	Unified Classif-ication	GEOLOGIC DESCRIPTION	REMARKS
1	↑				0-0.42: Liquefied SILT, dark brown/highly turbid water.	
2						Drive = NR Rec = 3.08 Yield =
3						
4						
5					5" (MUCK) 0.42'	
6						
7				SP	0.42-1.42: POORLY GRADED SAND Very loose, wet, light brown, medium to mostly fine SAND, abundant plant fiber.	
8						
9						
10	S-1					
11						
12						
13						
14						
15						
16						
17					17" (SLUDGE) 1.42' 1.42-3.08: POORLY GRADED SAND	
18				SP	Medium dense, wet, blue-gray, medium to mostly fine SAND, occasional layers of fine black Sand, occasional bark chips.	
19						
20					(BANDED SAND)	

RUST E&I
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Test Boring Log

Boring No. L2100

PROJECT: Cumberland Bay

Sheet 2 of 2

CLIENT: New York State Department of Environmental Conservation - SSP

Job No. 39304.10006

Depth (Inch)	Sample Number	Blow Counts	Graphic Log	Unified Classif-ication	Geologic Description	Remarks
21					(cont.)	
22						
23						
24						
25						
26						
27						
28	S-1					
29	(cont.)					
30						
31						
32						
33						
34						
35						
36						
37					37" (BANDED SAND) 3.08'	
					End Core @ 3.08'	

RUST E&I
Albany, NY (518) 458-1313

Test Boring Log

Boring No. L2600

PROJECT: Cumberland Bay

Sheet 1 of 2

CLIENT: New York State Department of Environmental Conservation - SSP

Job No. 39304.10006

DRILLING CONTRACTOR: Rust/NYSDEC

Meas. Pt. Elev.: 97.50

PURPOSE: Lacustrine Sediment Core Sampling

Ground Elev.: 93.65

DRILLING METHOD: Direct Push		SAMPLE	CORE	CASING	Datum: --
DRILL RIG TYPE: None: Hand	TYPE	–	Sch 40 PVC	–	Date Started:
WATER DEPTH: 3.85	DIAM.	–	2 inch	–	Date Finished:
MEAS. PT.: Ice Surface	WEIGHT	–			Driller: McGrath/Williams
DATE OF MEAS.: --	FALL	–			Inspector: B. Edwards

Depth (Inch)	Sample Number	Blow Count	Graphic Log	Unified Classif-ication	GEOLOGIC DESCRIPTION	REMARKS
1				OL/OH	0-0.96: ORGANIC SILT WITH SAND Very loose, wet, brown, highly organic SILT, trace medium to fine Sand; abundant organic material, slight odor (decay).	Drive = 7.7 Rec = 3.2 Yield = 42%
2						
3						
4						
5						
6						
7						
8						
9						
10	S-1					
11					11.5" (SLUDGE) 0.96'	
12						
13				OL	0.96-2.04: Loose, wet, gray and dark gray to black, organic SILT, abundant wood fiber and bark chips.	
14						
15						
16						
17						
18						
19						
20					(SLUDGE)	

RUST E&I
Albany, NY (518) 458-1313

Test Boring Log

Boring No. L2600

PROJECT: Cumberland Bay

Sheet 2 of 2

CLIENT: New York State Department of Environmental Conservation - SSP

Job No. 39304.10006

Depth (Inch)	Sample Number	Blow Counts	Graphic Log	Unified Classif-ication	Geologic Description	Remarks
21						
22						
23						
24					24.5" (SLUDGE) 2.04'	
25					24.5-27: GAP	
26						
27					27" 2.25'	
28	S-1 (cont.)			SP	27-31: <u>POORLY GRADED SAND</u> Loose to medium dense, wet, dark gray medium to mostly fine SAND.	
29						
30						
31					31" (BANDED SAND) 2.58'	
32				OL/OH	31-36: <u>ORGANIC SILT WITH SAND</u> Soft, wet, gray, highly organic SILT, and fine gray Sand. Layer (~1/2") of white pulpat 32" strong odor of (PCB?).	
33						
34						
35						
36					36" (SAND) 3.0'	
					End of Core Loss = 4.7' = 56.4"	
92					92.4" 7.7'	
93					END OF DRIVE @ 7.7'	

RUST E&I Albany, NY (518) 458-1313	**Test Boring Log**			**Boring No. M2400**
PROJECT: Cumberland Bay				Sheet 1 of 1
CLIENT: New York State Department of Environmental Conservation - SSP				Job No. 39304.10006
DRILLING CONTRACTOR: Rust/NYSDEC				Meas. Pt. Elev.: 99.5
PURPOSE: Lacustrine Sediment Core Sampling				Ground Elev.: 90.80
DRILLING METHOD: Direct Push	SAMPLE	CORE	CASING	Datum: USGS (amsl)
DRILL RIG TYPE: None: Hand — TYPE	–	Sch 40 PVC	–	Date Started:
WATER DEPTH: — DIAM.	–	2 inch	–	Date Finished:
MEAS. PT.: Ice Surface — WEIGHT	–			Driller: McGrath/Williams
DATE OF MEAS.: -- — FALL	–			Inspector: B. Edwards

Depth (Feet)	Sample Number	Blow Count	Graphic Log	Unified Classif-ication	GEOLOGIC DESCRIPTION	REMARKS
1 2 3 4	S-1 S-2		M2400 (0-4)	OL	0-4': ORGANIC SILT Very soft, wet (oversaturated), dark gray organic SILT; occasional wood chips, abundant wood fiber, totally cohesionless (muck), very strong odor of organic decay. 48" (SLUDGE) 4.0'	Drive = 11.50 Rec = 10.92 Yield = 95%
5	S-3		M2400 5.5-7.0)	NA	4-5.5': PULP Soft, wet, whitish pulp (beehive), strong PCB like odor. 66" (SLUDGE) 5.5'	
6 7 8 9 10	S-4		M2400 (7.0-10.9)	OL/OH	5.5-10.2': ORGANIC SILT WITH SAND Soft, wet, dark-gray organic SILT, trace fine Sand, abundant woody fibers. (SLUDGE) 122" 10.20'	
11				SP	10.2-10.9': POORLY GRADED SAND Medium dense, wet, gravely medium find SAND. 131" (BANDED SAND) 10.94'	
					End Core @ 10.92' 11.50'	
12 13 14 15 16 17 18 19 20					End Drive @ 11.50'	

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Test Boring Log

Boring No. N2400

PROJECT: Cumberland Bay

Sheet 1 of 1

CLIENT: New York State Department of Environmental Conservation - SSP

Job No. 39304.10006

DRILLING CONTRACTOR: Rust/NYSDEC

Meas. Pt. Elev.: 97.5

PURPOSE: Lacustrine Sediment Core Sampling

Ground Elev.: 88.30

DRILLING METHOD: Direct Push

Datum: USGS (amsl)

DRILL RIG TYPE: None: Hand

Date Started:

WATER DEPTH: 9.20

Date Finished:

MEAS. PT.: Ice Surface

Driller: McGrath/Williams

DATE OF MEAS.: --

Inspector: B. Edwards

	SAMPLE	CORE	CASING
TYPE	–	Sch 40 PVC	–
DIAM.	–	2 inch	–
WEIGHT	–		
FALL	–		

Depth (Feet)	Sample Number	Blow Count	Graphic Log	Unified Classif-ication	GEOLOGIC DESCRIPTION	REMARKS
1 2 3	S-1			NA	0-3.33': Water, with suspended sludge/mud. Totally cohesiveless and liquefied. 39.96" (SLUDGE) 3.33'	Drive = 9.05' Rec = 7.17' + water Yield = 79%
4 5			N2400 (3.3 - 5)	OL/OH	3.33-5': ORGANIC SILT WITH SAND Very soft, wet, dark gray organic SILT, some wood fiber. Strong odor (decay) (faint odor of PCB). 60" (SLUDGE) 5.0'	
6 7			N2400 (5 - 7.5)	NA Pulp	5-7': PULP Soft, wet, whitish paper pulp (beehive). 84" (SLUDGE) 7.0'	
				OL/OH	7-7.5': GAP 90" 7.5'	
8			N2400 (7.5 - 9)		7.5-9.02': ORGANIC SILT Soft, wet, gray, organic SILT, trace fine Sand, abundant wood. 102" (SLUDGE) 8.5'	
9				NA	Soft, wet, white pulp. 108.6" (SLUDGE) 9.05'	
10					End of Drive @ 9.05'	

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Test Boring Log

Boring No. O2200

PROJECT: Cumberland Bay

Sheet 1 of 1

CLIENT: New York State Department of Environmental Conservation - SSP

Job No. 39304.10006

DRILLING CONTRACTOR: Rust/NYSDEC

Meas. Pt. Elev.: 97.50

PURPOSE: Lacustrine Sediment Core Sampling

Ground Elev.: 86.90

DRILLING METHOD: Direct Push

Datum: USGS (amsl)

DRILL RIG TYPE: None: Hand

WATER DEPTH: 10.60

MEAS. PT.: Ice Surface

DATE OF MEAS.: --

	SAMPLE	CORE	CASING
TYPE	–	Sch 40 PVC	–
DIAM.	–	2 inch	–
WEIGHT	–		
FALL	–		

Date Started:

Date Finished:

Driller: McGrath/Williams

Inspector: B. Edwards

Depth (Feet)	Sample Number	Blow Count	Graphic Log	Unified Classif-ication	GEOLOGIC DESCRIPTION	REMARKS
	↑				0-2.44': Very soft, wet, dark brown, highly organic SILT, trace(+) fine Sand; occasional thin laminae of fine SAND, abundant wood and plant fiber, strong odor of decay.	Drive = 4.60' Rec = 4.60' Yield = 100%
0.5						
1.0						
1.5						
2.0	S-1				(SLUDGE) 2.44'	
2.5					2.44-3.08': Soft, whitish, platy paper (pulp) odor (PCB).	
3.0					(SLUDGE) 3.08' 3.08-4.60': Very soft, wet, dark brown, highly organic SILT, trace(+) fine SAND, frequent wood fiber and bark chips, slight odor (PCB/OIL).	
3.5						
4.0	↓					
4.5					(SLUDGE) 4.6' End Core @ 4.60' Drive depth 4.60'	Lake bottom 4.6 dbg 82.3 l
5.0						

RUST E&I Albany, NY (518) 458-1313	**Test Boring Log**	**Boring No. P1900**
PROJECT: Cumberland Bay		Sheet 1 of 2
CLIENT: New York State Department of Environmental Conservation - SSP		Job No. 39304.10006
DRILLING CONTRACTOR: Rust/NYSDEC		Meas. Pt. Elev.: 97.50
PURPOSE: Lacustrine Sediment Core Sampling		Ground Elev.: 88.50

DRILLING METHOD: Direct Push		SAMPLE	CORE	CASING	Datum: USGS (amsl)
DRILL RIG TYPE: None: Hand	TYPE	–	Sch 40 PVC	–	Date Started:
WATER DEPTH: 11.80	DIAM.	–	2 inch	–	Date Finished:
MEAS. PT.: Ice Surface	WEIGHT	–			Driller: McGrath/Williams
DATE OF MEAS.: --	FALL	–			Inspector: B. Edwards

Depth (Inch)	Sample Number	Blow Count	Graphic Log	Unified Classif-ication	GEOLOGIC DESCRIPTION	REMARKS
1	↑			SW-SM	0-0.17': POORLY GRADED SAND WITH SILT Loose, wet, gray, fine SAND, some Silt.	Drive = 2.95 Rec = 2.50 Yield = 85%
2					2" (MUCK) 0.17'	
3					0.17-0.58': ORGANIC SILT WITH SAND	
4				OL/OH	Very loose, wet, dark gray organic SILT, some fine Sand, abundant wood fiber, occasional bark chips.	
5						
6						
7					7" (SLUDGE) 0.58'	
8					0.58-2.50':	
9				SW-SM	POORLY GRADED SAND WITH SILT Loose, wet, gray, mostly fine SAND with organic Silt, abundant bark chips, occasional laminae of fine SAND.	
10						
11						
12						
13						
14						
15	S1					
16						
17						
18						
19						
20	↓				(SLUDGE)	

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Test Boring Log

Boring No. P1900

PROJECT: Cumberland Bay

Sheet 2 of 2

CLIENT: New York State Department of Environmental Conservation - SSP

Job No. 39304.10006

Depth (Inch)	Sample Number	Blow Counts	Graphic Log	Unified Classif-ication	Geologic Description	Remarks
21						
22						
23						
24						
25						
26						
27						
28						
29						
30					30" (SLUDGE BED) 2.50'	
31					End Core @ 2.50'	
32					Loss = 0.45'	
33						
34						
35					35.4" 2.95'	
36					End Drive @ 2.95'	

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Test Boring Log

Boring No. P2300

PROJECT: Cumberland Bay					Sheet 1 of 1
CLIENT: New York State Department of Environmental Conservation - SSP					Job No. 39304.10006
DRILLING CONTRACTOR: Rust/NYSDEC					Meas. Pt. Elev.: 97.5
PURPOSE: Lacustrine Sediment Core Sampling					Ground Elev.: 83.0
DRILLING METHOD: Direct Push		SAMPLE	CORE	CASING	Datum: USGS (amsl)
DRILL RIG TYPE: None: Hand	TYPE	–	Sch 40 PVC	–	Date Started:
WATER DEPTH:	DIAM.	–	2 inch	–	Date Finished:
MEAS. PT.: Ice Surface	WEIGHT	–			Driller: McGrath/Williams
DATE OF MEAS.: --	FALL	–			Inspector: B. Edwards

Depth (Feet)	Sample Number	Blow Count	Graphic Log	Unified Classif-ication	GEOLOGIC DESCRIPTION	REMARKS
	S1			OL/OH	0-4.42': ORGANIC SILT WITH SAND Very soft, wet (over saturated), organic blue-gray SILT, little fine Sand; abundant wood chip, bark, plant fiber. Strong decay odor, occasional laminae of black sands.	Drive = 4.85' Rec = 4.70' Yield = 97%
1						
2						
3						
4				SP	53" (SLUDGE) 4.42' 56.4" Medium dense, wet, gray, fine SAND. 4.70' 58.2" End Core @ 4.70' 4.85'	
5					End Drive @ 4.85'	
6						
7						
8						
9						
10						

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Test Boring Log

Boring No. Q2400

PROJECT: Cumberland Bay					Sheet 1 of 1
CLIENT: New York State Department of Environmental Conservation - SSP					Job No. 39304.10006
DRILLING CONTRACTOR: Rust/NYSDEC					Meas. Pt. Elev.: 97.50
PURPOSE: Lacustrine Sediment Core Sampling					Ground Elev.: 78.80
DRILLING METHOD: Direct Push		SAMPLE	CORE	CASING	Datum: USGS (amsl)
DRILL RIG TYPE: None: Hand	TYPE	–	Sch 40 PVC	–	Date Started:
WATER DEPTH: 18.70	DIAM.	–	2 inch	–	Date Finished:
MEAS. PT.: Ice Surface	WEIGHT	–			Driller: McGrath/Williams
DATE OF MEAS.: --	FALL	–			Inspector: B. Edwards

Depth (Feet)	Sample Number	Blow Count	Graphic Log	Unified Classif-ication	GEOLOGIC DESCRIPTION	REMARKS
0.5	S-1			OL	0-4.33' (52"): <u>ORGANIC SOIL (SLUDGE) WITH SAND</u> Very soft, wet, dark brown, organic SILT, trace(+) fine Sand; abundant wood fiber, occasional bark chips, non-plastic, strong odor of organic decay.	Drive = 4.64' Rec = 4.64' Yield = 100%
1.0						
1.5						
2.0						
2.5						
3.0						
3.5						
4.0					(SLUDGE) 4.33'	
4.5				MH	<u>ELASTIC SILT WITH SAND</u> Soft, wet, dark gray, Clayey-Silt; low plasticity, slight odor. 4.64'	
5.0					Drive Depth 4.64' End Core @ 4.64'	Natural lake bottom 4.64' dbg 74.16 amsl

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Test Boring Log

Boring No. R2100

PROJECT: Cumberland Bay
Sheet 1 of 1
CLIENT: New York State Department of Environmental Conservation - SSP
Job No. 39304.10006
DRILLING CONTRACTOR: Rust/NYSDEC
Meas. Pt. Elev.: --
PURPOSE: Lacustrine Sediment Core Sampling
Ground Elev.: --
DRILLING METHOD: Direct Push
Datum: --
DRILL RIG TYPE: None: Hand
Date Started:
WATER DEPTH:
Date Finished:
MEAS. PT.: Ice Surface
Driller: McGrath/Williams
DATE OF MEAS.: --
Inspector: B. Edwards

	SAMPLE	CORE	CASING
TYPE	–	Sch 40 PVC	–
DIAM.	–	2 inch	–
WEIGHT	–		
FALL	–		

Depth (Feet)	Sample Number	Blow Count	Graphic Log	Unified Classif-ication	GEOLOGIC DESCRIPTION	REMARKS
0.5				OL	0-1.83': ORGANIC SILT Very soft, wet, dark brown, highly organic SILT, abundant wood fiber, bark chips, and plant fiber, strong decay odor.	Drive = 4.40' Rec = 3.08' Yield = 70%
1.0						
1.5					22" (SLUDGE) 1.83'	
2.0				OL/OH	1.83-3.0': ORGANIC SILT WITH SAND Soft, wet, gray organic SILT with fine Sand, abundant wood fiber.	
2.5						
3.0					36" (SLUDGE) 3.0' 37" 3.08' POORLY GRADED SAND Medium dense, wet, gray, fine SAND, frequent wood chips. (BANDED SAND)	
3.5				SP		
4.0					End Core @ 3.08'	
4.5					52.8" 4.40'	
5.0					End of Drive @ 4.4'	

APPENDIX D

April 1998 Sludge Bed Cores

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Test Boring Log

Boring No. BB3100

PROJECT: Cumberland Bay - Predesign Investigation	Sheet 1 of 1
CLIENT: New York State Department of Environmental Conservation	Job No. 202352
DRILLING CONTRACTOR: Rust Environment & Infrastructure	Meas. Pt. Elev.:
PURPOSE: Sludge Bed Predesign Investigation	Surface Elev.: 85.64'
DRILLING METHOD: Piston Auger	Lake Elev.: 100.84'
DRILL RIG TYPE:	Date Started: 4/15/98
WATER DEPTH: 15.2'	Date Finished:
MEAS. PT.:	Driller: D. Foti/R. Totino
DATE OF MEAS.:	Inspector: B. Edwards

	SAMPLE	CORE	CASING
TYPE			
DIAM.			
WEIGHT			
FALL			

Depth (Feet)	Sample Number	Blow Count	Casing Blow	Recovery	GEOLOGIC DESCRIPTION	REMARKS
					Ltbr cmf(-) SAND, t $, l(-) f G; wet.	
0.25					0.25'	
					Ltbr mf(+) SAND, t $; wet.	
0.5					0.58'-0.62': mf wood chip seam, c S.	
0.75						
1.0					1.0'	
					C(+)mf SAND, t(-) $, mf(+) G; wet.	
1.25						
					1.42'	
1.5					Ltbr mf(+) SAND, t $; wet. 1.5'	
					Bottom of core @ 1.5'.	
1.75					Depth to sludge = 15.2 ft. Core Driven = 1.4 ft. Core Recovery = 1.5 ft. No samples.	
2.0						
2.25						
2.5						

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Test Boring Log

Boring No. L50E 2350

PROJECT: Cumberland Bay - Predesign Investigation
Sheet 1 of 2
CLIENT: New York State Department of Environmental Conservation
Job No. 202352
DRILLING CONTRACTOR: Rust Environment & Infrastructure
Meas. Pt. Elev.:
PURPOSE: Sludge Bed Predesign Investigation
Surface Elev.: 91.74'
Lake Elev.: 100.84'
Date Started: 4/15/98
Date Finished:
Driller: D. Foti/R. Totino
Inspector: B. Edwards

DRILLING METHOD: Piston Auger		SAMPLE	CORE	CASING
DRILL RIG TYPE:	TYPE			
WATER DEPTH: 9.1'	DIAM.			
MEAS. PT.:	WEIGHT			
DATE OF MEAS.:	FALL			

Depth (Feet)	Sample Number	Blow Count	Casing Blow	Recovery	GEOLOGIC DESCRIPTION	REMARKS
					Dkbr-bl $y Organics, saturated.	
0.5						
					0.83'	
1.0					Grades to dkbr fiberous SLUDGE, l mf(+) wood chips, t f Sand, saturated.	
1.5						
2.0	S-1					
2.5					Chunks of pulp (wh) @ 2.33' and 3.17'.	
3.0						
3.5						
4.0						
4.5					Grades to ltgr pulp, l(-) fibers/ wood chips. 4.5'	
					Grades to fiberous SLUDGE and PULP, l(+) mf wood chips. 4.83'	
5.0					5.0'	

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Test Boring Log

Boring No. L50E 2350

PROJECT: Cumberland Bay - Predesign Investigation

Sheet 2 of 2

CLIENT: New York State Department of Environmental Conservation

Job No. 202352

Depth (Feet)	Sample Number	Blow Counts	Casing Blow	Recovery	Geologic Description	Remarks
					Fiberous SLUDGE and PULP, l(+) mf wood chips. 5.08' Ltbr/or PULP, l(-) f wood chips, saturated. 5.25'	
5.5	S-2 (cont.)				Ltgr PULP, t(+) f wood chips/ fibers, saturated.	
6.0					6.17'	
6.5					Grades to dkbr fiberous SLUDGE, l(-) f wood chips, saturated.	
7.0						
7.5						
8.0	S-3					
8.5						
9.0						
9.5						
10.0					10.1'	
10.5					Bottom of core @ 10.1'. Depth to sludge = 9.1 ft. Core Driven = 11.6 ft. Core Recovery = 9.9 ft. Three sample collected for PCB analysis: S-1 = 0-4.5' S-2 = 4.5'-6.17' S-3 = 6.5'-10.08'	
11.0						
11.5						
12.0						

RUST E&I Albany, NY (518) 458-1313	# Test Boring Log	**Boring No. N+50E 2250**

PROJECT: Cumberland Bay - Predesign Investigation	Sheet 1 of 1
CLIENT: New York State Department of Environmental Conservation	Job No. 202352
DRILLING CONTRACTOR: Rust Environment & Infrastructure	Meas. Pt. Elev.:
PURPOSE: Sludge Bed Predesign Investigation	Surface Elev.: 90.74'

		SAMPLE	CORE	CASING	
DRILLING METHOD: Piston Auger					Lake Elev.: 100.84'
DRILL RIG TYPE:	TYPE				Date Started: 4/15/98
WATER DEPTH: 10.1'	DIAM.				Date Finished:
MEAS. PT.:	WEIGHT				Driller: D. Foti/R. Totino
DATE OF MEAS.:	FALL				Inspector: B. Edwards

Depth (Feet)	Sample Number	Blow Count	Casing Blow	Recovery	GEOLOGIC DESCRIPTION	REMARKS
0.5	S-1				Ltbr fiberous pulp/sludge, l(+) mf wood chips. 0.42' Grades to ltbr pulp, l(+) mf wood chips.	
1.0					1.0' Dkbr fiberous sludge, l(-) pulp. 1.33'	
1.5					Grades to dkbr SILT, l(+) mf(+) S, t(+) f wood chips. 1.83'	
2.0	S-2				Grades to br fiberous sludge, l(-) f wood chips.	
2.5					2.67'	
3.0					Bottom of core @ 2.67'. Depth to sludge = 10.1 ft. Core Driver = 3.2 ft. Core Recovery = 2.8 ft. No samples collected.	
3.5						
4.0						
4.5						
5.0						

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Test Boring Log

Boring No. P1700

PROJECT: Cumberland Bay - Predesign Investigation

Sheet 1 of 1

CLIENT: New York State Department of Environmental Conservation

Job No. 202352

DRILLING CONTRACTOR: Rust Environment & Infrastructure

Meas. Pt. Elev.:

PURPOSE: Sludge Bed Predesign Investigation

Surface Elev.: 88.24'

DRILLING METHOD: Piston Auger

Lake Elev.: 100.84'

DRILL RIG TYPE:

Date Started: 4/15/98

WATER DEPTH: 12.6'

Date Finished:

MEAS. PT.:

Driller: D. Foti/R. Totino

DATE OF MEAS.:

Inspector: B. Edwards

	SAMPLE	CORE	CASING
TYPE			
DIAM.			
WEIGHT			
FALL			

Depth (Feet)	Sample Number	Blow Count	Casing Blow	Recovery	GEOLOGIC DESCRIPTION	REMARKS
					Gr c(-)mf SAND, t(+) $, wet. 0.17'	
0.5					Ltgr cmf SAND, t $, wet.	
1.0					0.96'	
					Bottom of core @ 0.96'.	
1.5					Depth to sludge = 12.6 ft. Core Driven = 1.2 ft. Core Recovery = 1.0 ft. No samples collected.	
2.0						
2.5						
3.0						
3.5						
4.0						
4.5						
5.0						

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Test Boring Log

Boring No. P2100

PROJECT: Cumberland Bay - Predesign Investigation
Sheet 1 of 2

CLIENT: New York State Department of Environmental Conservation
Job No. 202352

DRILLING CONTRACTOR: Rust Environment & Infrastructure
Meas. Pt. Elev.:

PURPOSE: Sludge Bed Predesign Investigation
Surface Elev.: 87.14'

DRILLING METHOD: Piston Auger
Lake Elev.: 100.84'

DRILL RIG TYPE:
Date Started: 4/15/98

WATER DEPTH: 13.7'
Date Finished:

MEAS. PT.:
Driller: D. Foti/R. Totino

DATE OF MEAS.:
Inspector: B. Edwards

	SAMPLE	CORE	CASING
TYPE			
DIAM.			
WEIGHT			
FALL			

Depth (Feet)	Sample Number	Blow Count	Casing Blow	Recovery	GEOLOGIC DESCRIPTION	REMARKS
					Dkbr f SAND s(-) $, l(-) organic fibers, saturated. 0.16' Grades to br/tan fiberous SLUDGE, l(+) mf wood chips, saturated.	
0.5					0.75' Dkbr f wood chips. 0.83'	
1.0	S-1				Br/tn fiberous SLUDGE, l(+) mf wood chips and organic matter (leaves, saturated.	
1.5						
2.0					2.17'	
2.5					Grgm fiberous paper pulp, saturated.	
3.0	S-2				3.33'	
3.5					Gr fiberous paper pulp, saturated.	
4.0						
4.5					4.5'	
5.0	S-3				Grades to br/gr fiberous SLUDGE, l(+) $, saturated.	

RUST E&I Albany, NY (518) 458-1313	**Test Boring Log**	**Boring No.** **P2100**
PROJECT: Cumberland Bay - Predesign Investigation		Sheet 2 of 2
CLIENT: New York State Department of Environmental Conservation		Job No. 202352

Depth (Feet)	Sample Number	Blow Counts	Casing Blow	Recovery	Geologic Description	Remarks
	S-3 (cont.)				5.17'	
5.5					Bottom of core @ 5.17'. Depth to sludge = 13.7 ft. Core Driven = 7.1 ft. Core Recovery = 5.1 ft. Three sample collected for PCB analysis: S-1 = 0-2.17' S-2 = 2.17'-4.5' S-3 = 4.5'-5.17'	
6.0						
6.5						
7.0						
7.5						
8.0						
8.5						
9.0						
9.5						
10.0						
10.5						
11.0						
11.5						
12.0						

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Test Boring Log

Boring No.
P2600

PROJECT: Cumberland Bay - Predesign Investigation

Sheet 1 of 1

CLIENT: New York State Department of Environmental Conservation

Job No. 202352

DRILLING CONTRACTOR: Rust Environment & Infrastructure

Meas. Pt. Elev.:

PURPOSE: Sludge Bed Predesign Investigation

Surface Elev.: 80.28'

DRILLING METHOD: Piston Auger

Lake Elev.: 100.98'

DRILL RIG TYPE:

Date Started: 4/14/98

WATER DEPTH: 20.7'

Date Finished:

MEAS. PT.:

Driller: D. Foti/R. Totino

DATE OF MEAS.:

Inspector: B. Edwards

	SAMPLE	CORE	CASING
TYPE			
DIAM.			
WEIGHT			
FALL			

Depth (Feet)	Sample Number	Blow Count	Casing Blow	Recovery	GEOLOGIC DESCRIPTION	REMARKS
0.25	S-1				Bl super saturated SILT, organics, t(+) root matter/leaves a m angular G.	Note: Sample contains super saturated organics; sample liquefied during removal.
0.5						
0.75						
1.0					1.0'	
1.25					Bottom of core @ 1.0'. Depth to sludge = 20.7 ft. Core Driven = 1.1 ft. Core Recovery = 0.5 ft. One samples collected for PCB analysis: S1 = 0 - 0.0.58'	
1.5						
1.75						
2.0						
2.25						
2.5						

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Test Boring Log

Boring No. Q2000A

PROJECT: Cumberland Bay - Predesign Investigation				Sheet 1 of 1
CLIENT: New York State Department of Environmental Conservation				Job No. 202352
DRILLING CONTRACTOR: Rust Environment & Infrastructure				Meas. Pt. Elev.:
PURPOSE: Sludge Bed Predesign Investigation				Surface Elev.: 86.34'
DRILLING METHOD: Piston Auger	SAMPLE	CORE	CASING	Lake Elev.: 100.84'
DRILL RIG TYPE: TYPE				Date Started: 4/15/98
WATER DEPTH: 14.5' DIAM.				Date Finished:
MEAS. PT.: WEIGHT				Driller: D. Foti/R. Totino
DATE OF MEAS.: FALL				Inspector: B. Edwards

Depth (Feet)	Sample Number	Blow Count	Casing Blow	Recovery	GEOLOGIC DESCRIPTION	REMARKS
					Dkbr organic SILT, t(+) f wood chips, root matter, saturated. 0.25'	
0.5					grades to Dkbr fiberous SLUDGE, s(-) mf wood chips, saturated.	
1.0					1.2' mf wood chips, t mf S. 1.3'	
1.5	S-1				Seam of organic matter (twigs, leaves) @ 1.7', 1.8', 2.5', 3.0'.	
2.0						
2.5						
3.0					3.2'	
3.5	S-2				Ltgr PULP, l(-) f wood chips, saturated. 3.6'	
4.0	S-3				grades to Dkbr fiberous SLUDGE, t f wood chips, pulp, v wet. 4.3'	
4.5					Bottom of core @ 4.3'.	
5.0						

Depth to sludge = 14.5 ft.
Core Driven = 5.5 ft.
Core Recovery = 4.3 ft.

Three samples collected for PCB analysis:
S1 = 0 - 3.2'
S2 = 3.2' - 3.6'
S3 = 3.6' - 4.3'

RUST E&I Albany, NY (518) 458-1313	**Test Boring Log**	**Boring No. Q2000B**
PROJECT: Cumberland Bay - Predesign Investigation		Sheet 1 of 1
CLIENT: New York State Department of Environmental Conservation		Job No. 202352
DRILLING CONTRACTOR: Rust Environment & Infrastructure		Meas. Pt. Elev.:
PURPOSE: Sludge Bed Predesign Investigation		Surface Elev.: 86.24'

		SAMPLE	CORE	CASING	
DRILLING METHOD: Piston Auger					Lake Elev.: 100.84'
DRILL RIG TYPE:	TYPE				Date Started: 4/15/98
WATER DEPTH: 14.6'	DIAM.				Date Finished:
MEAS. PT.:	WEIGHT				Driller: D. Foti/R. Totino
DATE OF MEAS.:	FALL				Inspector: B. Edwards

Depth (Feet)	Sample Number	Blow Count	Casing Blow	Recovery	GEOLOGIC DESCRIPTION	REMARKS
					Br silty organics l(+) root matter, saturated. 0.25'	
0.5						
1.0					At 10" significant wood chips, v wet.	
1.5					grades to Ltbr fiberous SLUDGE, l(+) pulp, c(-)mf wood chips, v wet.	
2.0						
2.5					2.58'	
					Dkgr Pulp, l(-) f S, v wet. 3.0'	
3.0					Ltgr Pulp, v wet. 3.16'	
3.5					grades to Dkgr Pulp, t(+) fiberous/ v f wood chips. 3.92'	
4.0					Dkgr mf SAND, l(-) fiberous Sludge, f wood chips, wet. 4.08'	
					Bottom of core @ 4.08'.	
4.5					Depth to sludge = 14.6 ft. Core Driven = 5.4 ft. Core Recovery = 4.1 ft. No samples collected	
5.0						

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Test Boring Log

Boring No. Q2300

PROJECT: Cumberland Bay - Predesign Investigation
Sheet 1 of 1
CLIENT: New York State Department of Environmental Conservation
Job No. 202352
DRILLING CONTRACTOR: Rust Environment & Infrastructure
Meas. Pt. Elev.:
PURPOSE: Sludge Bed Predesign Investigation
Surface Elev.: 83.83'
DRILLING METHOD: Piston Auger
Lake Elev.: 100.98'
DRILL RIG TYPE:
Date Started: 4/14/98
WATER DEPTH: 17.1'
Date Finished:
MEAS. PT.:
Driller: D. Foti/R. Totino
DATE OF MEAS.:
Inspector: B. Edwards

	SAMPLE	CORE	CASING
TYPE			
DIAM.			
WEIGHT			
FALL			

Depth (Feet)	Sample Number	Blow Count	Casing Blow	Recovery	GEOLOGIC DESCRIPTION	REMARKS
					Br fiberous SLUDGE, l f wood chips, l(-) root matter, saturated.	
0.5						
1.0					More fiberous @ .83'. 1.1' Tngr fiberous SLUDGE, s(-) pulp, saturated. 1.3'	
1.5					grades to Ltbr fiberous SLUDGE, l pulp, v wet.	
2.0	S-1					
2.5					2.8'	
3.0					grades to Ltbr-tn fiberous SLUDGE, s(+) pulp, v wet.	
3.5					3.5' grades to Ltbr fiberous SLUDGE, l pump, v wet.	
4.0					4.1' Bottom of core @ 4.1'.	
4.5					Depth to sludge = 17.1 ft. Core Driven = 4.5 ft. Core Recovery = 4.1 ft. Composite sample collected from 0-4.1' for PCB lab analysis.	
5.0						

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Test Boring Log

Boring No.
Q2800

PROJECT: Cumberland Bay - Predesign Investigation	Sheet 1 of 1
CLIENT: New York State Department of Environmental Conservation	Job No. 202352
DRILLING CONTRACTOR: Rust Environment & Infrastructure	Meas. Pt. Elev.:
PURPOSE: Sludge Bed Predesign Investigation	Surface Elev.: 92.78'

		SAMPLE	CORE	CASING	
DRILLING METHOD: Piston Auger					Lake Elev.: 100.98'
DRILL RIG TYPE:	TYPE				Date Started: 4/14/98
WATER DEPTH: 8.2'	DIAM.				Date Finished:
MEAS. PT.:	WEIGHT				Driller: D. Foti/R. Totino
DATE OF MEAS.:	FALL				Inspector: B. Edwards

Depth (Feet)	Sample Number	Blow Count	Casing Blow	Recovery	GEOLOGIC DESCRIPTION	REMARKS
0.25	S-1				Br fiberous SLUDGE, s wood (fine) chips, l(+) root/organics, v. moist. 0.33'	
0.5	S-2				Grbr mf SAND, s(+) fiberous sludge, wood chips a root matter. 0.5'	
0.75					Grbr mf SAND, t(+) wood chips c; wet. 0.92'	
1.0						
1.25					Bottom of core @ 0.92'. Depth to sludge = 8.2 ft. Core Driven = 1.2 ft. Core Recovery = 1.0 ft. Two samples collected for PCB analysis: S1 = 0 - 0.33' S2 = 0.33' - 0.92'	
1.5						
1.75						
2.0						
2.25						
2.5						

RUST E&I Albany, NY (518) 458-1313	**Test Boring Log**				**Boring No. R2500**
PROJECT: Cumberland Bay - Predesign Investigation					Sheet 1 of 1
CLIENT: New York State Department of Environmental Conservation					Job No. 202352
DRILLING CONTRACTOR: Rust Environment & Infrastructure					Meas. Pt. Elev.:
PURPOSE: Sludge Bed Predesign Investigation					Surface Elev.: 83.98'
DRILLING METHOD: Piston Auger		SAMPLE	CORE	CASING	Lake Elev.: 100.98'
DRILL RIG TYPE:	TYPE				Date Started: 4/14/98
WATER DEPTH: 17.0'	DIAM.				Date Finished:
MEAS. PT.:	WEIGHT				Driller: D. Foti/R. Totino
DATE OF MEAS.:	FALL				Inspector: B. Edwards

Depth (Feet)	Sample Number	Blow Count	Casing Blow	Recovery	GEOLOGIC DESCRIPTION	REMARKS
					Br organic SILT, t root matter, saturated. 0.3'	
0.5					Br fiberous SLUDGE, l mf wood chips, t $, v wet.	
1.0						
1.5						
2.0	S-1					
2.5					2.5' Some med wood chips. 2.8'	
3.0					Br fiberous SLUDGE, l mf wood chips, t $, v wet.	
3.5						
4.0					4.2' Tngr paper PULP, v wet. 4.3'	
4.5	S-2				grades to Brgr fiberous SLUDGE, s paper pulp, wet. 4.7'	
5.0					Bottom of core @ 4.7'.	

Depth to sludge = 17.0 ft.
Core Driven = 5.3 ft.
Core Recovery = 5.1 ft.

Two samples collected for PCB analysis:
S1 = 3" - 50"
S2 = 50" = 56"

RUST E&I Albany, NY (518) 458-1313	**Test Boring Log**	**Boring No. R2600**

PROJECT: Cumberland Bay - Predesign Investigation					Sheet 1 of 1
CLIENT: New York State Department of Environmental Conservation					Job No. 202352
DRILLING CONTRACTOR: Rust Environment & Infrastructure					Meas. Pt. Elev.:
PURPOSE: Sludge Bed Predesign Investigation					Surface Elev.: 78.61'
DRILLING METHOD: Piston Auger		SAMPLE	CORE	CASING	Lake Elev.: 100.71'
DRILL RIG TYPE:	TYPE				Date Started: 4/16/98
WATER DEPTH: 22.1'	DIAM.				Date Finished:
MEAS. PT.:	WEIGHT				Driller: D. Foti/R. Totino
DATE OF MEAS.:	FALL				Inspector: B. Edwards

Depth (Feet)	Sample Number	Blow Count	Casing Blow	Recovery	GEOLOGIC DESCRIPTION	REMARKS
					Dkbr silty organics, t(+) f S.	
0.25						
					0.38'	
0.5					Bottom of core @ 0.38'. Depth to sludge = 22.1 ft. Core Driven = 0.6 ft. Core Recovery = 0.38 ft. No samples collected.	
0.75						
1.0						
1.25						
1.5						
1.75						
2.0						
2.25						
2.5						

RUST E&I Albany, NY (518) 458-1313	# Test Boring Log	**Boring No.** **S2000**

PROJECT: Cumberland Bay - Predesign Investigation | Sheet 1 of 1

CLIENT: New York State Department of Environmental Conservation | Job No. 202352

DRILLING CONTRACTOR: Rust Environment & Infrastructure | Meas. Pt. Elev.:

PURPOSE: Sludge Bed Predesign Investigation | Surface Elev.: 87.84'

		SAMPLE	CORE	CASING	
DRILLING METHOD: Piston Auger					Lake Elev.: 100.84'
DRILL RIG TYPE:	TYPE				Date Started: 4/15/98
WATER DEPTH: 13.0'	DIAM.				Date Finished:
MEAS. PT.:	WEIGHT				Driller: D. Foti/R. Totino
DATE OF MEAS.:	FALL				Inspector: B. Edwards

Depth (Feet)	Sample Number	Blow Count	Casing Blow	Recovery	GEOLOGIC DESCRIPTION	REMARKS
					Br fiberous SLUDGE, l(+) f wood chips, v. wet. 0.08'	
0.25					Ltbr mf(+) SAND, t(-) $, wet.	
0.5					0.5'	
					Bottom of core @ 0.5'.	
0.75					Depth to sludge = 13.0 ft. Core Driven = na Core Recovery = 0.5 ft. No samples.	
1.0						
1.25						
1.5						
1.75						
2.0						
2.25						
2.5						

RUST E&I Albany, NY (518) 458-1313	# Test Boring Log	**Boring No. S2300**

PROJECT: Cumberland Bay - Predesign Investigation	Sheet 1 of 1
CLIENT: New York State Department of Environmental Conservation	Job No. 202352
DRILLING CONTRACTOR: Rust Environment & Infrastructure	Meas. Pt. Elev.:
PURPOSE: Sludge Bed Predesign Investigation	Surface Elev.: 83.04'

DRILLING METHOD: Piston Auger		SAMPLE	CORE	CASING	Lake Elev.: 100.84'
DRILL RIG TYPE:	TYPE				Date Started: 4/15/98
WATER DEPTH: 17.8'	DIAM.				Date Finished:
MEAS. PT.:	WEIGHT				Driller: D. Foti/R. Totino
DATE OF MEAS.:	FALL				Inspector: B. Edwards

Depth (Feet)	Sample Number	Blow Count	Casing Blow	Recovery	GEOLOGIC DESCRIPTION	REMARKS
					Brbl silty organic, l(-) fiberous f wood chips, saturated.	
0.5					At 0.5' f wood chips.	
1.0					1.08'	
					grades to Dkbr fiberous SLUDGE, l(+) mf wood chips/fiberous, v wet.	
1.5						
2.0						
2.5						
3.0						
3.5					Course chunk of wood chip @ 3.4' - 3.6'.	
					Dkbr fiberous SLUDGE, t(+) m(-) f S. Chunk gr C @ 4.08'. 4.0' 4.08'	
4.0						
					Bottom of core @ 4.08'.	
4.5					Depth to sludge = 17.8 ft. Core Driven = 4.7 ft. Core Recovery = 4.1 ft.	
5.0						

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Test Boring Log

Boring No. S2700

PROJECT: Cumberland Bay - Predesign Investigation

Sheet 1 of 1

CLIENT: New York State Department of Environmental Conservation

Job No. 202352

DRILLING CONTRACTOR: Rust Environment & Infrastructure

Meas. Pt. Elev.:

PURPOSE: Sludge Bed Predesign Investigation

Surface Elev.: 82.98'

DRILLING METHOD: Piston Auger

Lake Elev.: 100.98'

DRILL RIG TYPE:

Date Started: 4/14/98

WATER DEPTH: 18.0'

Date Finished:

MEAS. PT.:

Driller: D. Foti/R. Totino

DATE OF MEAS.:

Inspector: B. Edwards

	SAMPLE	CORE	CASING
TYPE			
DIAM.			
WEIGHT			
FALL			

Depth (Feet)	Sample Number	Blow Count	Casing Blow	Recovery	GEOLOGIC DESCRIPTION	REMARKS
					Br organic SILT, super-saturated.	
0.5					0.6'	
1.0					Dkbr fiberous SLUDGE (plastic), little root matter, saturated.	
1.5						
2.0	S-1				Very fiberous @ 2.4'.	
2.5						
3.0					3.1' Same w/ l(+) m(+)f G (rounded), wet. 3.3'	
3.5					Brgr fiberous SLUDGE, l(-) fine wood chips, wet. 3.83'	
4.0					Bottom of core @ 3.83'. Depth to sludge = 18.0 ft. Core Driver = 3.7 ft. Core Recovery = 3.8 ft. (Note: 0.1 ft. void at bottom of core)	
4.5					Composite sample collected from 0-3.81' for PCB lab analysis.	
5.0						

RUST E&I Albany, NY (518) 458-1313	**Test Boring Log**	**Boring No. S2800**

PROJECT: Cumberland Bay - Predesign Investigation					Sheet 1 of 1
CLIENT: New York State Department of Environmental Conservation					Job No. 202352
DRILLING CONTRACTOR: Rust Environment & Infrastructure					Meas. Pt. Elev.:
PURPOSE: Sludge Bed Predesign Investigation					Surface Elev.: 91.08'
DRILLING METHOD: Piston Auger		SAMPLE	CORE	CASING	Lake Elev.: 100.98'
DRILL RIG TYPE:	TYPE				Date Started: 4/14/98
WATER DEPTH: 9.9'	DIAM.				Date Finished:
MEAS. PT.:	WEIGHT				Driller: D. Foti/R. Totino
DATE OF MEAS.:	FALL				Inspector: B. Edwards

Depth (Feet)	Sample Number	Blow Count	Casing Blow	Recovery	GEOLOGIC DESCRIPTION	REMARKS
0.25	S-1				Br fiberous SLUDGE, l(-) root matter and organics, wet.	
0.5					0.46' grades to Br mf(+) SAND, s(-) Sludge, organics, wet.	
	S-2				0.67' Grbr mf(+) SAND, t Silt. 0.71'	
0.75					Bottom of core @ 0.96'.	
1.0					Depth to sludge = 9.9 ft. Core Driven = 0.96 ft. Core Recovery = 0.96 ft. Two samples collected for PCB analysis: S-1 = 0 - 0.5' S-2 = 0.5' - 0.71'	
1.25						
1.5						
1.75						
2.0						
2.25						
2.5						

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Test Boring Log

Boring No.
T50E 2150

PROJECT: Cumberland Bay - Predesign Investigation	Sheet 1 of 1
CLIENT: New York State Department of Environmental Conservation	Job No. 202352
DRILLING CONTRACTOR: Rust Environment & Infrastructure	Meas. Pt. Elev.:
PURPOSE: Sludge Bed Predesign Investigation	Surface Elev.: 85.21'

DRILLING METHOD: Piston Auger		SAMPLE	CORE	CASING	Lake Elev.: 100.71'
DRILL RIG TYPE:	TYPE				Date Started: 4/16/98
WATER DEPTH: 15.5'	DIAM.				Date Finished:
MEAS. PT.:	WEIGHT				Driller: D. Foti/R. Totino
DATE OF MEAS.:	FALL				Inspector: B. Edwards

Depth (Feet)	Sample Number	Blow Count	Casing Blow	Recovery	GEOLOGIC DESCRIPTION	REMARKS
					Dkbr mf SAND, l $, f wood chips, saturated. 0.25'	
0.5					Grades to Dkbr fiberous SLUDGE, l(+) f wood chips, trace organic matter, saturated.	
1.0						
1.5					Dkbr mf wood chips, l(+) fiberous SLUDGE, saturated. 1.6' 1.67'	
2.0					1.8': Seam of br fiberous SLUDGE, l f wood chips. 1.8' Br c(-)mf SAND, t $, f wood chips, saturated.	
2.5					Dkbr fiberous SLUDGE, l(+) f wood chips, saturated. Organic matter/leaves @ 2.4', 2.8', 3.0' and 3.1'.	
3.0						
3.5					3.7'	
4.0					Dkbr-bk mf(+) SAND, s(-) $, l(-) f wood chips, saturated. 4.1'	
4.5					Bottom of core @ 4.1'. Depth to sludge = 15.5 ft. Core Driven = 5.0 ft. Core Recovery = 4.1 ft. No sample collected	
5.0						

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Test Boring Log

Boring No. U2700

PROJECT: Cumberland Bay - Predesign Investigation					Sheet 1 of 1
CLIENT: New York State Department of Environmental Conservation					Job No. 202352
DRILLING CONTRACTOR: Rust Environment & Infrastructure					Meas. Pt. Elev.:
PURPOSE: Sludge Bed Predesign Investigation					Surface Elev.: 80.94'
DRILLING METHOD: Piston Auger		SAMPLE	CORE	CASING	Lake Elev.: 100.84'
DRILL RIG TYPE:	TYPE				Date Started: 4/15/98
WATER DEPTH: 19.9'	DIAM.				Date Finished:
MEAS. PT.:	WEIGHT				Driller: D. Foti/R. Totino
DATE OF MEAS.:	FALL				Inspector: B. Edwards

Depth (Feet)	Sample Number	Blow Count	Casing Blow	Recovery	GEOLOGIC DESCRIPTION	REMARKS
					Br SILT, l(+) f S, t(+) f G, saturated. 0.17'	
0.5					Br fiberous SLUDGE, saturated. 5" cm wood chips and fibers.	
1.0					1.17'	
					F wood chips (seam). 1.21'	
1.5					Br fiberous SLUDGE, saturated, l root matter & wood chips.	
	S-1					
2.0						
2.5						
3.0					3.25'	
					Grades to br fiberous SLUDGE, l fine S. 3.42'	
3.5					Bottom of core @ 3.42'.	
4.0					Depth to sludge = 19.9 ft. Core Driven = 3.3 ft. Core Recovery = 3.4 ft.	
4.5					One sample collected for PCB analysis: S-1 = 0.17' - 3.42'	
5.0						

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Test Boring Log

Boring No.
V2600

PROJECT: Cumberland Bay - Predesign Investigation
Sheet 1 of 1

CLIENT: New York State Department of Environmental Conservation
Job No. 202352

DRILLING CONTRACTOR: Rust Environment & Infrastructure
Meas. Pt. Elev.:

PURPOSE: Sludge Bed Predesign Investigation
Surface Elev.: 83.04'

DRILLING METHOD: Piston Auger		SAMPLE	CORE	CASING	Lake Elev.: 100.84'
DRILL RIG TYPE:	TYPE				Date Started: 4/15/98
WATER DEPTH: 17.8'	DIAM.				Date Finished:
MEAS. PT.:	WEIGHT				Driller: D. Foti/R. Totino
DATE OF MEAS.:	FALL				Inspector: B. Edwards

Depth (Feet)	Sample Number	Blow Count	Casing Blow	Recovery	GEOLOGIC DESCRIPTION	REMARKS
0.5	S-1				Dkbr silty organics, l(-) f wood chips/root matter; saturated.	
1.0					0.83' Grades to br SILT, l(+) f S, f wood chips. 1.08'	
1.5					Grades to br mf(+) SAND, l $, wood chips. 1.42' Grades to Br SILT, l(-) mf(+) S, f wood chips.	
2.0	S-2				1.92'	
2.5					Br fiberous SLUDGE, l(+) mf wood chips. At 2.67' very fiberous w/ mf wood chips.	
3.0						
3.5					At 3.25' Gr CLAY and mf G (1/2" seam). 3.5'	
4.0					Bottom of core @ 3.5'. Depth to sludge = 17.8 ft. Core Driver = 4.0 ft. Core Recovery = 3.6 ft.	
4.5					Two samples collected for PCB analysis: S1 = 0 - .83' S2 = .83' - 3.5'	
5.0						

RUST E&I Albany, NY (518) 458-1313	# Test Boring Log	**Boring No.** **W2400A**

PROJECT: Cumberland Bay - Predesign Investigation					Sheet 1 of 1
CLIENT: New York State Department of Environmental Conservation					Job No. 202352
DRILLING CONTRACTOR: Rust Environment & Infrastructure					Meas. Pt. Elev.:
PURPOSE: Sludge Bed Predesign Investigation					Surface Elev.: 84.84'
DRILLING METHOD: Piston Auger		SAMPLE	CORE	CASING	Lake Elev.: 100.84'
DRILL RIG TYPE:	TYPE				Date Started: 4/15/98
WATER DEPTH: 16.0'	DIAM.				Date Finished:
MEAS. PT.:	WEIGHT				Driller: D. Foti/R. Totino
DATE OF MEAS.:	FALL				Inspector: B. Edwards

Depth (Feet)	Sample Number	Blow Count	Casing Blow	Recovery	GEOLOGIC DESCRIPTION	REMARKS
					Br fiberous SLUDGE, l f wood chips, saturated. 0.08' 0.17' Cmf SAND, l(-) $, t wood fibers. At 5" - 5.25" mf(+) SAND, t(+) $. At 7" c wood chips.	
0.5	S-1				Br fiberous SLUDGE, l f wood chips, saturated.	
1.0						
1.5					1.79'	
2.0					Bottom of core @ 1.79'. Depth to sludge = 16.0 ft. Core Driven = 2.7 ft. Core Recovery = 1.9 ft. One sample collected for PCB analysis: S-1 = 0-1.79'	
2.5						
3.0						
3.5						
4.0						
4.5						
5.0						

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Test Boring Log

Boring No. W2400B

PROJECT: Cumberland Bay - Predesign Investigation					Sheet 1 of 1
CLIENT: New York State Department of Environmental Conservation					Job No. 202352
DRILLING CONTRACTOR: Rust Environment & Infrastructure					Meas. Pt. Elev.:
PURPOSE: Sludge Bed Predesign Investigation					Surface Elev.: 85.34'
DRILLING METHOD: Piston Auger		SAMPLE	CORE	CASING	Lake Elev.: 100.84'
DRILL RIG TYPE:	TYPE				Date Started: 4/15/98
WATER DEPTH: 15.5'	DIAM.				Date Finished:
MEAS. PT.:	WEIGHT				Driller: D. Foti/R. Totino
DATE OF MEAS.:	FALL				Inspector: B. Edwards

Depth (Feet)	Sample Number	Blow Count	Casing Blow	Recovery	GEOLOGIC DESCRIPTION	REMARKS
					Dkgr/br mf(+) SAND, l $, f wood chips, wet. 0.17'	
0.25					Dkbr $, t(+) f S, l f wood chips, wet. 0.33'	
					Dkgr/br mf(+) SAND, l $, f wood chips, wet. 0.42'	
0.5					Dkbr $, t(+) f S, l f wood chips, wet. 0.58'	
					Gr/br cmf SAND, t(+) $, f wood chips.	
0.75						
					0.92'	
1.0					Dkbr SILT, t f S, f wood chips. 1.0'	
					Br cmf SAND, t(+) $. 1.17'	
1.25					Bottom of core @ 1.17'.	
					Depth to sludge = 15.5 ft. Core Driven = 1.2 ft. Core Recovery = 1.2 ft. No samples.	
1.5						
1.75						
2.0						
2.25						
2.5						

RUST E&I Albany, NY (518) 458-1313	# Test Boring Log	**Boring No. W2650**
PROJECT: Cumberland Bay - Predesign Investigation		Sheet 1 of 1
CLIENT: New York State Department of Environmental Conservation		Job No. 202352
DRILLING CONTRACTOR: Rust Environment & Infrastructure		Meas. Pt. Elev.:
PURPOSE: Sludge Bed Predesign Investigation		Surface Elev.: 84.21'

DRILLING METHOD: Piston Auger		SAMPLE	CORE	CASING	Lake Elev.: 100.71'
DRILL RIG TYPE:	TYPE				Date Started: 4/16/98
WATER DEPTH: 16.5'	DIAM.				Date Finished:
MEAS. PT.:	WEIGHT				Driller: D. Foti/R. Totino
DATE OF MEAS.:	FALL				Inspector: B. Edwards

Depth (Feet)	Sample Number	Blow Count	Casing Blow	Recovery	GEOLOGIC DESCRIPTION	REMARKS
					Bk silty organics, t f Sand, saturated. 0.08'	
0.25					Br mf SAND, t(-) $, saturated.	
0.5					0.5'	
					Bottom of core @ 0.5'. Depth to sludge = 16.5 ft. Core Driven = 1.2 ft. Core Recovery = 0.5 ft. No samples.	
0.75						
1.0						
1.25						
1.5						
1.75						
2.0						
2.25						
2.5						

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Test Boring Log

Boring No.
X2700

PROJECT: Cumberland Bay - Predesign Investigation	Sheet 1 of 1
CLIENT: New York State Department of Environmental Conservation	Job No. 202352
DRILLING CONTRACTOR: Rust Environment & Infrastructure	Meas. Pt. Elev.:
PURPOSE: Sludge Bed Predesign Investigation	Surface Elev.: 83.74'
DRILLING METHOD: Piston Auger	Lake Elev.: 100.84'
DRILL RIG TYPE:	Date Started: 4/15/98
WATER DEPTH: 17.1'	Date Finished:
MEAS. PT.:	Driller: D. Foti/R. Totino
DATE OF MEAS.:	Inspector: B. Edwards

	SAMPLE	CORE	CASING
TYPE			
DIAM.			
WEIGHT			
FALL			

Depth (Feet)	Sample Number	Blow Count	Casing Blow	Recovery	GEOLOGIC DESCRIPTION	REMARKS
0.5					BrBl silty organics, l(+) root matter (leaves), saturated.	
1.0	S-1					
1.5					Br mf(+) SAND, l(+) f wood chips/organics, saturated. 1.67' 1.83'	
2.0					Bl silty organics, l organic matter, v wet. 2.0' Grades to Blbr silty organics, l fibers/wood chips.	
2.5					2.5': Significant c(-)mf wood chips.	
3.0	S-2				2.92' Br fiberous SLUDGE?, wet. 3.17-3.21': cmf wood chips. 3.25'	
3.5					Gr cmf(-) SAND, t $, moist. 3.41' 3.67': 1/4" seam cmf SAND. 3.67-3.75': cm wood chips. Grading to br fiberous SLUDGE?, l(+) f wood chips, moist. 3.92'	
4.0					Bottom of core @ 3.92'.	
4.5					Depth to sludge = 17.1 ft. Core Driven = 4.7 ft. Core Recovery = 3.9 ft. Two sample collected for PCB analysis: S-1 = 0-1.67' S-2 = 1.67'-3.92'	
5.0						

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Test Boring Log

Boring No. X2900

PROJECT: Cumberland Bay - Predesign Investigation					Sheet 1 of 1
CLIENT: New York State Department of Environmental Conservation					Job No. 202352
DRILLING CONTRACTOR: Rust Environment & Infrastructure					Meas. Pt. Elev.:
PURPOSE: Sludge Bed Predesign Investigation					Surface Elev.: 88.74'
DRILLING METHOD: Piston Auger		SAMPLE	CORE	CASING	Lake Elev.: 100.84'
DRILL RIG TYPE:	TYPE				Date Started: 4/15/98
WATER DEPTH: 12.1'	DIAM.				Date Finished:
MEAS. PT.:	WEIGHT				Driller: D. Foti/R. Totino
DATE OF MEAS.:	FALL				Inspector: B. Edwards

Depth (Feet)	Sample Number	Blow Count	Casing Blow	Recovery	GEOLOGIC DESCRIPTION	REMARKS
					Ltbr c(-)mf SAND, t(-) $, wet. 0.25'	
0.5					Grading to gr mf SAND, t(-) $, wet.	
1.0					at 1.0' - 1.04' dkgr mf SAND, t(-) $, wet. 1.33'	
1.5					Gr mf SAND, t(-) $, w/ organics, wet. 1.58' Bottom of core @ 1.58'.	
2.0					Depth to sludge = 12.1 ft. Core Driven = 2.0 ft. Core Recovery = 1.58 ft.	
2.5					No samples collected.	
3.0						
3.5						
4.0						
4.5						
5.0						

RUST E&I Albany, NY (518) 458-1313	**Test Boring Log**				**Boring No.** **Z2900**
PROJECT: Cumberland Bay - Predesign Investigation					Sheet 1 of 1
CLIENT: New York State Department of Environmental Conservation					Job No. 202352
DRILLING CONTRACTOR: Rust Environment & Infrastructure					Meas. Pt. Elev.:
PURPOSE: Sludge Bed Predesign Investigation					Surface Elev.: 83.84'
DRILLING METHOD: Piston Auger		SAMPLE	CORE	CASING	Lake Elev.: 100.84'
DRILL RIG TYPE:	TYPE				Date Started: 4/15/98
WATER DEPTH: 17.0'	DIAM.				Date Finished:
MEAS. PT.:	WEIGHT				Driller: D. Foti/R. Totino
DATE OF MEAS.:	FALL				Inspector: B. Edwards

Depth (Feet)	Sample Number	Blow Count	Casing Blow	Recovery	GEOLOGIC DESCRIPTION	REMARKS
					Br organic SILT, l(-) root matter, v wet. 0.1' 0.2' grades to Bl.	
0.25					Br fiberous SLUDGE, s(+) $, f wood chips, v wet.	
0.5	S-1					
0.75					0.83'	
1.0					Br mf SAND, t $, wet. 1.0'	
1.25					Br fiberous SLUDGE, s(+) $, l f wood chips, v wet. 1.2'	
1.5					Br mf SAND, t $, wet. Seam of organic Silt/Sludge @ 1.3'. 1.67'	
1.75					Br fiberous SLUDGE, s(+) $, l f wood chips, wet. Seam of mf wood chips @ 1.9'. 2.08'	
2.0	S-2				Grades to br mf SAND, s(-) sludge and $, wet. 2.17'	
2.25					Bottom of core @ 2.17'.	
2.5						

Depth to sludge = 17.0 ft.
Core Driven = 2.9 ft.
Core Recovery = 2.1 ft.

Two samples collected for PCB analysis:
S-1 = 2.0' - 10.0"
S-2 = 20.0' - 26.0"

APPENDIX E

Geophysical Survey

HAGER-RICHTER
GEOSCIENCE, INC.

GEOPHYSICAL SURVEY
CUMBERLAND BAY SLUDGE BED SITE
PLATTSBURGH - CLINTON COUNTY, N.Y.
NYSDEC SITE NO. 510017

Prepared for:

Rust Environment & Infrastructure, Inc.
12 Metro Park Road
Albany, New York 12205

Prepared by:

Hager-Richter Geoscience, Inc.
8 Industrial Way - D10
Salem, New Hampshire 03079

File 97G64
July, 1998

0. EXECUTIVE SUMMARY

Hager-Richter Geoscience, Inc. conducted a geophysical survey at the Cumberland Bay Sludge Bed Site located on Lake Champlain in Plattsburgh, Clinton County, New York for Rust Environment & Infrastructure, Inc. (Rust) in February, 1998. The geophysical survey is part of an environmental characterization of the Site by Rust for the New York State Department of Environmental Conservation (NYSDEC).

Rust and the NYSDEC are investigating the sludge bed. The sludge is reported to be composed of highly organic waste material derived from a nearby paper mill.

The objectives of the geophysical survey were: [1] to detect large metal objects submerged in the sludge, and [2] to determine, if possible, the vertical and horizontal extent of the sludge layer at the Site. As specified by Rust, two complementary geophysical techniques were used -- electromagnetic induction terrain conductivity (commonly called EM) and ground penetrating radar (GPR).

The geophysical survey was conducted in two phases. The first phase consisted of testing the methods to determine whether useful data were being acquired, and the second phase was to acquire data over a larger area. Rust established a staked survey grid and specified the areas of interest for each phase of the geophysical survey.

The survey was conducted in February when Cumberland Bay was frozen, and the ice thickness was in excess of 12 inches for most of the area. The EM survey consisted of approximately 40,000 data stations. The GPR survey consisted of 120 traverses totaling over 134,000 feet over an area of approximately 30 acres.

The results of the geophysical survey at the Cumberland Bay Sludge Bed Site may be summarized as follows:

- One possible submerged metal object was detected by the EM survey near the east end of Wilcox Dock.
- Many other small submerged objects and two large objects were detected in the survey area. The objects are inferred to be non-metallic, and most are located in the southwest portion of the survey area.

- The apparent conductivity data determined by the EM survey exhibit general correlation with the lateral extent and thickness of the sludge, i.e., the apparent conductivity is highest in the areas where the sludge bed is thickest and lowest where the sludge is not present.

- Based on the GPR data, the approximate thickness of the sludge layer within the GPR survey area varies from less than about ½-foot in the northeast portion of the survey area to more than three feet near the Wilcox Dock.

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PLATES

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Geophysical Survey
Cumberland Bay Sludge Bed Site
Plattsburgh - Clinton County, New York
NYSDEC Site No. 510017
File 97G64 July, 1998

1. INTRODUCTION

Hager-Richter Geoscience, Inc. conducted a geophysical survey at the Cumberland Bay Sludge Bed Site on Lake Champlain in Plattsburgh, Clinton County, New York for Rust Environment & Infrastructure, Inc. (Rust) on February 18-19 and 24-27, 1998. The geophysical survey is part of an environmental characterization of the Site by Rust for the New York State Department of Environmental Conservation (NYSDEC).

Rust and the NYSDEC are investigating the sludge bed for possible remediation. The site encompasses much of Cumberland Bay, a shallow water bay at the north end of the town of Plattsburgh. The general location of the Site is shown in Figure 1. Figure 2 is a Site Plan showing the survey grid and the estimated extent and thickness of the sludge bed based on work completed by Rust prior to the geophysical survey. The sludge is reported to be composed of highly organic waste material derived from a nearby paper mill.

The objectives of the geophysical survey were: [1] to detect large metal objects possibly submerged in the sludge, and [2] to determine, if possible, the vertical and horizontal extent of the sludge layer at the Site. As specified by Rust, two complementary geophysical techniques were used -- electromagnetic induction terrain conductivity (commonly called EM) and ground penetrating radar (GPR).

The geophysical survey was conducted in two phases. The first phase consisted of testing the methods to determine whether useful data were being acquired, and the second phase was to acquire data over a larger area. Rust established a staked survey grid and specified the areas of interest for both phases of the geophysical survey.

The GPR survey was conducted in an area approximately 30 acres in size and the EM data was conducted in two areas totaling about 26 acres. The survey was conducted in February when Cumberland Bay was frozen. The ice thickness was in excess of 12 inches for most of the area at the time of survey.

Jeffrey Reid, P.G., Jonathon Puliafico, and William Desmarais of Hager-Richter conducted the field operations. The project was coordinated with Ms. Helen Mongillo of Rust. Mr. Mark Williams of Rust and Mr. Robert Edwards of NYSDEC observed the field operations. Interpretation and analysis of the geophysical data were completed at the Hager-Richter offices. Original data and field notes will be retained in the Hager-Richter files for a minimum of three years.

2. EQUIPMENT AND PROCEDURES

2.1 GENERAL

Two complementary techniques were used at the Cumberland Bay Sludge Bed Site: electromagnetic induction terrain conductivity (commonly called EM), and ground penetrating radar. A 100-foot by 100-foot survey grid was established and staked by Rust prior to conducting the survey.

2.2 TERRAIN CONDUCTIVITY

2.2.1 General. A general description of the equipment and procedures for the EM survey, as used by Hager-Richter, is contained in the Appendix.

2.2.2 Limitations of the Method. As with any of the electrical geophysical methods, terrain conductivity data are subject to interference from such cultural features as buildings, fencing, and underground and overhead power lines. The only such feature present at the Cumberland Bay Sludge Bed Site the metal associated with Wilcox Dock.

Terrain conductivity meters were designed and calibrated to be used in the range of natural ground conductivity. Values of apparent conductivity greater than about 100 mmho/m are likely not valid measures of actual ground conductivity, but are useful for detecting areas of conductive man-made features. Apparent conductivity values for the Cumberland Bay Sludge Bed Site vary from about 3 mmho/m to 18 mmho/m.

2.2.3 Site Specific. Data for the terrain conductivity survey were recorded with a Geonics EM31 electromagnetic induction terrain conductivity meter at approximately 2.5-foot intervals along lines spaced 10 feet apart. EM data were collected at about 40,000 stations at the subject site. The 12-foot long boom of the EM31-DL terrain conductivity meter was oriented perpendicular to the traverse lines, effectively providing overlapping coverage between traverses. Data were recorded in the vertical dipole mode (nominal depth of exploration of 18 feet) for both the quadrature phase component (apparent conductivity) and in-phase component.

Apparent conductivity data were measured along a baseline at the beginning and end of the field day to check for instrument drift. No significant instrument drift was detected.

2.3 GROUND PENETRATING RADAR

2.3.1 General. A general description of the equipment and procedures for the GPR survey, as used by Hager-Richter, is contained in the Appendix.

2.3.2 Limitations of the Method. The maximum depth to which GPR signals can penetrate depends on the electrical properties of the subsurface materials. The higher the electrical conductivity of the subsurface materials, the lower the radar signal penetration. Clay minerals and/or brackish water in the subsurface, for example, attenuate the GPR signal, so reflections are not received from materials at greater depths.

There are limitations of the GPR technique as used to detect and/or locate targets such as those stated in the objective: (1) surface conditions, (2) electrical conductivity of the subsurface, (3) contrast of the electrical conductivities of the targets and the subsurface, and (4) spacing between lines. Of these limitations, only the fourth, line spacing, is controlled by the operator.

The subject survey was conducted when the Bay was ice-covered. The condition of the ice surface can affect the quality of the GPR data and the depth of penetration of the GPR signal. For portions of the subject survey, the ice surface was covered with 4 to 8 inches of slush and standing water due to warmer temperatures experienced later in the day. The presence of slush and standing water significantly reduced GPR signal penetration for some areas.

The electrical conductivity of the subsurface determines the attenuation of the GPR signals, and thereby limits the maximum depth of exploration. The GPR signal does not penetrate clay-rich soils, and targets buried in clay can be missed.

A definite contrast in the electrical conductivities of the subsurface and the target is required to obtain a reflection of the GPR signal. If the contrast is too small, then the reflection may be too weak to recognize, and the target can be missed.

The spacing between lines is under control of the GPR operator, and the design of the survey is based on the dimensions of the smallest target of interest. Targets with dimensions smaller than the spacing between GPR survey lines, 10 feet for this site, can be missed.

Accurate determination of the depth of any interface requires calibration of the site specific GPR signal velocity. Where targets of a known depth are not available at a site, the time-to-depth conversion of the GPR signal can be estimated from handbook values, but such depth estimations might contain significant error.

Interpretation of GPR data is subjective. As noted above, "ground truth" through correlation with borings and excavations is required for positive identification of most objects detected on the basis of GPR data.

2.3.3 Site Specific. GPR traverses were conducted in areas specified by Rust with the lines spaced no greater than 10 feet apart and oriented north-south. The GPR survey was conducted using a 300 MHZ antenna equipped with a survey wheel, and the data were recorded with a time windows of 200, 220, 250, or 300 nsec., depending on water depth. The GPR antenna was pulled by an all-terrain vehicle for all traverses.

The GPR signal penetration at the subject Site varied from about 100 nsec to more than 220 nsec, corresponding to a depth of about 8 to 18 feet, using a time-to-depth conversion of 14 nsec/ft for the GPR signal in the ice/water, 18 nsec/ft for the sludge, and 12 nsec/ft for the GPR signal in saturated lake bed sediments for this Site based on calibration from selected data provided by Rust. The sludge thickness data provided by Rust were measured by probing and limited coring. The data contained significant internal variation due to the inherent limitations of the measuring methods used (i.e., incomplete core recoveries for core data and variable material densities for probing data).

3. RESULTS AND DISCUSSION

3.1 GENERAL

The results of the geophysical survey conducted at the Cumberland Bay Sludge Bed Site are given in Plates 1-4. Plates 1 and 2 are color contour plots of apparent conductivity and the in-phase component data, respectively. Plate 3 shows the approximate thickness of the sludge layer based on the GPR survey. Plate 4 shows the locations of submerged objects detected by the geophysical survey.

3.2 TERRAIN CONDUCTIVITY

The locations of the EM data stations are shown in Plates 1 and 2. The EM survey consisted of approximately 40,000 data stations over an area of approximately 26 acres.

EM surveys are useful in environmental investigations for objectives such as [1] detecting the presence of anomalously conductive soils, rock, or groundwater, and [2] detecting buried metal. The apparent conductivity data are sensitive to changes in electrical properties caused by natural and man-made variations in the geologic materials (soils, rock, groundwater), and to the presence of metal objects. The in-phase component data, on the other hand, are *only* useful to interpret the presence of metal objects.

Background apparent conductivity values and in-phase values range from approximately 2 to 4 mmho/m and 1 to 2 parts per thousand (ppt), respectively. As can be seen on Plate 1, the apparent conductivity varies over the survey area with the highest values in the vicinity of Wilcox Dock. The variation in apparent conductivity correlates well with variations in sludge thickness determined from probing and coring (Figure 2), and the GPR survey (Plate 3). The highest values of apparent conductivity correlate with the location of the greatest sludge thickness. The general shape of the 6 mmho/m contour is similar to the estimated shape of the limit of the sludge bed.

The in-phase component data, shown in Plate 2, exhibit little variation across the survey area, except for anomalies in the immediate vicinity of Wilcox Dock, where a portion of the dock is constructed with steel sheet piles. One additional small in-phase component anomaly was detected at approximately coordinates Q+50,2450. The anomaly is not associated with surface metal and is attributed to submerged metal. The location of the possible buried metal object is shown on Plate 4.

3.3 Ground Penetrating Radar

The locations of the GPR traverses are shown in Plate 3. The GPR survey consisted of 120 traverses totaling over 134,000 linear feet over an area of approximately 30 acres.

In general, the quality of the GPR records for the traverses on the bay is good. For portions of the survey, however, 4 to 8 inches of slush and standing water were present on the ice surface due to midday melting. For such areas, the GPR data quality was reduced significantly, and the GPR data collected under melting conditions could, in large part, not be interpreted. In particular, the GPR data for the southern and eastern edges of the GPR survey area could not be interpreted due to limited GPR signal penetration. The areas of limited GPR signal penetration are shown on Plate 3.

The Site specific time-to-depth conversion of the GPR signal for the different materials was determined by comparing depths of known interfaces from selected probe and sediment cores acquired by Rust with GPR reflections from approximately the same location. Based on this comparison, the following depth conversions were established:

Ice/Fresh Water	14 nsec/ft.
Sludge	18 nsec/ft.
Lake Bed Sediment	12 nsec/ft.

Such values for water and sediment compare well with values for similar materials published in the GPR equipment manufacturer's manual. The calibration data for the sludge thicknesses provided by Rust were obtained by probing and limited coring. The data contained significant internal variation due to the inherent limitations of the measuring methods used (i.e., incomplete core recoveries for core data and variable material densities for probing data). Therefore, the time-to-depth conversion for the sludge material is an estimate only, and may vary significantly.

Interpretation of the GPR data was difficult. Most GPR records for the Cumberland Bay Sludge Bed Site are characterized by clear GPR reflections from the lake bottom. In most cases, one or two sub-bottom reflectors could be distinguished. For this report, we assumed that sludge was present everywhere in the GPR survey area, and that the first sub-bottom reflector represents the bottom of the sludge. Examples of GPR records for the sludge bed are shown in Figure 3. The second sub-bottom reflector may represent an interface within the lake bed sediments, and was detected only in areas where the sludge is interpreted to be relatively thin.

The estimated thickness of sludge based on the GPR data is shown in Plate 3. The estimated thickness varies from less than about ½-foot in the northeast portion of the survey area to more than about three feet near Wilcox Dock.

Plate 4 shows the locations of objects detected by GPR survey. Most of the objects are small, and similar in size to small boulders. Because the objects do not produce EM anomalies, we infer that the objects are not metallic. Most of the objects are located in the southwest portion of the GPR survey area. Two large objects occur at H+50,2200 and K+45,2440. The lower GPR record reproduced in Figure 3 shows typical signatures of the unidentified objects.

4. CONCLUSIONS

Based on the geophysical survey conducted at the Cumberland Bay Sludge Bed Site in Plattsburgh, Clinton County, New York, we conclude that:

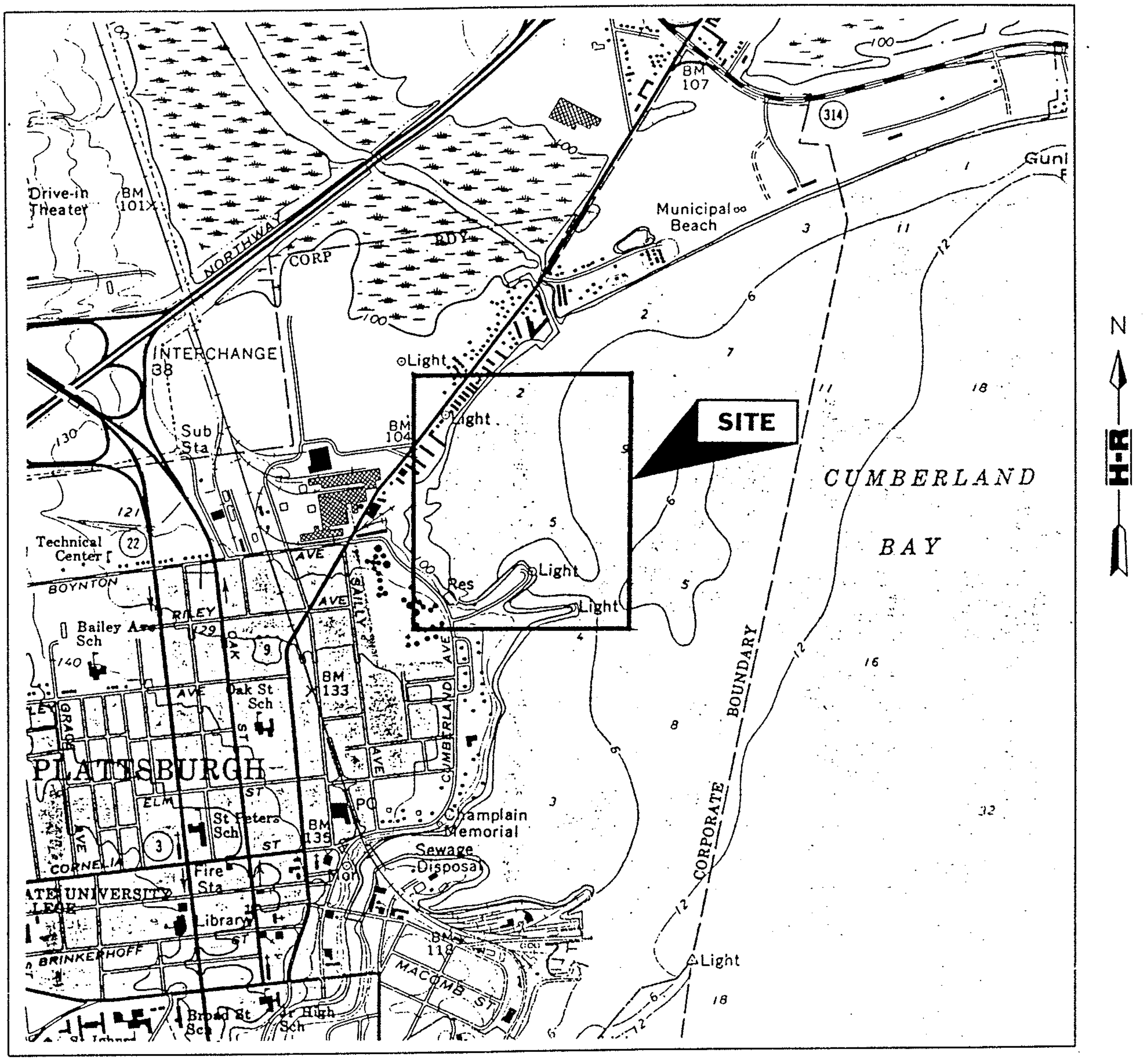
- One possible submerged metal object was detected by the EM survey near the east end of Wilcox Dock.
- Many other small submerged objects and two large objects were detected in the survey area. The objects are inferred to be non-metallic, and most are located in the southwest portion of the survey area.
- The apparent conductivity data determined by the EM survey exhibit general correlation with the lateral extent and thickness of the sludge, i.e., the apparent conductivity is highest in the areas where the sludge bed is thickest and lowest where the sludge is not present.
- Based on the GPR data, the approximate thickness of the sludge layer within the GPR survey area varies from less than about ½-foot in the northeast portion of the survey area to more than three feet near the Wilcox Dock.

5. LIMITATIONS

This report was prepared for the exclusive use of Rust Environment & Infrastructure, Inc. and the New York State Department of Environmental Conservation (collectively the Client). No other party shall be entitled to rely on this Report or any information, documents, records, data, interpretations, advice or opinions given to Client by Hager-Richter Geoscience, Inc. (H-R) in the performance of its work. The Report relates solely to the specific project for which H-R has been retained and shall not be used or relied upon by Client or any third party for any variation or extension of this project, any other project or any other purpose without the express written permission of H-R. Any unpermitted use by Client or any third party shall be at Client's or such third party's own risk and without any liability to H-R.

H-R has used reasonable care, skill, competence and judgment in the preparation of this Report consistent with professional standards for those providing similar services at the same time, in the same locale, and under like circumstances. Unless otherwise stated, the work performed by H-R should be understood to be exploratory and interpretational in character and any results, findings or recommendations contained in this Report or resulting from the work proposed may include decisions which are judgmental in nature and not necessarily based solely on pure science or engineering. It should be noted that our conclusions might be modified if subsurface conditions were better delineated with additional subsurface exploration including, but not limited to, test pits, soil borings with collection of soil and water samples, and laboratory testing.

Except as expressly provided in this limitations section, H-R makes no other representation or warranty of any kind whatsoever, oral or written, expressed or implied; and all implied warranties of merchantability and fitness for a particular purpose, are hereby disclaimed.



QUADRANGLE LOCATION

SCALE (feet)

0 2000 4000

BASE MAP PLATTSBURGH, N.Y.-VT.
USGS TOPOGRAPHIC QUADRANGLE

Figure 1
General Site Location
Cumberland Bay Sludge Bed Site
Plattsburgh-Clinton County, New York
NYSDEC SITE NO. 510017

File 97G64	July, 1998

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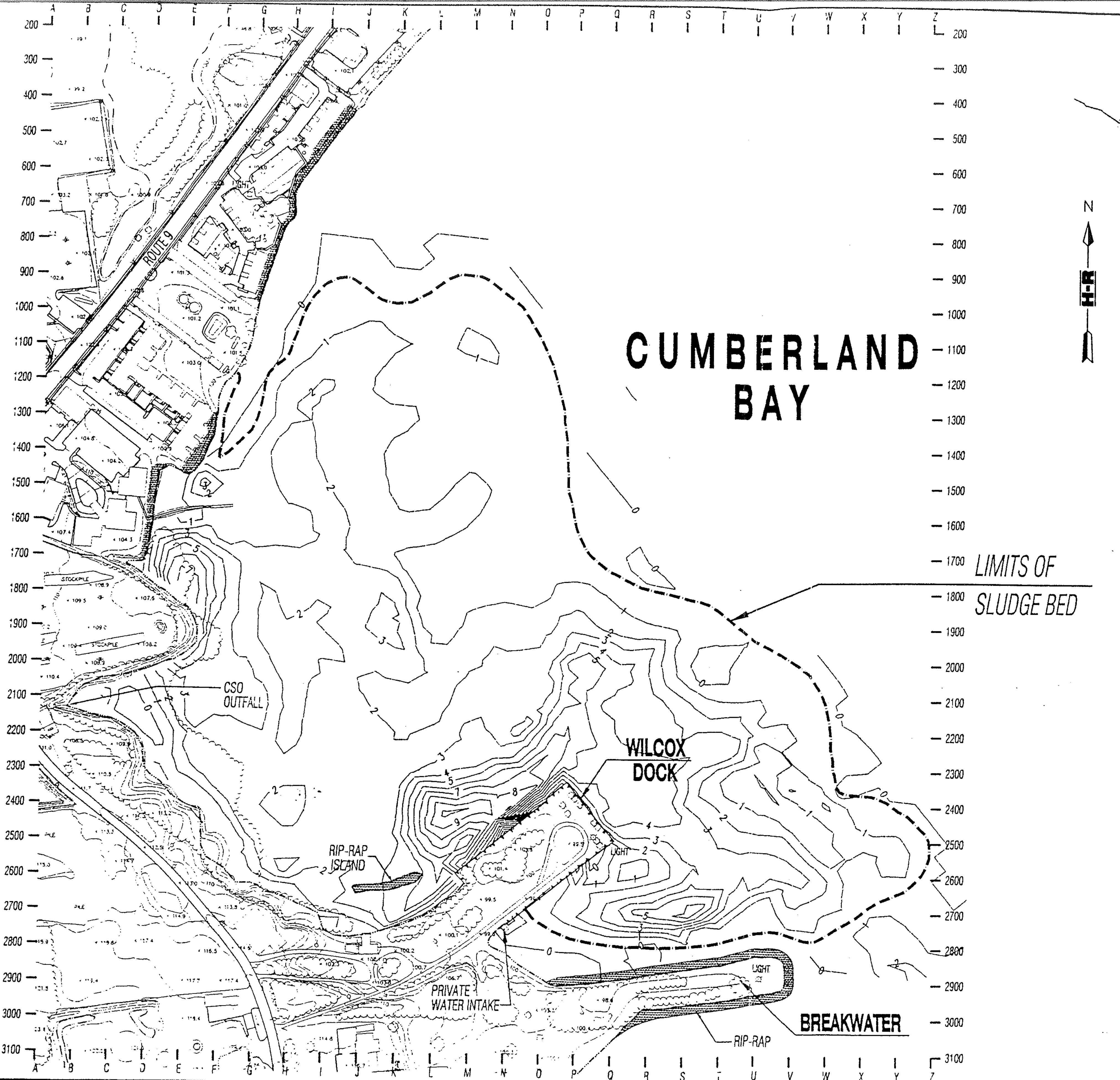
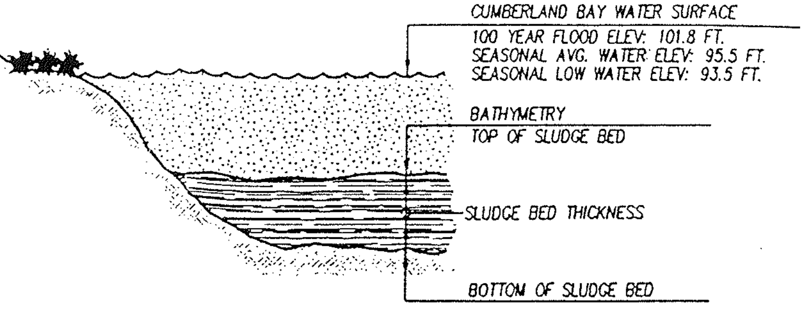
Salem, New Hampshire





LEGEND

—2— SLUDGE BED THICKNESS CONTOUR

SCALE (feet)

0 300 600

NOTES:

1. TAKEN FROM PLAN PROVIDED BY RUST ENVIRONMENT & INFRASTRUCTURE INC. DATED MAY 1998.
2. NORTH REFERENCE IS BASED ON NEW YORK STATE PLANE COORDINATE SYSTEM NAD 83 (1992).
3. REFERENCE NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION GPS CONTROL POINT STATION NAME 5030, & STATION NAME 5031–(ALUMINUM DISK MONUMENTS)

GPS 5030 – NORTH: 2142321.3905 / EAST: 233720.4101
GPS 5031 – NORTH: 2144868.7282 / EAST: 233627.2669
(NOT SHOWN)

GRID POINT A–200
NORTH: 2144681.2725 / EAST: 765279.2435
GRID POINT Z–3100
NORTH: 2141781.2725 / EAST: 767779.2435

Figure 2
Site Plan
Cumberland Bay Sludge Bed Site
Plattsburgh–Clinton County, New York
NYSDEC SITE NO. 510017

File 97G64	July, 1998

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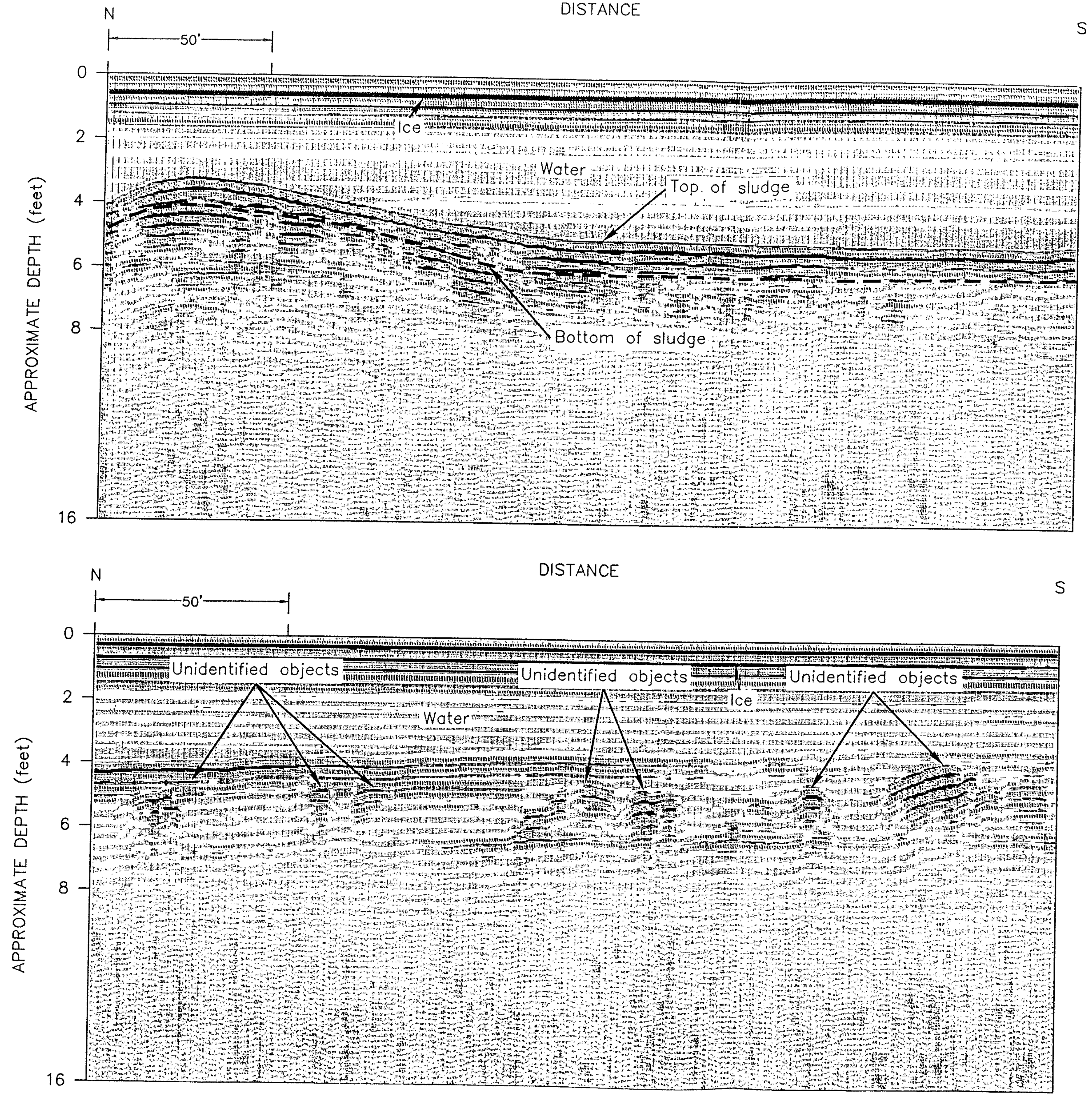
Salem, New Hampshire



NOTES:

1. Depth scale is approximate only. The actual time–to–depth conversion for the GPR signal varies with the dielectric properties of the materials in the subsurface and is not necessarily uniform.
Colors represent relative amplitude of reflected signals. Grey and white are lowest amplitude; brightest colors are highest amplitude.
Accuracy of distances along GPR record is approximately ±1 foot.

Figure 3
Examples of GPR Records
Cumberland Bay Sludge Bed Site
Plattsburgh–Clinton County, New York
NYSDEC SITE NO. 510017

File 97G64	July, 1998

HAGER–RICHTER GEOSCIENCE, INC.
Salem, New Hampshire

APPENDIX
TERRAIN CONDUCTIVITY (EM) SURVEYS

Field Work. We used a Geonics EM31-DL Terrain Conductivity Meter for the survey. This unit is an induction type instrument and provides measurement of both the quadrature-phase and in-phase components of terrain conductivity without ground electrodes or contact. The data for both components are recorded on a digital data logger. The EM31-DL is calibrated to read ground conductivity directly in millimhos per meter with a resolution of 2% of full scale and an accuracy of 1 mmho/meter.

The EM31-DL has coils mounted with a fixed separation of 12 feet in a rigid boom. In normal operation, it is used with a vertical dipole, and the nominal depth of earth sampled by the EM31-DL is about 18 feet. In the horizontal dipole mode, the nominal depth of earth sampled by the EM31-DL is about 9 feet.

Two components of the induced magnetic field measured by the EM31-DL are recorded: (1) the quadrature-phase component and (2) the in-phase component. The quadrature-phase component is a measure of the average terrain conductivity of the subsurface materials located between the receiver and transmitter of the EM31-DL. The in-phase component is a sensitive indicator of the presence of conductive metal objects; however, the exact identification of the object cannot be determined from the terrain conductivity data alone.

Data Analysis and Interpretation. Terrain conductivity data are most commonly plotted in either profile format or as contour maps, depending on the density of the data. At sites free of metal objects and other cultural interference, the terrain conductivity measured at a particular location is controlled by the subsurface fluid. The instrument response is more affected by near-surface material than by deeper material, particularly horizontal dipole data. In cases where the terrain conductivity meter coil is directly over a buried metal target, the apparent conductivity reading may be a negative number.

Terrain conductivity surveys are commonly included in environmental investigations because they can be used to determine the lateral extent of disposal areas and/or landfills, to detect buried metal objects, and to detect the presence of conductive leachate plumes. Typically, terrain conductivity values measured in disposal areas are irregular and highly variable over short distances due to the heterogeneous materials in the subsurface. The edges of disposal areas can be determined, then, where there is a change to smoothly varying values of terrain conductivity. In areas of buried metal objects, terrain conductivity meters commonly yield apparently negative values. Leachate plumes are generally recognized on the basis of terrain conductivity data as relatively smoothly varying, but anomalously elevated, values compared to the background values for a given site.

Limitations of the Method. As with any of the electrical geophysical methods, terrain conductivity data are subject to interference from such cultural features as buildings, fencing, and underground and overhead power lines. Thus, for certain sensitive geologic applications, the use of the terrain conductivity method in urban settings might be inappropriate.

The usefulness of terrain conductivity soundings for delineating stratigraphic changes with depth is limited by the relatively small combination of coil separations and dipole orientations available with Geonics' equipment. The instruments were not designed for detailed vertical soundings but, according to the manufacturer's literature (Geonics Technical Note TN-8, rev. 1983), give the most accurate results where the earth can be approximated by a two-layer model. Models of the earth calculated from terrain conductivity data are non-unique; in most cases, multiple models can satisfy the observed data.

The terrain conductivity meter instrument response varies with the orientation of the dipoles. In the horizontal dipole mode (coils vertical and co-planar), the instrument is more sensitive to near-surface conductive layers than it is in the vertical dipole mode (coils horizontal and co-planar). In the horizontal dipole mode, the high sensitivity to near-surface conductivity might mask the effects of changes at depth.

APPENDIX
GROUND PENETRATING RADAR SURVEYS

Field Work. A Geophysical Survey Systems, Inc. Model SIR-2 ground penetrating radar system was used for this survey. The SIR-2 is a fully digital system and includes a color monitor, grey-scale thermal printer, and 10-Gbyte digital tape backup system. The transmit/receive antenna is housed in a box that is moved across the surface. The antenna transmits electromagnetic signals into the subsurface and then detects, amplifies, and displays reflections of the signals in real-time on the color monitor. The result is a radar record of the subsurface.

The maximum depth of penetration of the GPR signal and the resolution of the reflections are controlled in part by the frequency of the antenna used and in part by the electrical properties of the subsurface. Hager-Richter owns antennas with the following center frequencies: 120 MHz, 300 MHz, 500 MHz, and 1000 MHz. The total time during which radar signals are recorded can be varied from a few to 1,000 nanoseconds (nsec). However, there is a trade-off between total time, corresponding to depth range, and resolution. As the total time of recording is increased, the resolution of the GPR records decreases. For a given site, the total time window is set to detect features located somewhat below the maximum expected target depths.

Interpretation. The horizontal axis of a GPR record represents distance across the surface and the vertical axis represents round-trip travel time of the radar signal. The round-trip travel time can be converted to approximate depth by correlating with reflections from targets of known depth or by using handbook values of velocities for materials in the subsurface. For those sites where the subsurface is electrically heterogeneous, the travel times of the radar signal may be different in the various materials, and the vertical scale for the radar records is not necessarily uniform with depth.

The reflections in a GPR record are produced by spatial changes in the physical properties (e.g., type of material, subsurface fluids, porosity, etc.) and related changes in the electrical properties (dielectric constant) of the subsurface materials in the path of the signals. The greater the difference in electrical properties between two materials in the subsurface, the stronger the reflection observed in the GPR record.

The size, shape, and amplitude of the GPR reflections are the characteristics that are considered in the interpretation of the data from any site. Because the electrical properties of metal USTs, utilities, and conduits different significantly from those of the soils in which they are buried, such objects produce GPR reflections with high amplitude and distinctive shapes that permit identification with a high degree of reliability. Most other objects, although readily detectable, require "ground truth" for identification. Only excavations provide positive identification for most objects identified in GPR surveys.

For GPR profiles oriented perpendicular to the long axis of a tank, the signature is similar to a hyperbola, the shape of which is a function of the diameter and depth of burial of the tank. For GPR profiles oriented parallel to the long axis of a tank, the signature is a set of parallel, high amplitude reflections that terminate sharply at the ends of the tank. GPR, then, is useful for determining the exact location and dimensions of USTs.

Limitations of the Method. The maximum depth to which GPR signals can penetrate depends on the electrical properties of the subsurface materials. The higher the electrical conductivity of the subsurface materials, the lower the radar signal penetration. Clay minerals and/or brackish water in the subsurface, for example, attenuate the GPR signal, so reflections are not received from materials at greater depths.

There are limitations of the GPR technique as used to detect and/or locate particular targets: (1) surface conditions, (2) electrical conductivity of the ground, (3) contrast of the electrical conductivities of the targets and the ground, and (4) spacing between lines. Of these limitations, only the fourth, line spacing, is controlled by the operator.

The condition of the ground surface can affect the quality of the GPR data and the depth of penetration of the GPR signal. Sites covered with high grass, bushes, landscape structures, debris, obstacles, soil mounds, etc. limit the survey access and the coupling of the GPR antenna with the ground. In many cases, the GPR signal will not penetrate below concrete pavement, and a target may not be detectable.

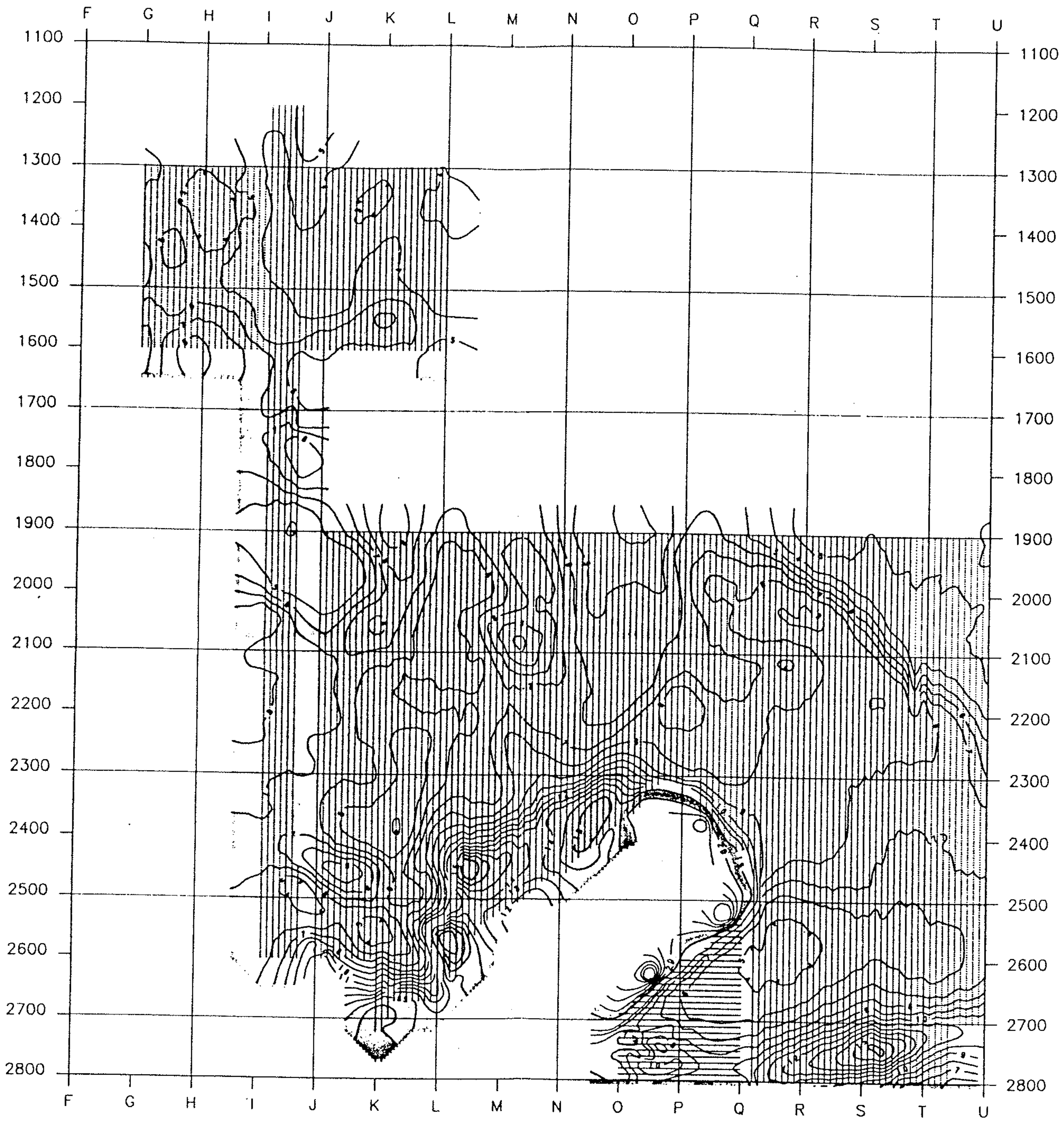
The electrical conductivity of the ground determines the attenuation of the GPR signals, and thereby limits the maximum depth of exploration. The GPR signal does not penetrate clay-rich soils, and targets buried in clay can be missed.

A contrast in the electrical conductivities of the ground and the target is required to obtain a reflection of the GPR signal. If the contrast is too small, possibly due to extremely corroded conditions of a metal target, then the reflection may be too weak to recognize, and the target can be missed.

The spacing between lines is under control of the GPR operator, and the design of the survey is based on the dimensions of the smallest target of interest. Targets with dimensions smaller than the spacing between GPR survey lines can be missed.

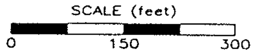
Accurate determination of the depth to any interface requires calibration of the site specific GPR signal velocity. Where targets of a known depth are not available at a site, the time-to-depth conversion of the GPR signal can be estimated from handbook values, but such depth estimations might contain significant error.

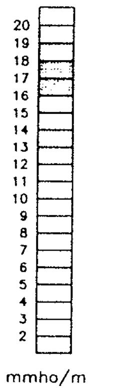
Interpretation of GPR data is subjective. As noted above, "ground truth" through correlation with borings and excavations is required for positive identification of most objects detected on the basis of GPR data.



LEGEND

· DATA STATION





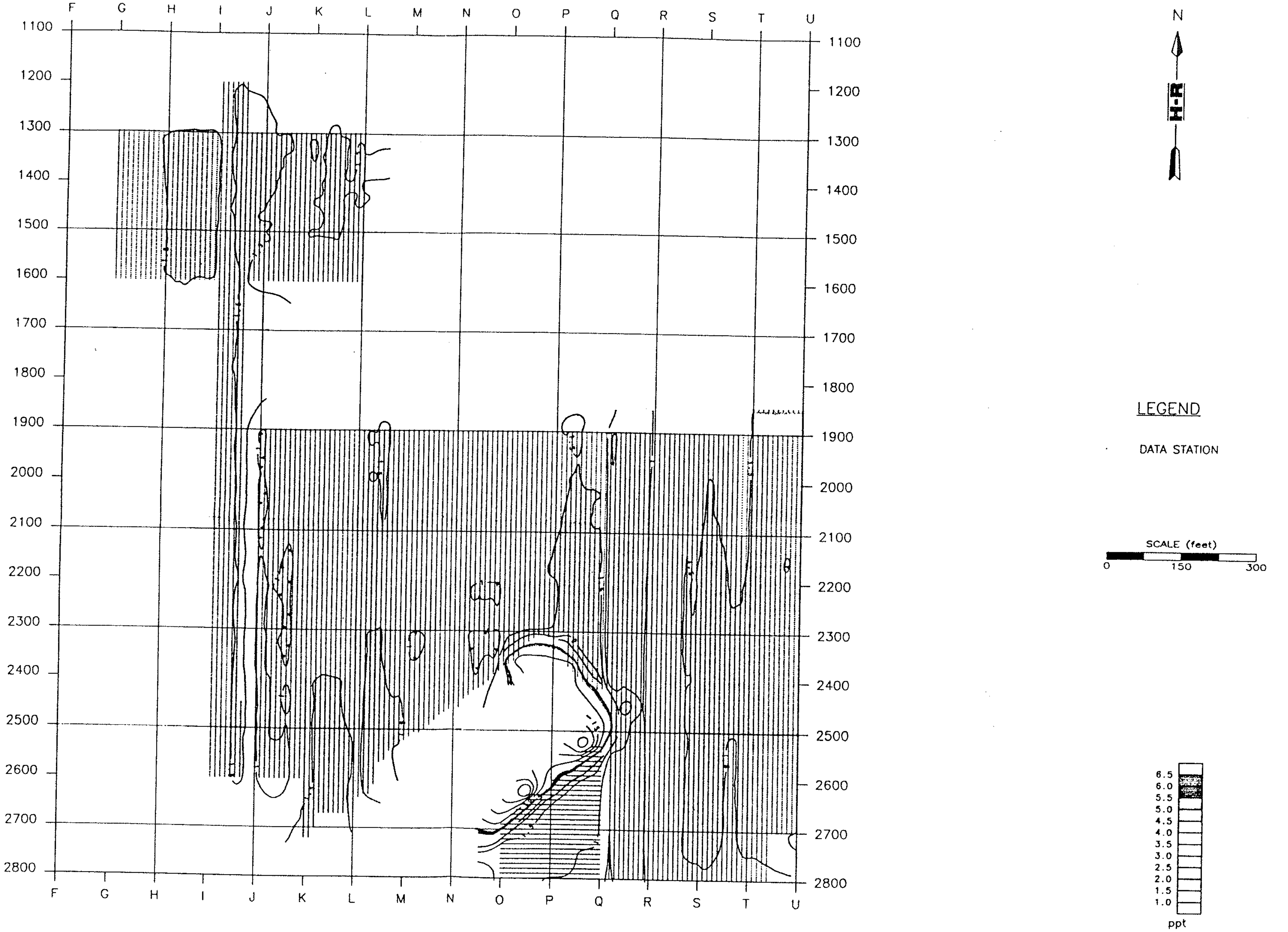
NOTES:

1. Data were recorded with EM31 in vertical dipole mode with boom perpendicular to traverse line.
2. Grid conventions established by Rust Environment & Infrastructure Inc.

PLATE 1
APPARENT CONDUCTIVITY
CUMBERLAND BAY SLUDGE BED SITE
PLATTSBURGH-CLINTON COUNTY, NEW YORK
NYSDEC SITE NO. 510017

FILE 97G64
JULY, 1998

HAGER-RICHTER GEOSCIENCE, INC.
SALEM, NEW HAMPSHIRE



NOTES:

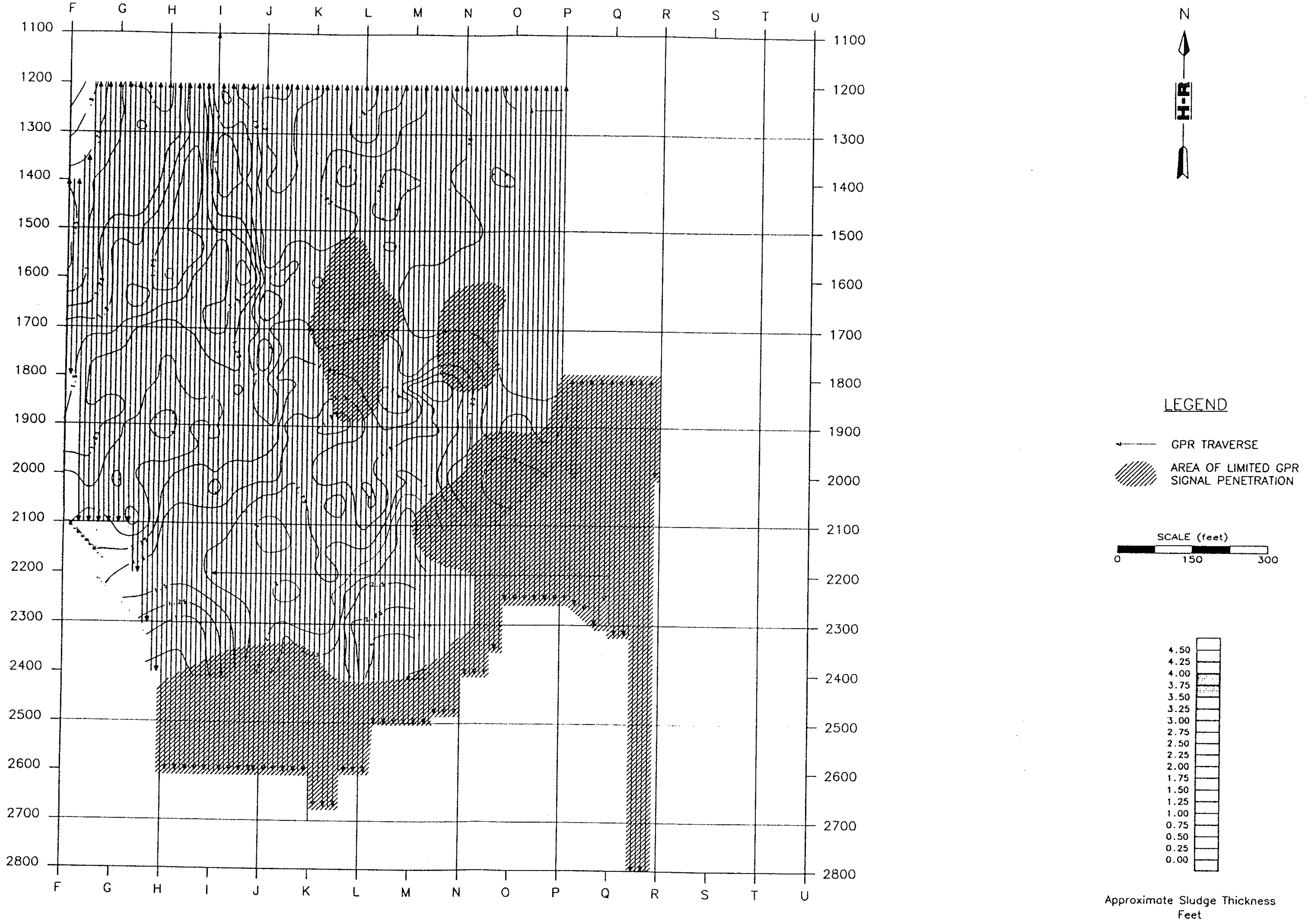
1. Data were recorded with EM31 in vertical dipole mode with boom perpendicular to traverse line.

2. Grid conventions established by Rust Environment & Infrastructure Inc.

PLATE 2
IN-PHASE COMPONENT
CUMBERLAND BAY SLUDGE BED SITE
PLATTSBURGH-CLINTON COUNTY, NEW YORK
NYSDEC SITE NO. 510017

FILE 97G64	JULY, 1998

HAGER-RICHTER GEOSCIENCE, INC.
SALEM, NEW HAMPSHIRE



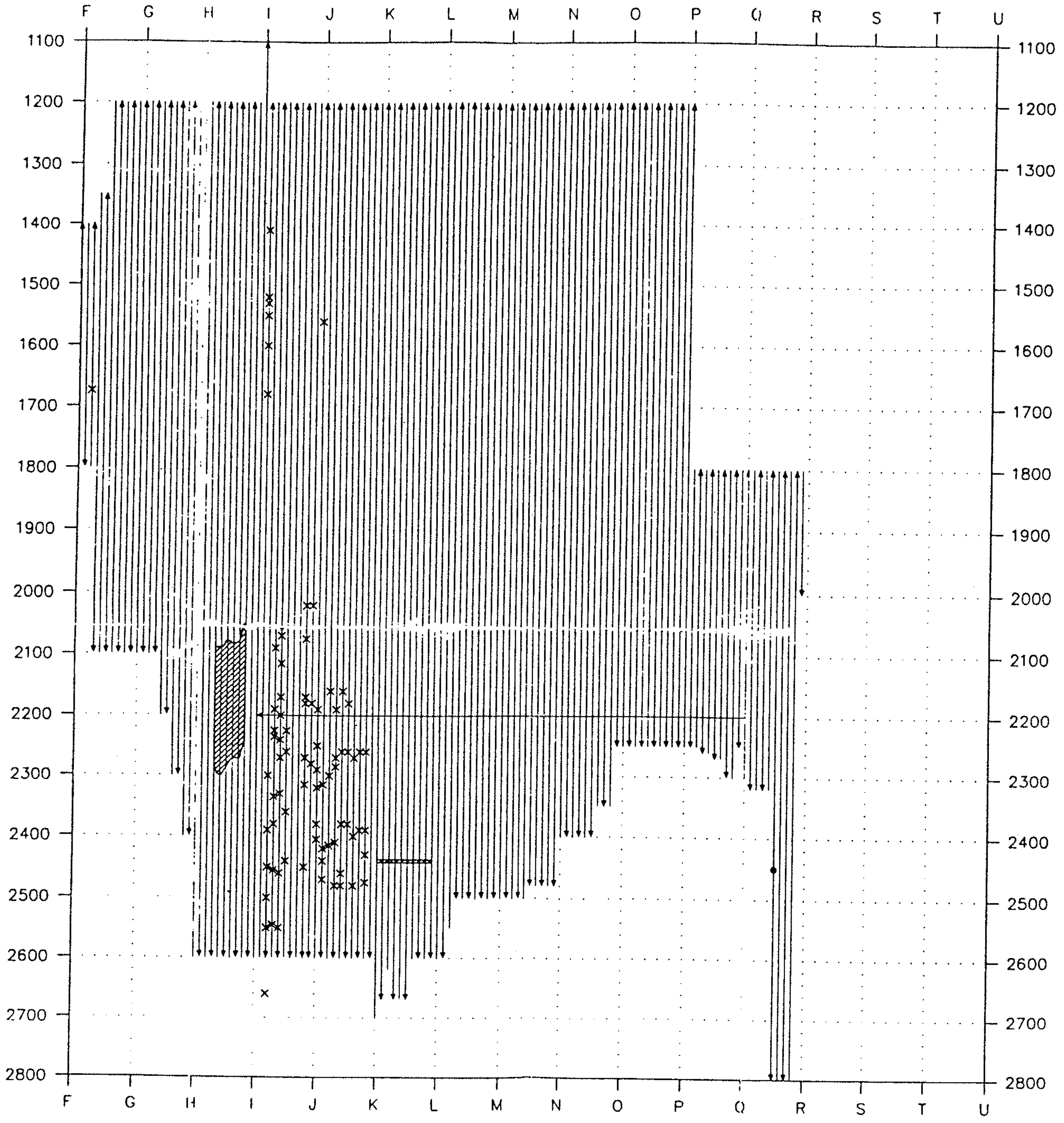
NOTES:

1. Thickness is approximate only. The actual time-to-depth conversion for the GPR signal varies with the dielectric properties of the materials in the subsurface and is not necessarily uniform.
2. The approximate sludge thickness contours shown on this plot are a non-unique model. The contours represent interpolations based on the assumption that the first sub-bottom GPR reflector represents the bottom of the sludge. The thickness of the sludge at any particular location may differ from that shown. Sludge thickness based on additional data may differ significantly.
3. GPR data for the southern and eastern edges of the survey area were not interpreted because of limited GPR signal penetration.
4. Grid conventions established by Rust Environment & Infrastructure Inc.

PLATE 3
GPR SURVEY
CUMBERLAND BAY SLUDGE BED SITE
PLATTSBURGH-CLINTON COUNTY, NEW YORK
NYSDEC SITE NO. 510017

FILE 97G64	JULY, 1998

HAGER-RICHTER GEOSCIENCE, INC.
SALEM, NEW HAMPSHIRE



LEGEND

← GPR TRAVERSE

× UNIDENTIFIED OBJECT

▨ UNIDENTIFIED OBJECT, LARGE

• UNIDENTIFIED METAL OBJECT

SCALE (feet)

0 150 300

NOTE:

Grid conventions established by Rust Environment
& Infrastructure Inc.

PLATE 4
SUBMERGED OBJECTS
CUMBERLAND BAY SLUDGE BED SITE
PLATTSBURGH–CLINTON COUNTY, NEW YORK
NYSDEC SITE NO. 510017

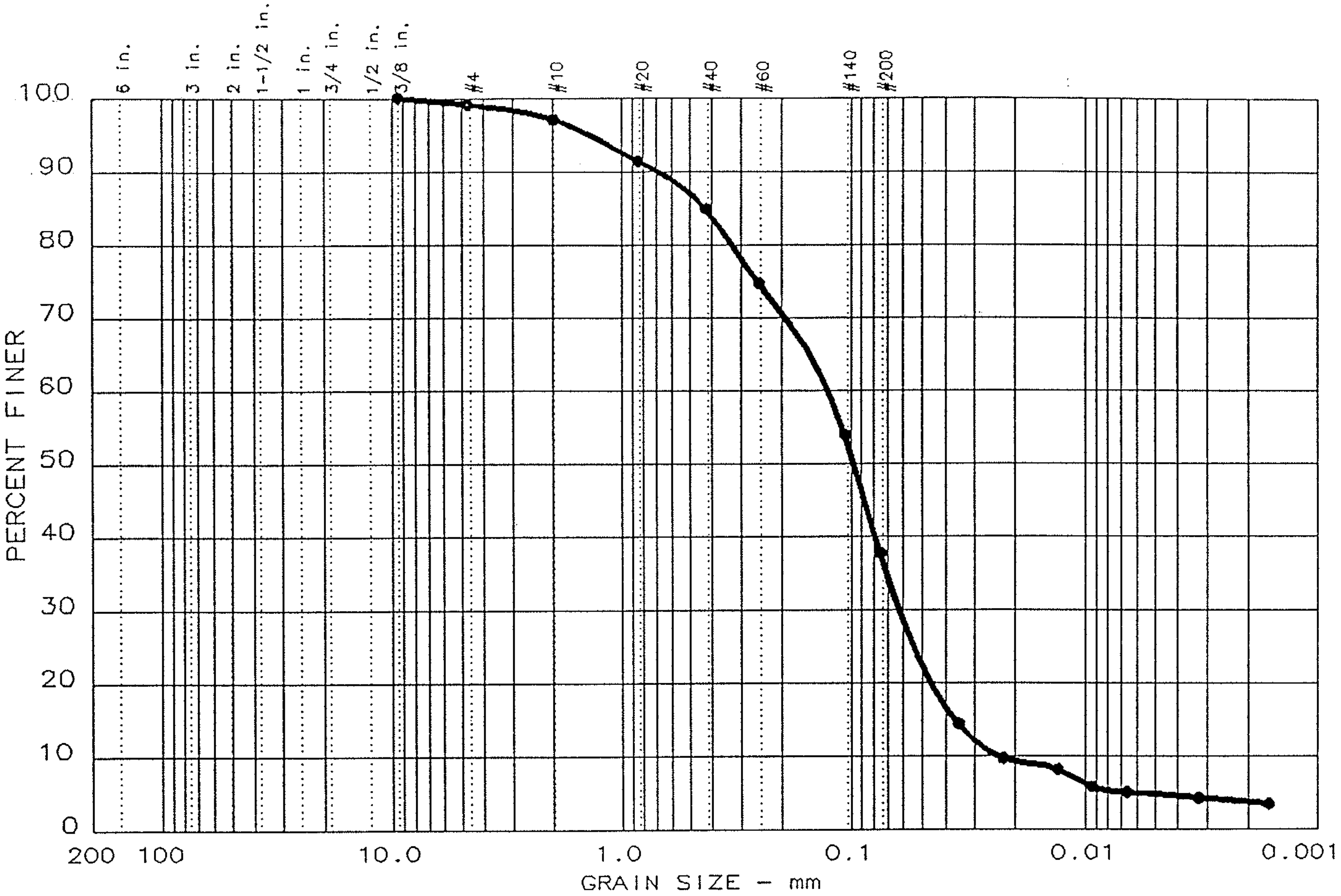
FILE 97G64	JULY, 1998

HAGER–RICHTER GEOSCIENCE, INC.
SALEM, NEW HAMPSHIRE

APPENDIX F

February 1998 Gradation Curves

PARTICLE SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	15	0.0	1.0	61.3	32.9	4.8

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			0.427	0.125	0.0971	0.0624	0.0363	0.0237	1.31	5.3

MATERIAL DESCRIPTION	USCS	AASHTO
● Dark Grey Silty Sand		

Project No.: 2800
Project: CUMBERLAND BAY
● Location: H-1900

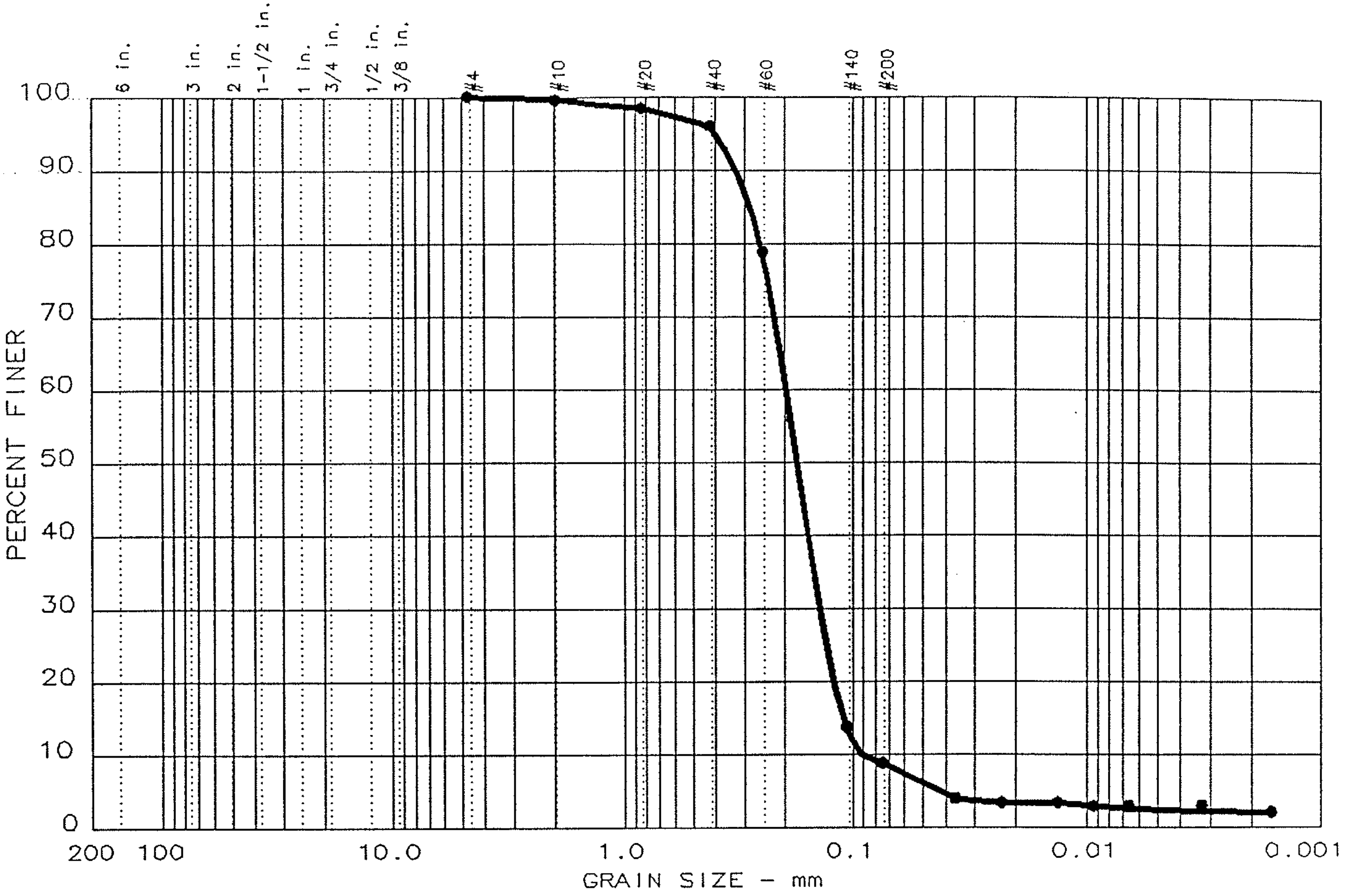
Date: 25 MARCH 1998

KIBER
ENVIRONMENTAL
SERVICES, INC.

Remarks:

Figure No. ______

PARTICLE SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	11	0.0	0.0	91.2	6.5	2.3

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			0.282	0.196	0.175	0.139	0.109	0.0906	1.09	2.2

MATERIAL DESCRIPTION	USCS	AASHTO
● Dark Grey Sand		

Project No.: 2800
Project: CUMBERLAND BAY
● Location: H-2100

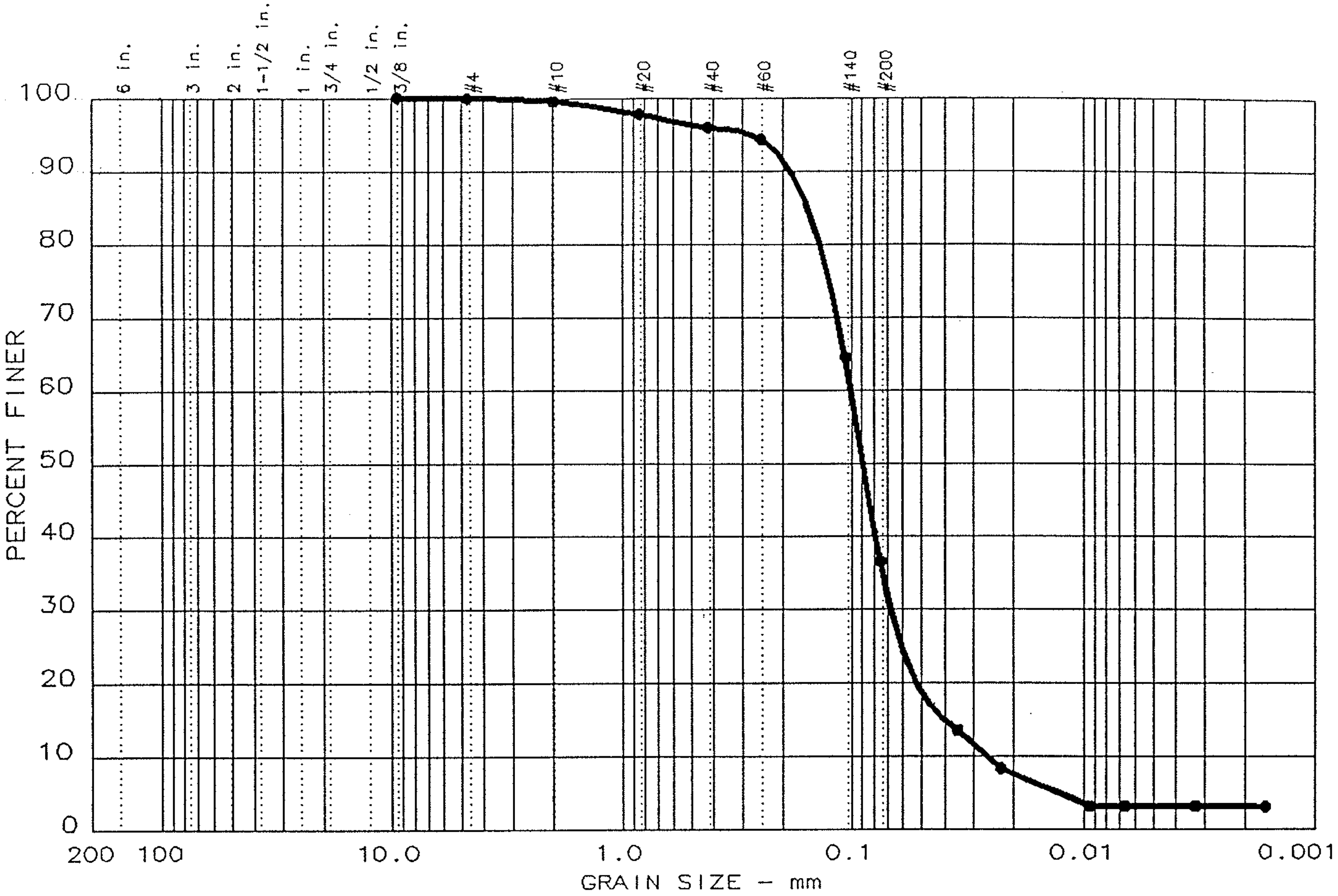
Date: 25 MARCH 1998

KIBER
ENVIRONMENTAL
SERVICES, INC.

Remarks:

Figure No. 3

PARTICLE SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	19	0.0	0.1	63.5	33.3	3.1

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			0.155	0.100	0.0889	0.0675	0.0397	0.0262	1.73	3.8

MATERIAL DESCRIPTION	USCS	AASHTO
● Dark Grey Silty Sand		

Project No.: 2800
Project: CUMBERLAND BAY
● Location: J-1200

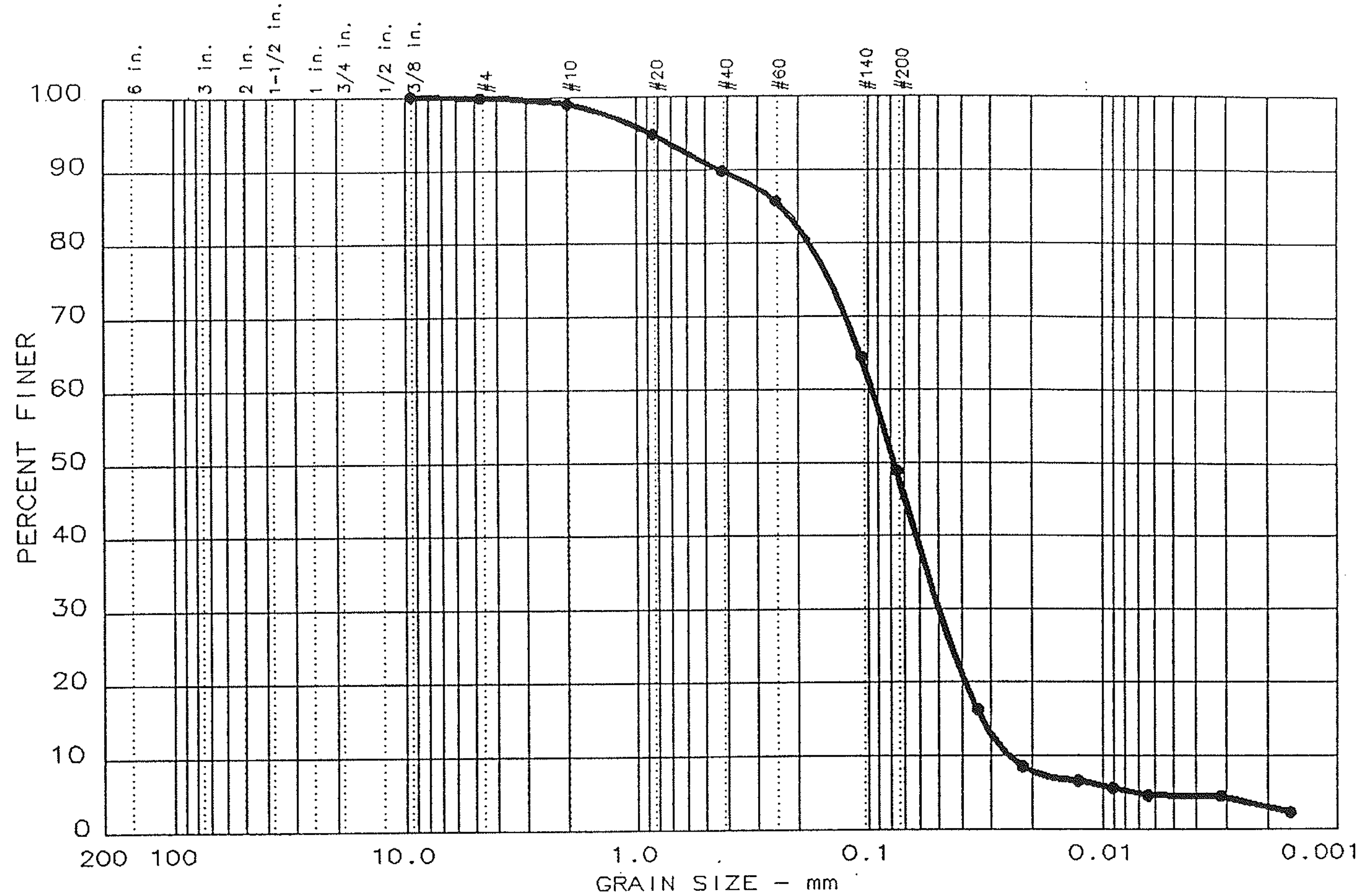
Date: 25 MARCH 1998

KIBER
ENVIRONMENTAL
SERVICES, INC.

Remarks:

Figure No. ______

PARTICLE SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	19	0.0	0.2	51.0	44.3	4.5

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			0.237	0.0955	0.0767	0.0499	0.0326	0.0250	1.04	3.8

MATERIAL DESCRIPTION	USCS	AASHTO
● Dark Grey Silty Sand		

Project No.: 2800

Project: CUMBERLAND BAY

● Location: J-1400

Date: 25 MARCH 1998

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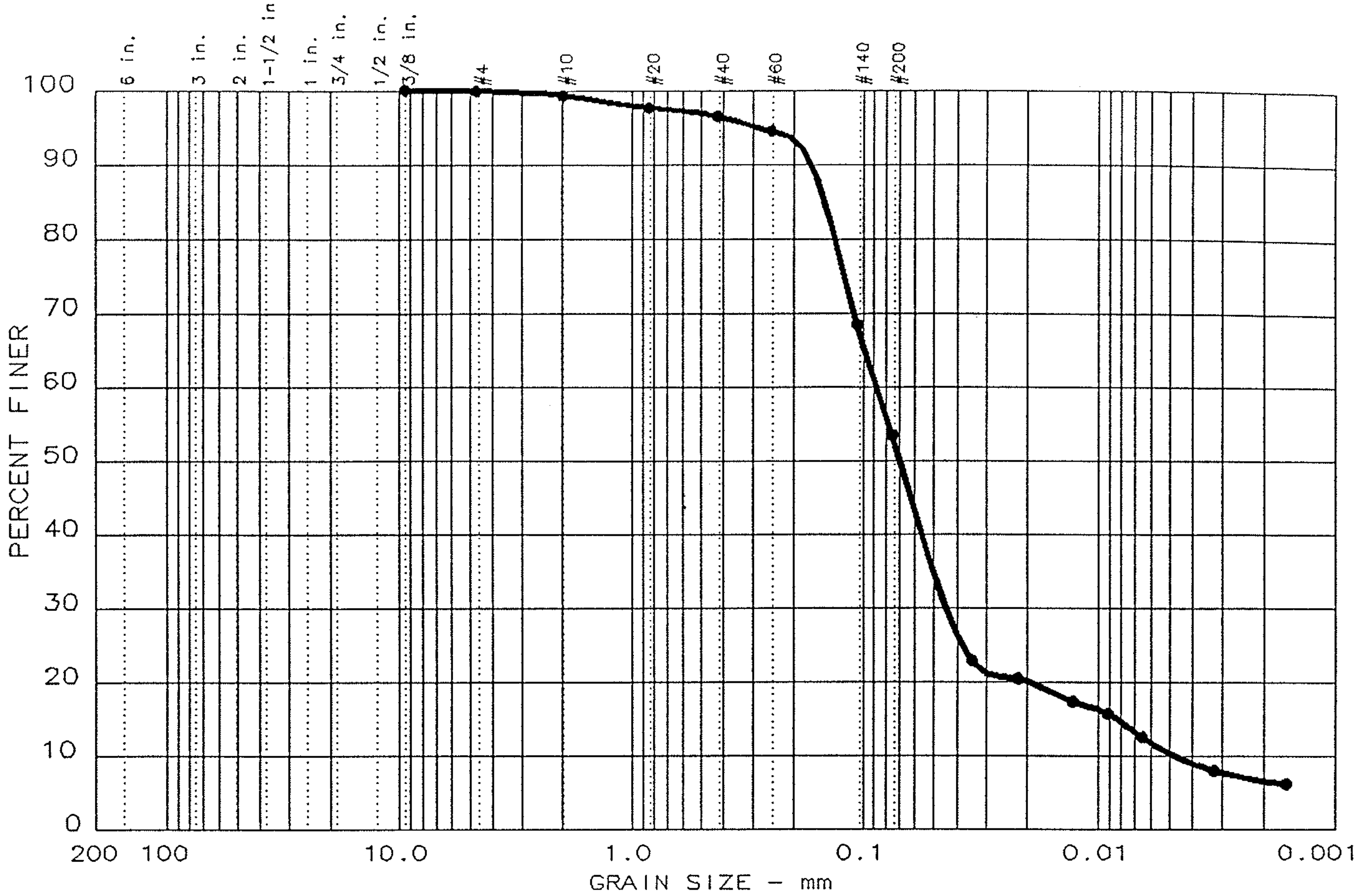
SERVICES, INC.

Remarks:

Figure No. 1

PARTICLE SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	16	0.0	0.1	46.5	43.2	10.2

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			0.146	0.0876	0.0694	0.0443	0.0083	0.0046	4.83	18.9

MATERIAL DESCRIPTION	USCS	AASHTO
● Dark Grey Sandy Clayey Silt		

Project No.: 2800
Project: CUMBERLAND BAY
● Location: J-1700

Date: 25 MARCH 1998

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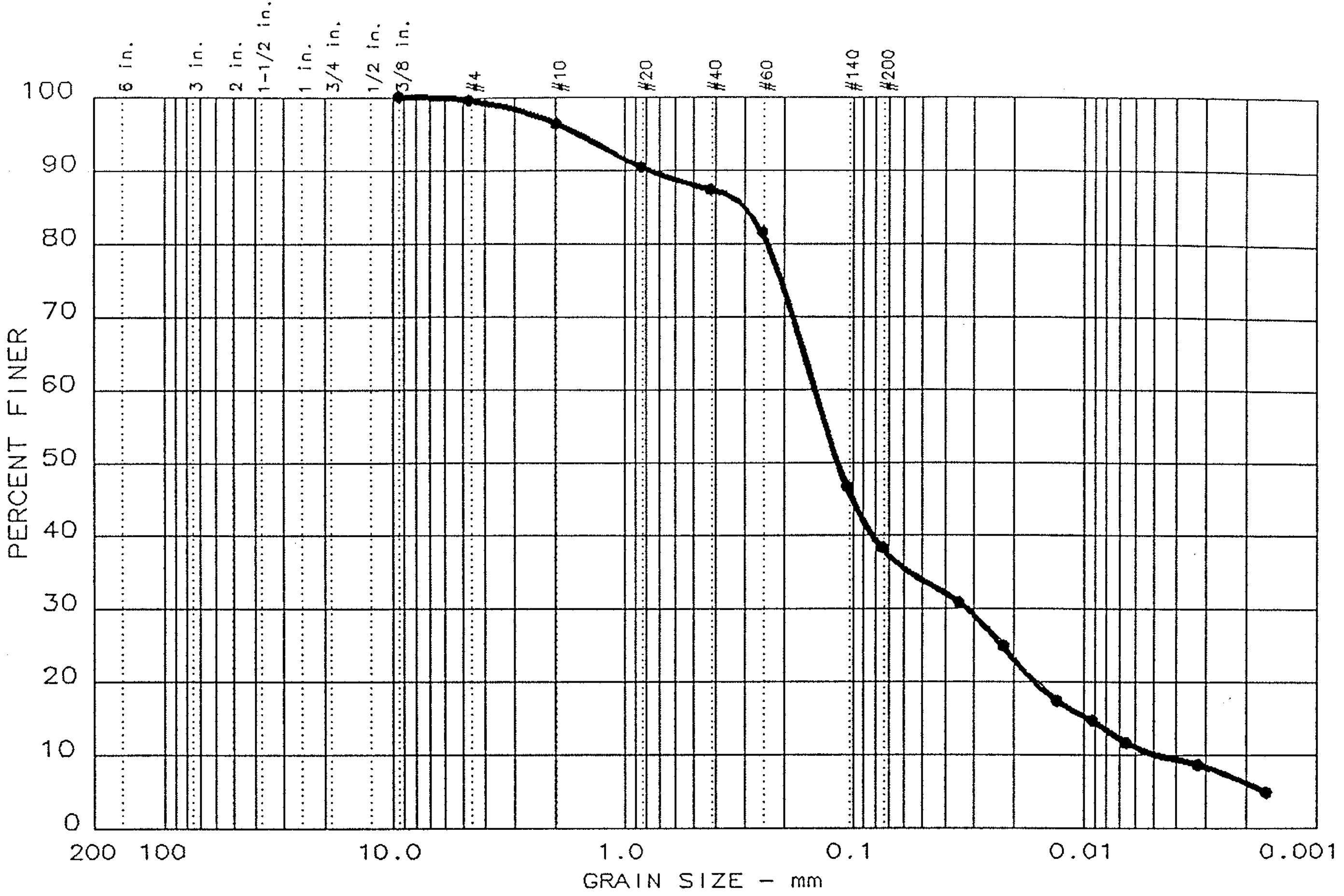
Remarks:

Figure No. 2

PARTICLE SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	18	0.0	0.5	61.2	28.2	10.1

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			0.299	0.146	0.116	0.0323	0.0096	0.0047	1.53	31.3

MATERIAL DESCRIPTION	USCS	AASHTO
● Dark Grey Clayey Silty Sand		

Project No.: 2800
Project: CUMBERLAND BAY
● Location: J-2300

Date: 25 MARCH 1998

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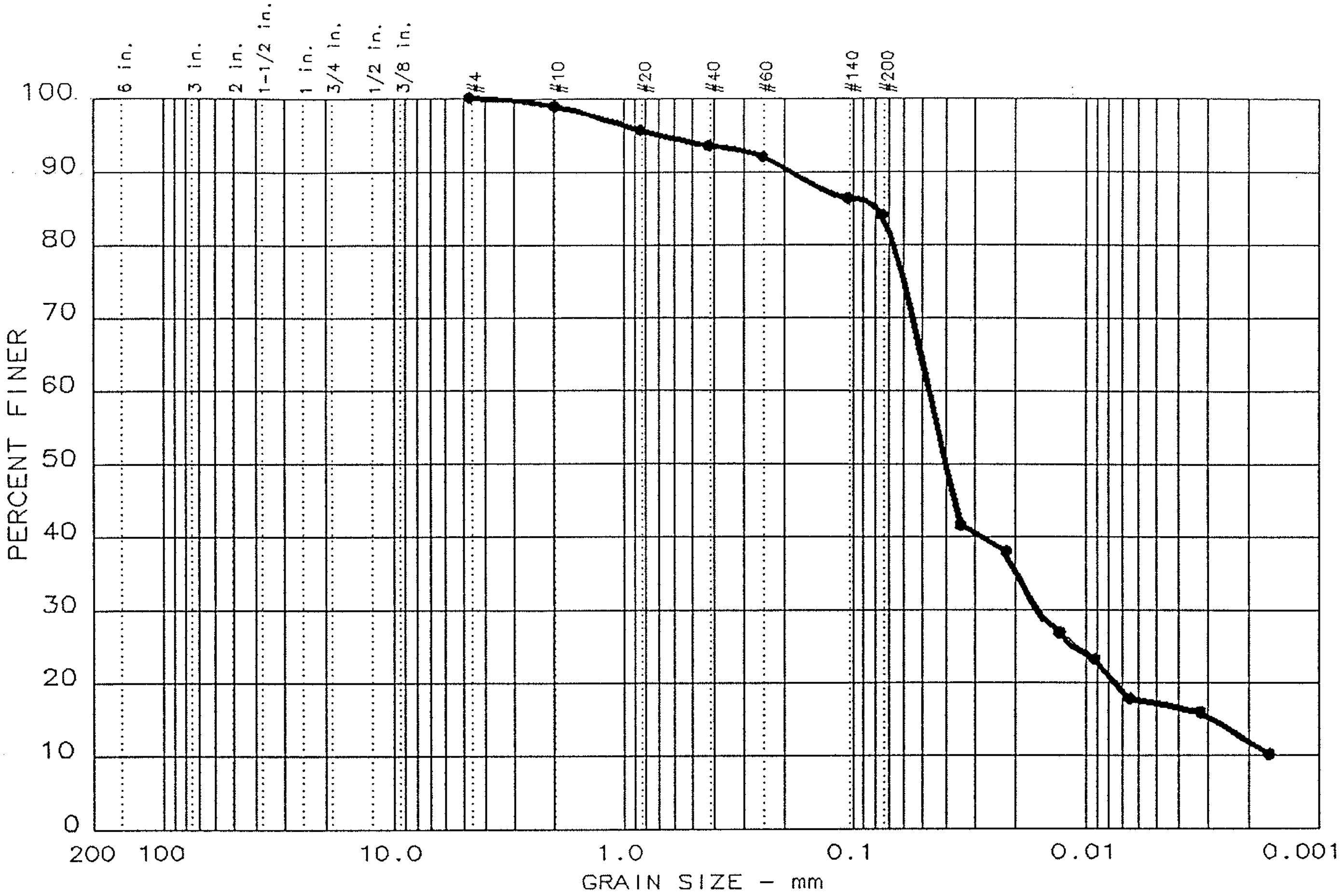
SERVICES, INC.

Remarks:

Figure No. 1

PARTICLE SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	6	0.0	0.0	16.0	66.9	17.1

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			0.0785		0.0398	0.0160	0.0028			

MATERIAL DESCRIPTION	USCS	AASHTO
● Dark Grey Sandy Clayey Silt		

Project No.: 2800
Project: CUMBERLAND BAY
● Location: J-2500

Date: 03 March 1998

KIBER
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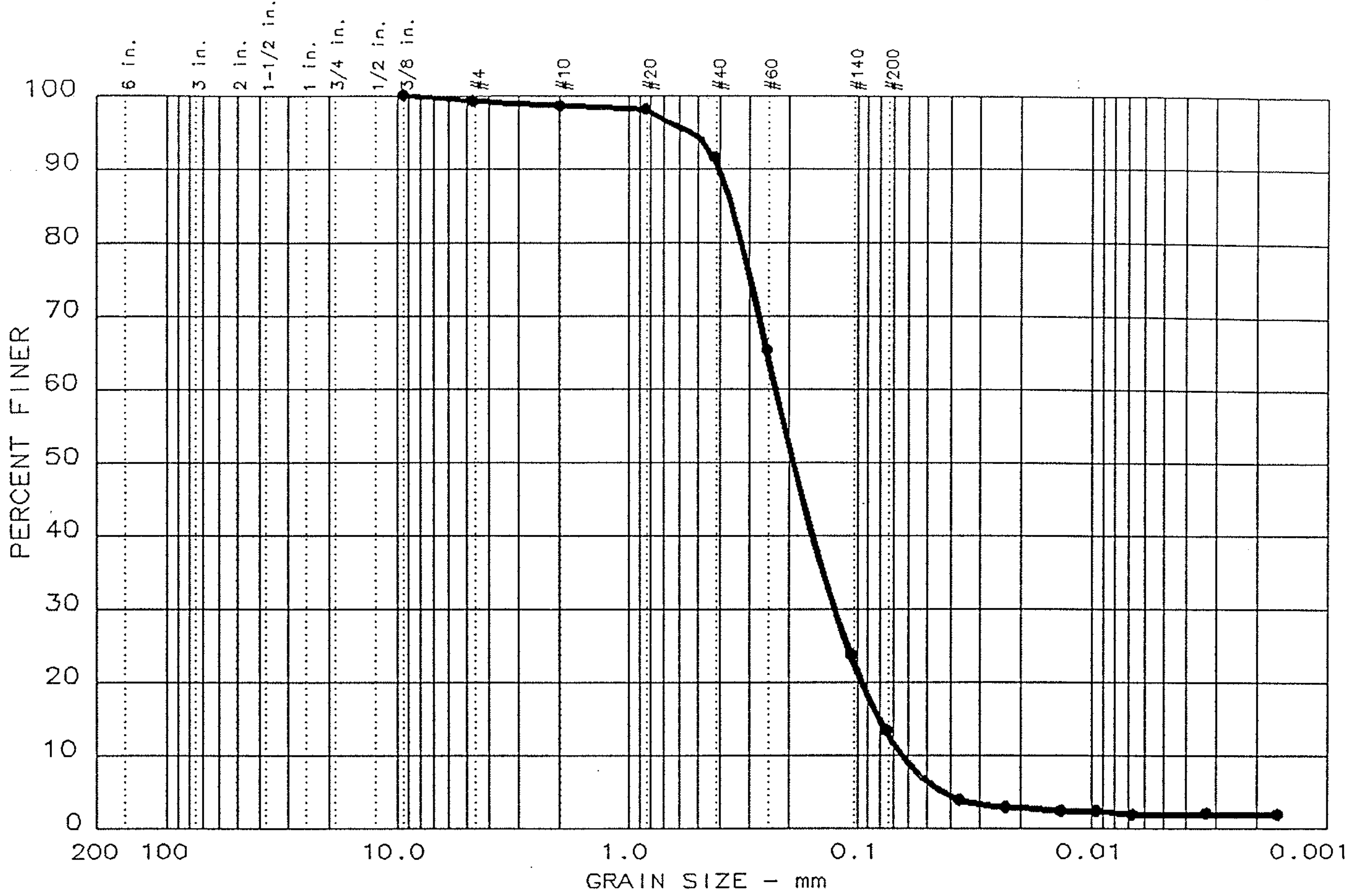
SERVICES, INC.

Remarks:

Figure No. ______

PARTICLE SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	12	0.0	0.8	85.8	11.5	1.9

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			0.356	0.228	0.190	0.125	0.0795	0.0632	1.08	3.6

MATERIAL DESCRIPTION	USCS	AASHTO
● Dark Grey Silty Sand		

Project No.: 2800
Project: CUMBERLAND BAY
● Location: L-1400

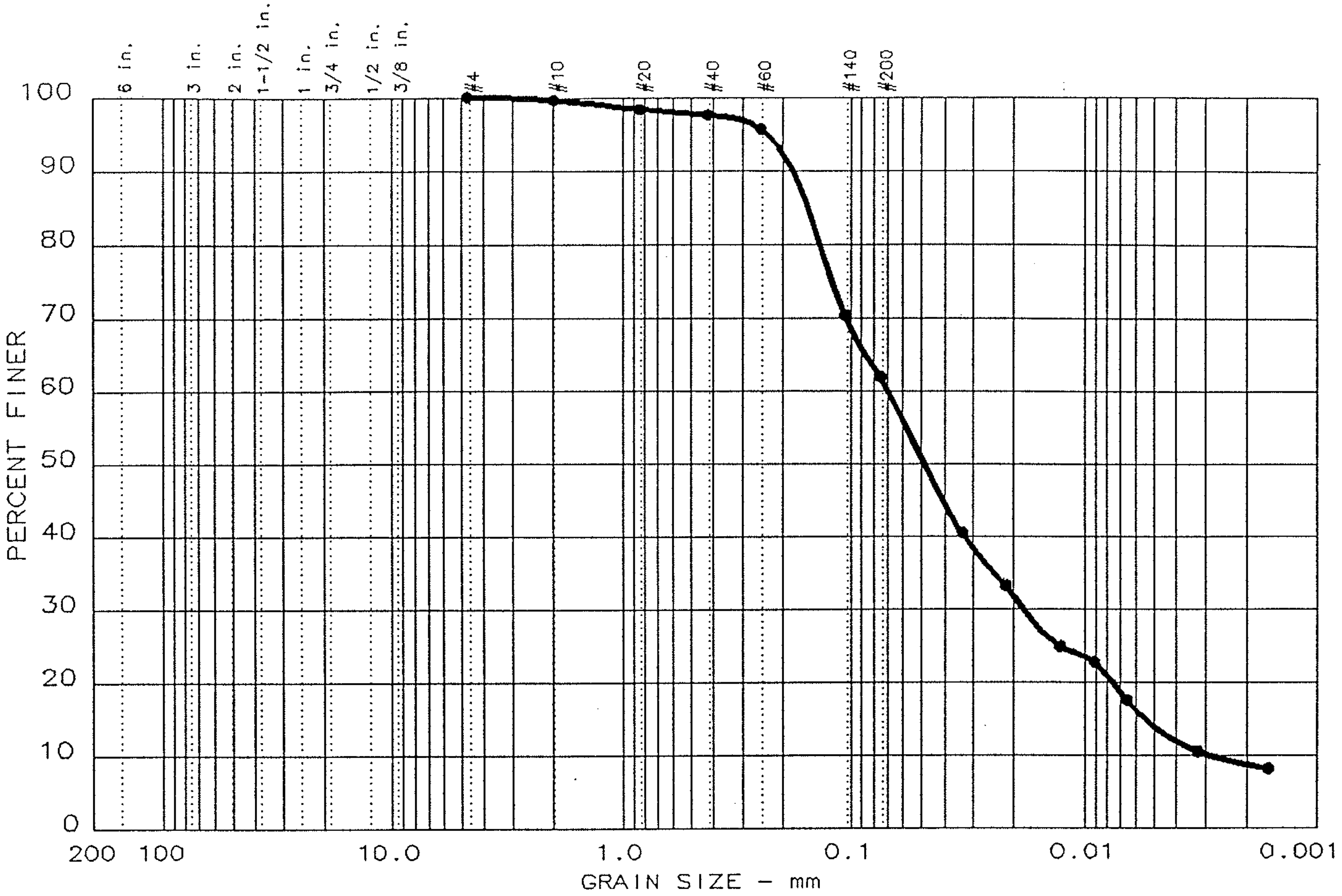
Date: 25 MARCH 1998

KIBER
ENVIRONMENTAL
SERVICES, INC.

Remarks:

Figure No. 3

PARTICLE SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	17	0.0	0.0	38.1	48.0	13.9

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			0.153		0.0484	0.0180	0.0055	0.0029	1.62	24.0

MATERIAL DESCRIPTION	USCS	AASHTO
● Dark Grey Sandy Clayey Silt		

Project No.: 2800
Project: CUMBERLAND BAY
● Location: L-1900

Date: 25 MARCH 1998

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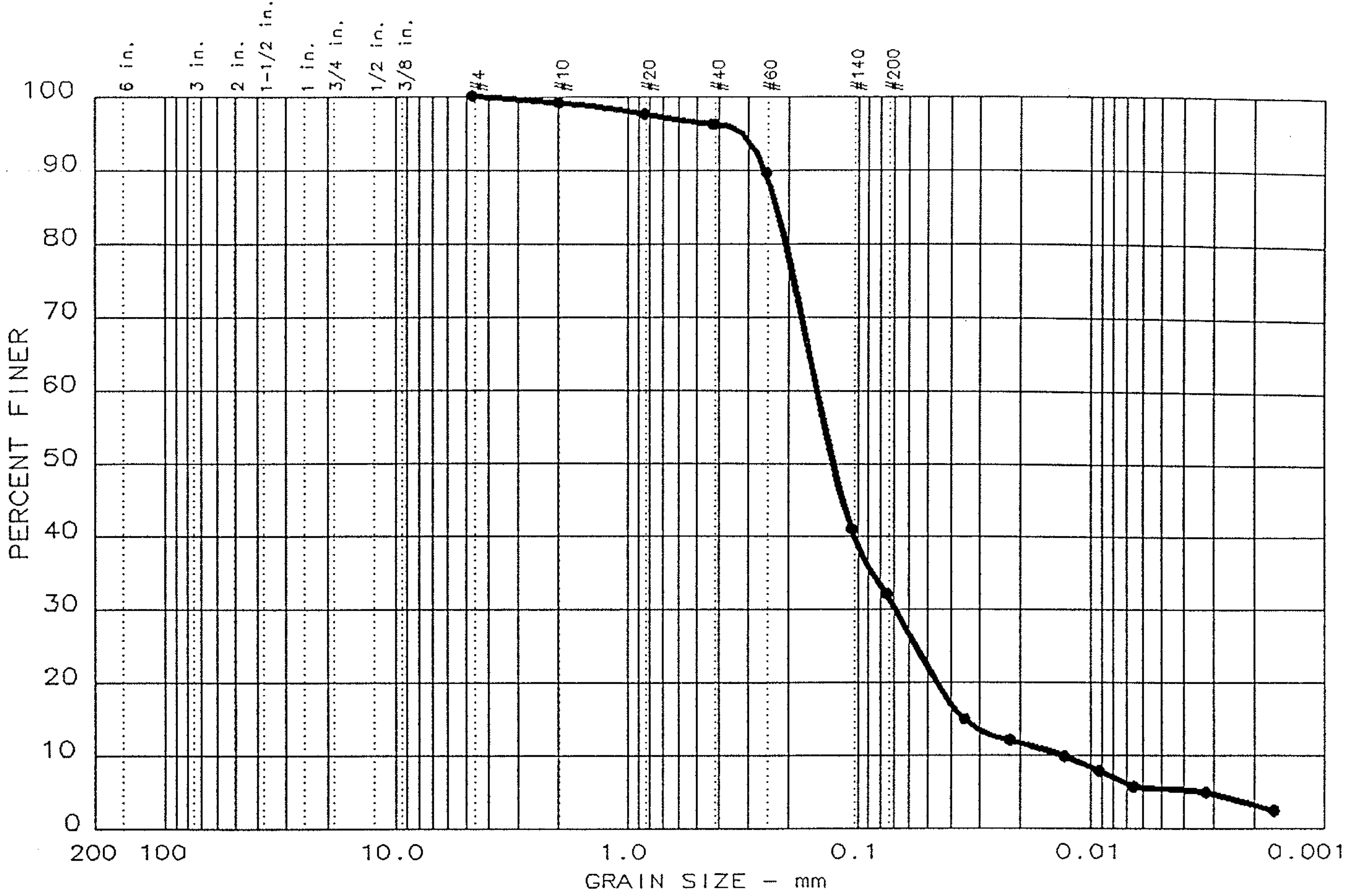
SERVICES, INC.

Remarks:

Figure No. ______

PARTICLE SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	9	0.0	0.0	68.0	26.6	5.4

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			0.225	0.149	0.127	0.0683	0.0350	0.0133	2.34	11.2

MATERIAL DESCRIPTION	USCS	AASHTO
● Dark Grey Silty Sand		

Project No.: 2800

Project: CUMBERLAND BAY

● Location: L-2100

Date: 25 MARCH 1998

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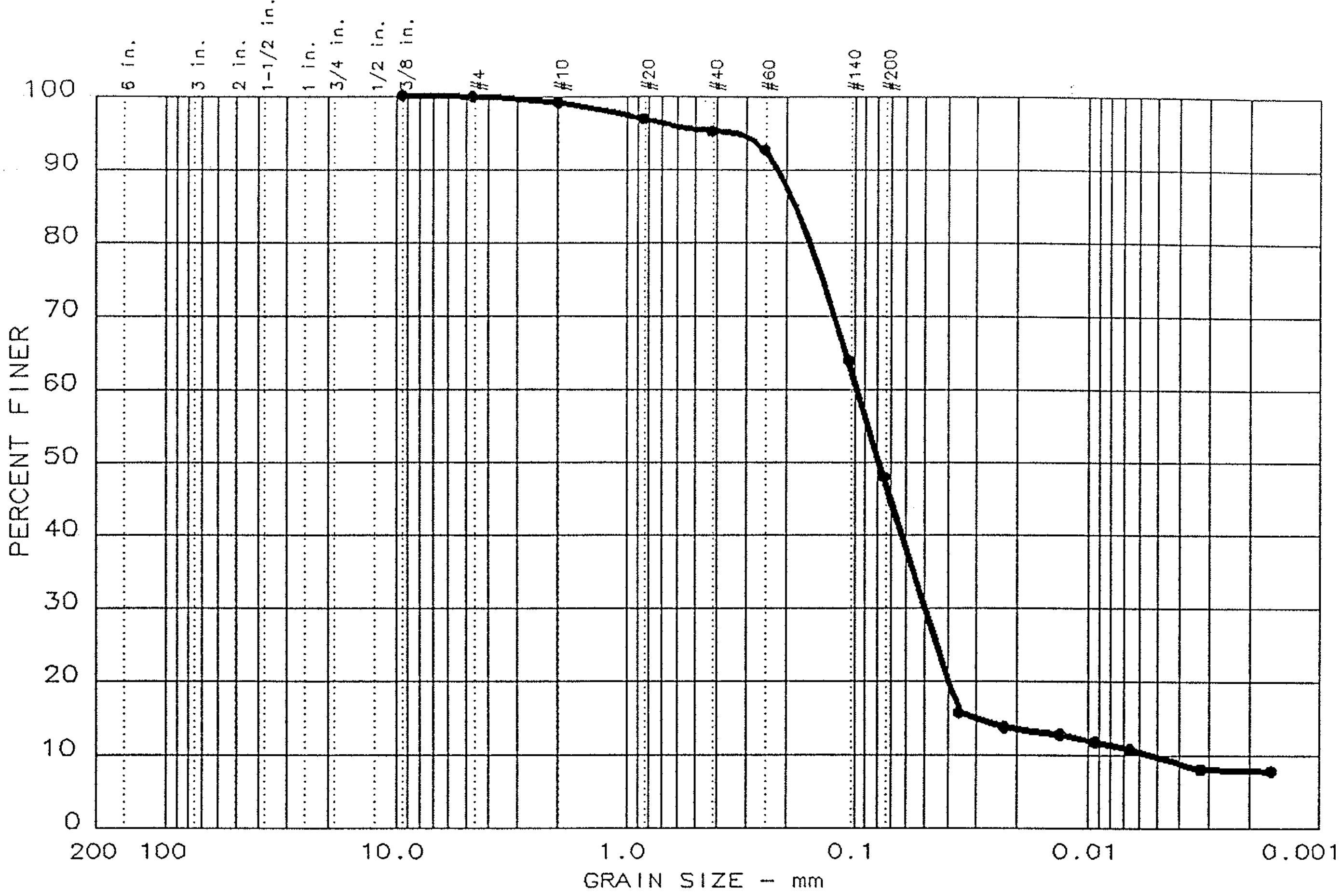
SERVICES, INC.

Remarks:

Figure No. ______

PARTICLE SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	14	0.0	0.1	51.9	38.2	9.8

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			0.182	0.0974	0.0783	0.0498	0.0300	0.0053	4.83	18.5

MATERIAL DESCRIPTION	USCS	AASHTO
● Dark Grey Clayey Silty Sand		

Project No.: 2800
Project: CUMBERLAND BAY
● Location: L 2600

Date: 25 MARCH 1998

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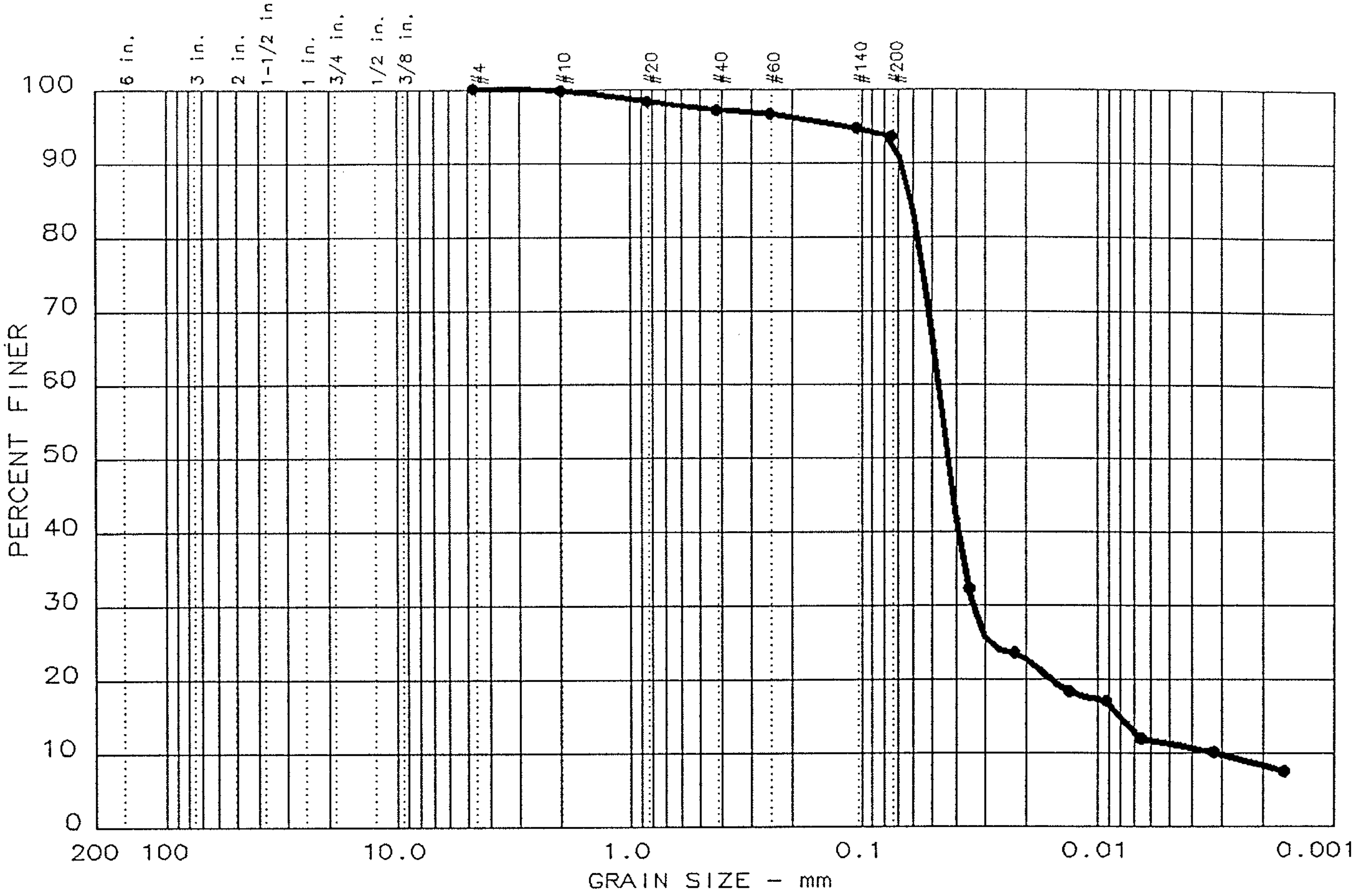
SERVICES, INC.

Remarks:

Figure No. 1

PARTICLE SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	13	0.0	0.0	6.5	82.3	11.2

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●					0.0429	0.0338	0.0080	0.0032	7.70	14.9

MATERIAL DESCRIPTION	USCS	AASHTO
● Dark Grey Clayey Silt		

Project No.: 2800
Project: CUMBERLAND BAY
● Location: M2400 (0-4)

Date: 25 MARCH 1998

KIBER
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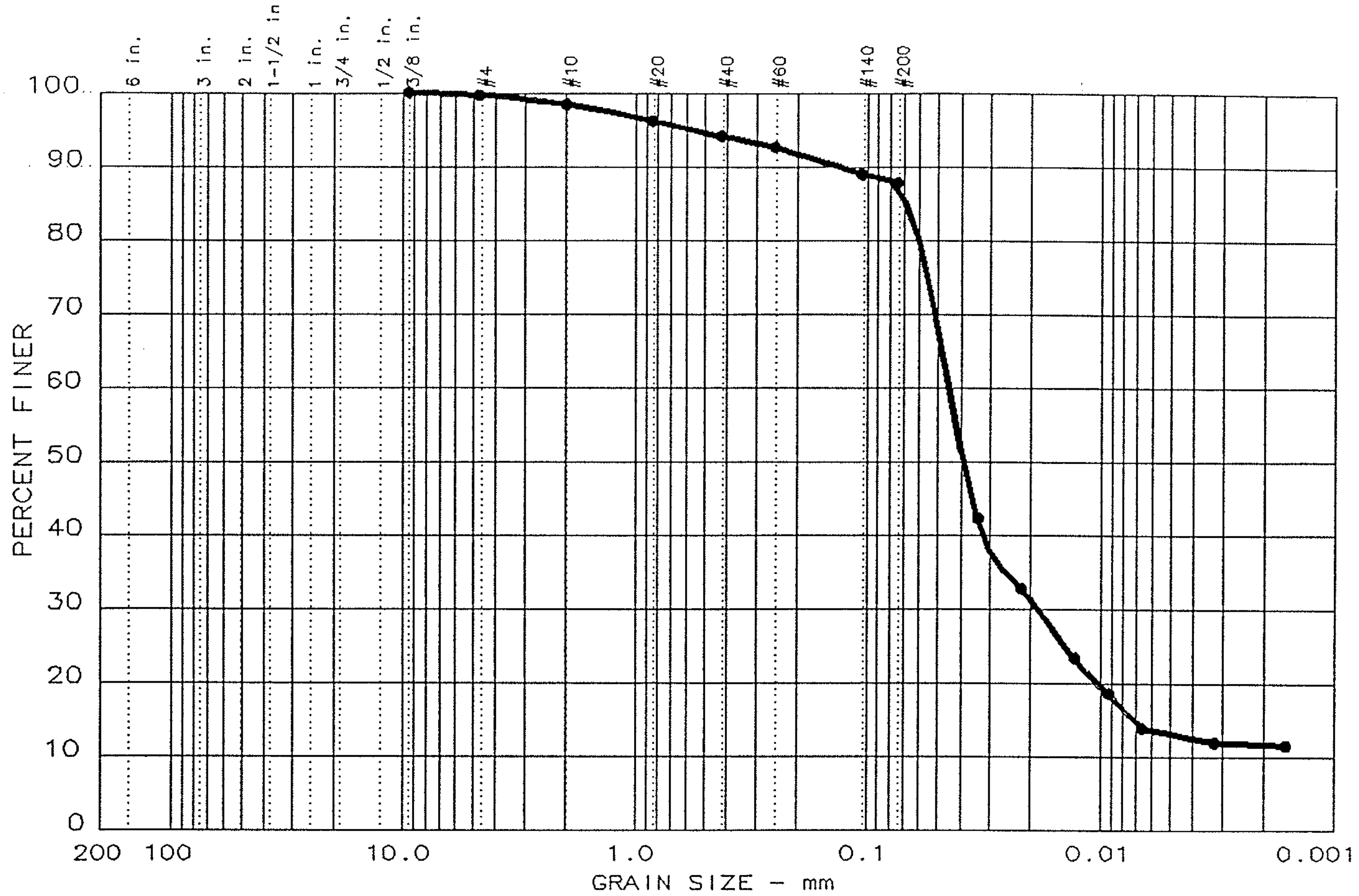
SERVICES, INC.

Remarks:

Figure No. 1

PARTICLE SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	10	0.0	0.4	11.9	74.7	13.0

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●					0.0389	0.0184	0.0072			

MATERIAL DESCRIPTION	USCS	AASHTO
● Dark Grey Sandy Clayey Silt		

Project No.: 2800
Project: CUMBERLAND BAY
● Location: M-2400(4-5.5)

Date: 25 MARCH 1998

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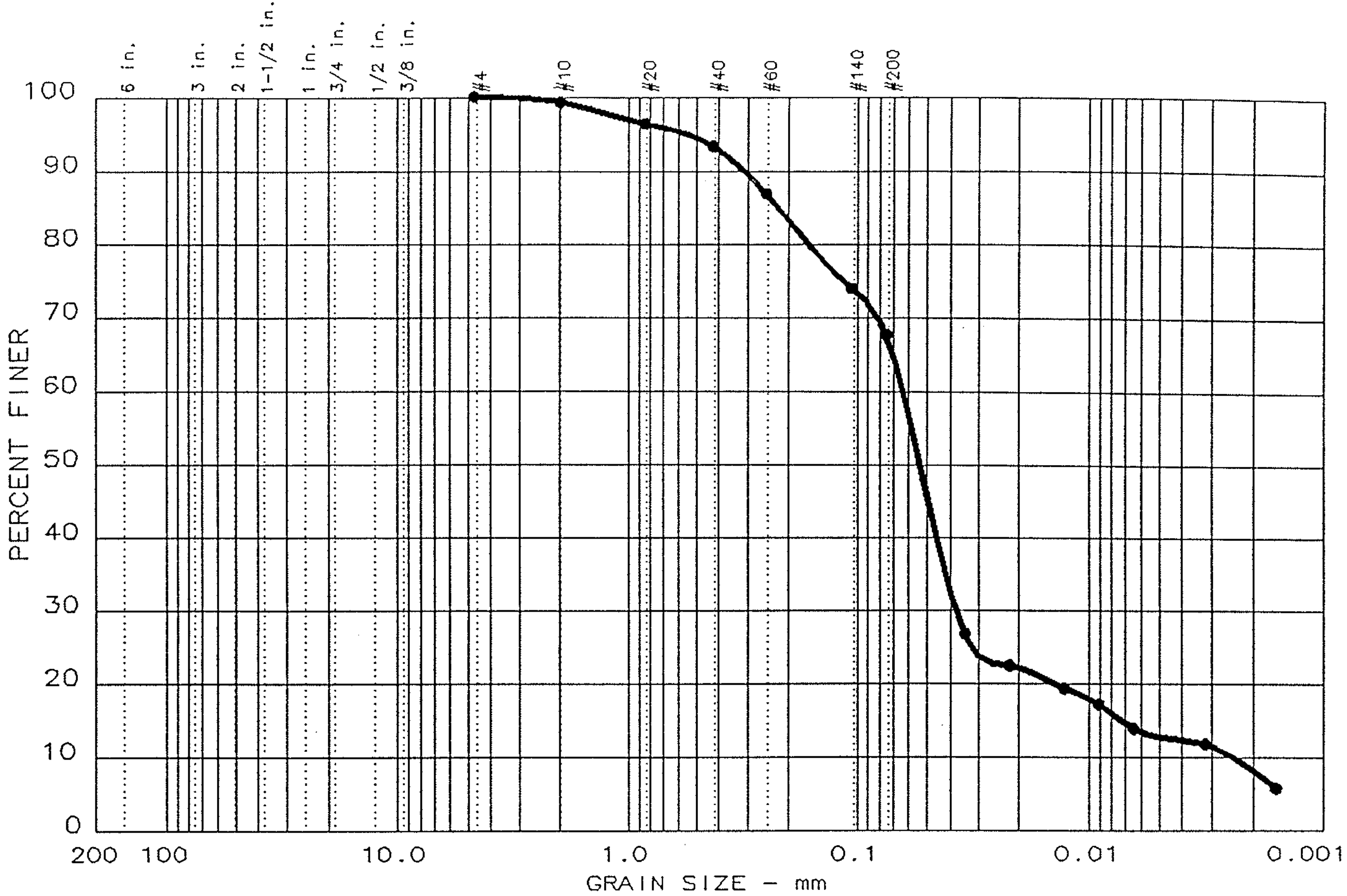
SERVICES, INC.

Remarks:

Figure No. ______

PARTICLE SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	1	0.0	0.0	32.4	54.9	12.7

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			0.221		0.0535	0.0376	0.0072	0.0024	9.20	26.1

MATERIAL DESCRIPTION	USCS	AASHTO
● Dark Grey Sandy Clayey Silt		

Project No.: 2800
Project: CUMBERLAND BAY
● Location: M-2400 (5.5-10.9)

Date: 25 MARCH 1998

KIBER
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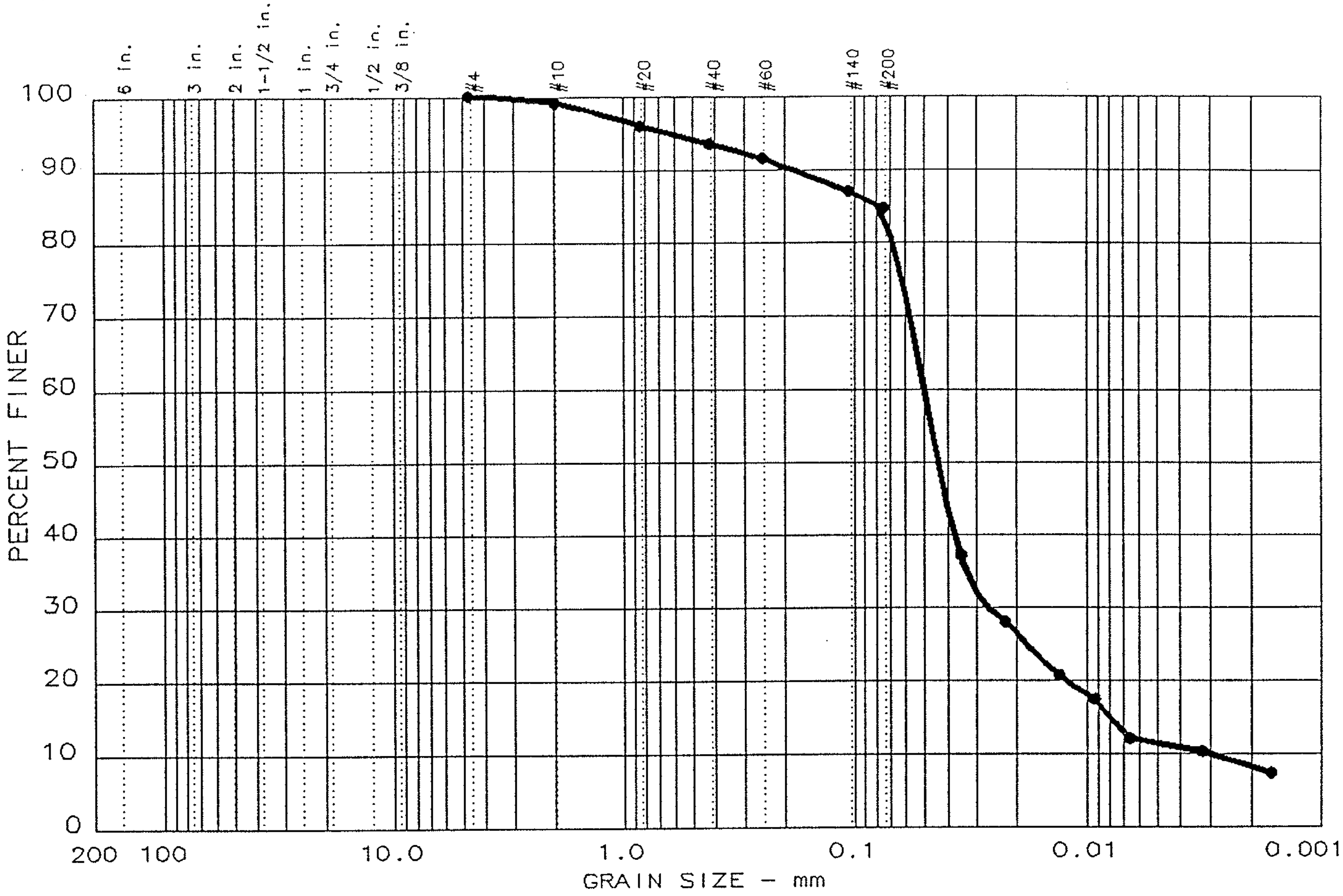
SERVICES, INC.

Remarks:

Figure No. ______

PARTICLE SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	8	0.0	0.0	15.3	73.2	11.5

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			0.0785		0.0436	0.0266	0.0079	0.0029	4.91	17.3

MATERIAL DESCRIPTION	USCS	AASHTO
● Dark Grey Sandy Clayey Silt		

Project No.: 2800
Project: CUMBERLAND BAY
● Location: N-2400 (0-5)

Date: 25 MARCH 1998

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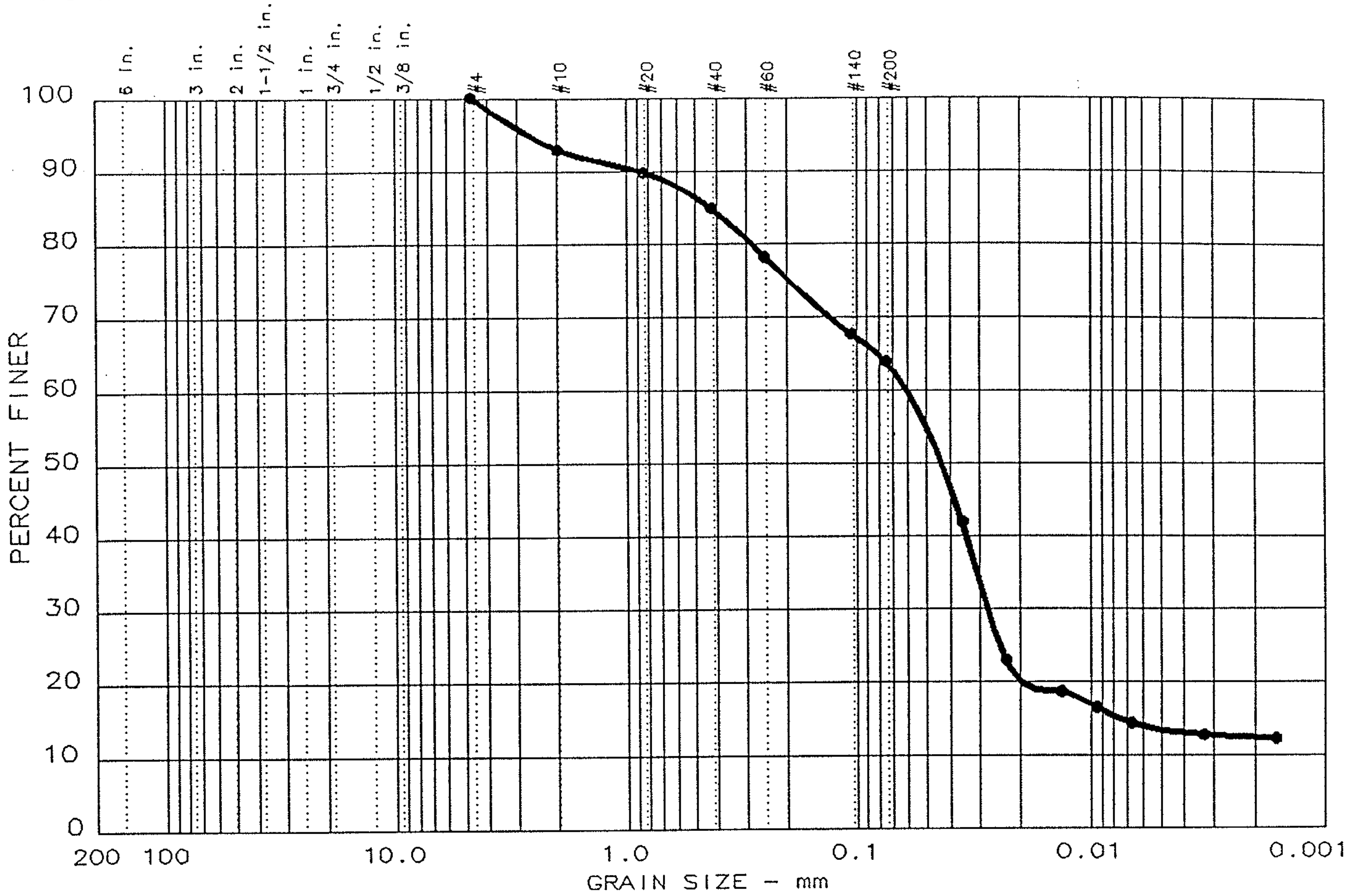
SERVICES, INC.

Remarks:

Figure No. ______

PARTICLE SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	7	0.0	0.0	36.1	50.5	13.4

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			0.432		0.0432	0.0278	0.0075			

MATERIAL DESCRIPTION	USCS	AASHTO
● Dark Grey Sandy Clayey Silt		

Project No.: 2800
Project: CUMBERLAND BAY
● Location: N-2400 (5-8')

Date: 25 March 1998

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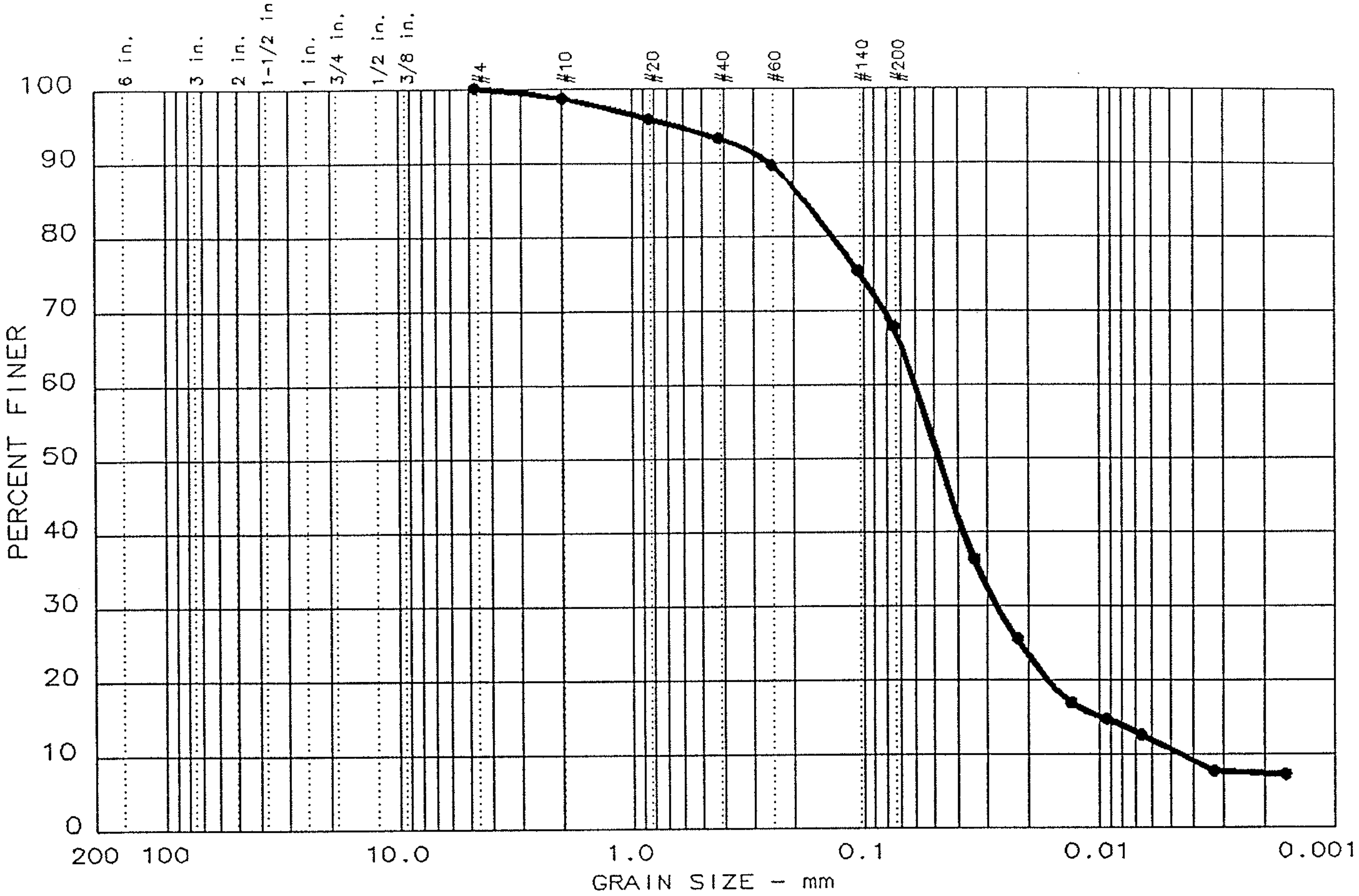
SERVICES, INC.

Remarks:

Figure No. ______

PARTICLE SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	2	0.0	0.0	32.2	57.2	10.6

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			0.180		0.0478	0.0272	0.0097	0.0045	2.72	13.4

MATERIAL DESCRIPTION	USCS	AASHTO
● Dark Grey Sandy Clayey Silt		

Project No.: 2800
Project: CUMBERLAND BAY
● Location: N 2400 (8-10)

Date: 25 MARCH 1998

KIBER
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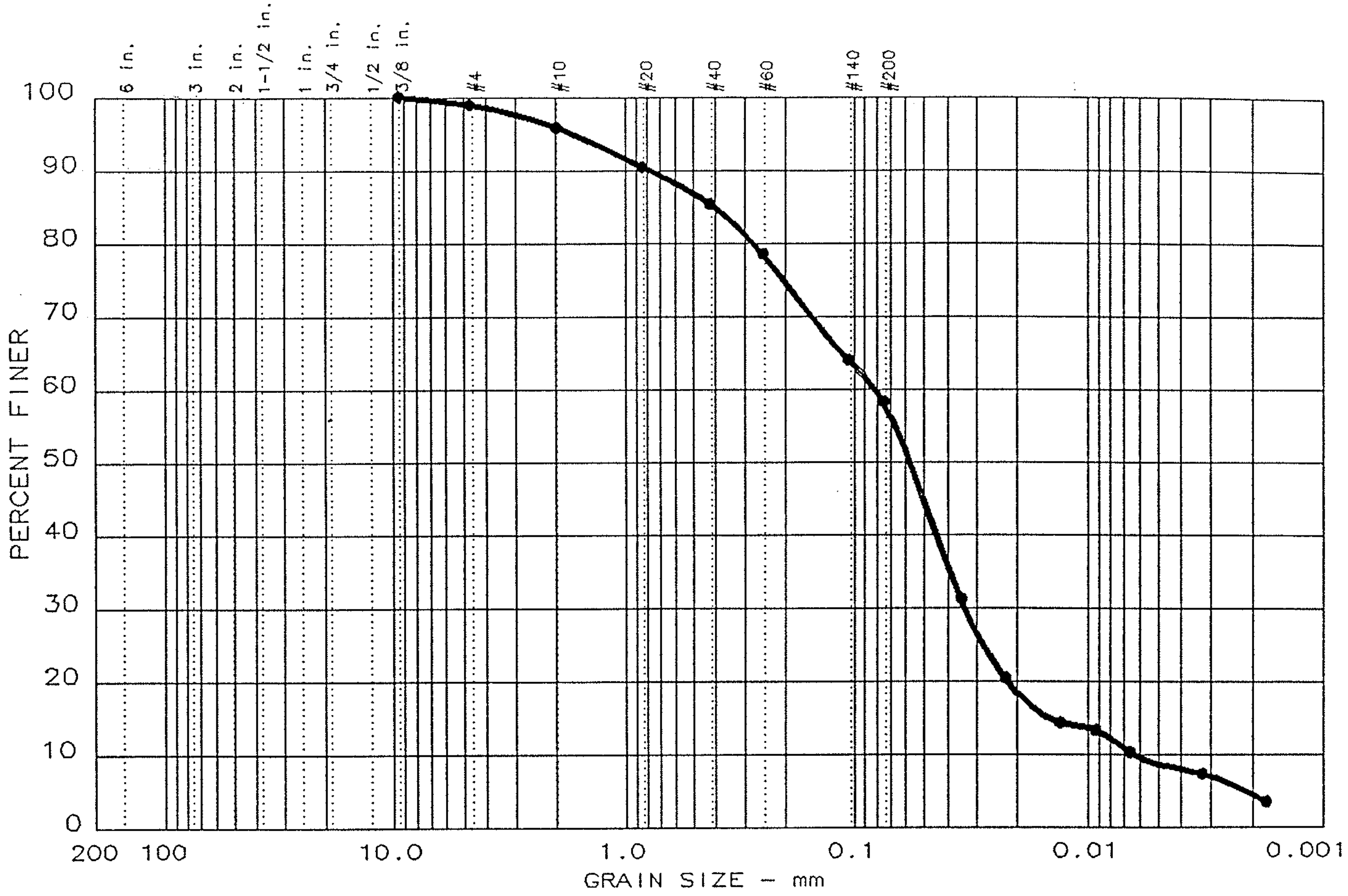
SERVICES, INC.

Remarks:

Figure No. 1

PARTICLE SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	11	0.0	1.2	40.5	49.7	8.6

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			0.407	0.0804	0.0574	0.0338	0.0147	0.0064	2.23	12.6

MATERIAL DESCRIPTION	USCS	AASHTO
● Dark Grey Sandy Clayey Silt		

Project No.: 2800
Project: CUMBERLAND BAY
● Location: 0-2200

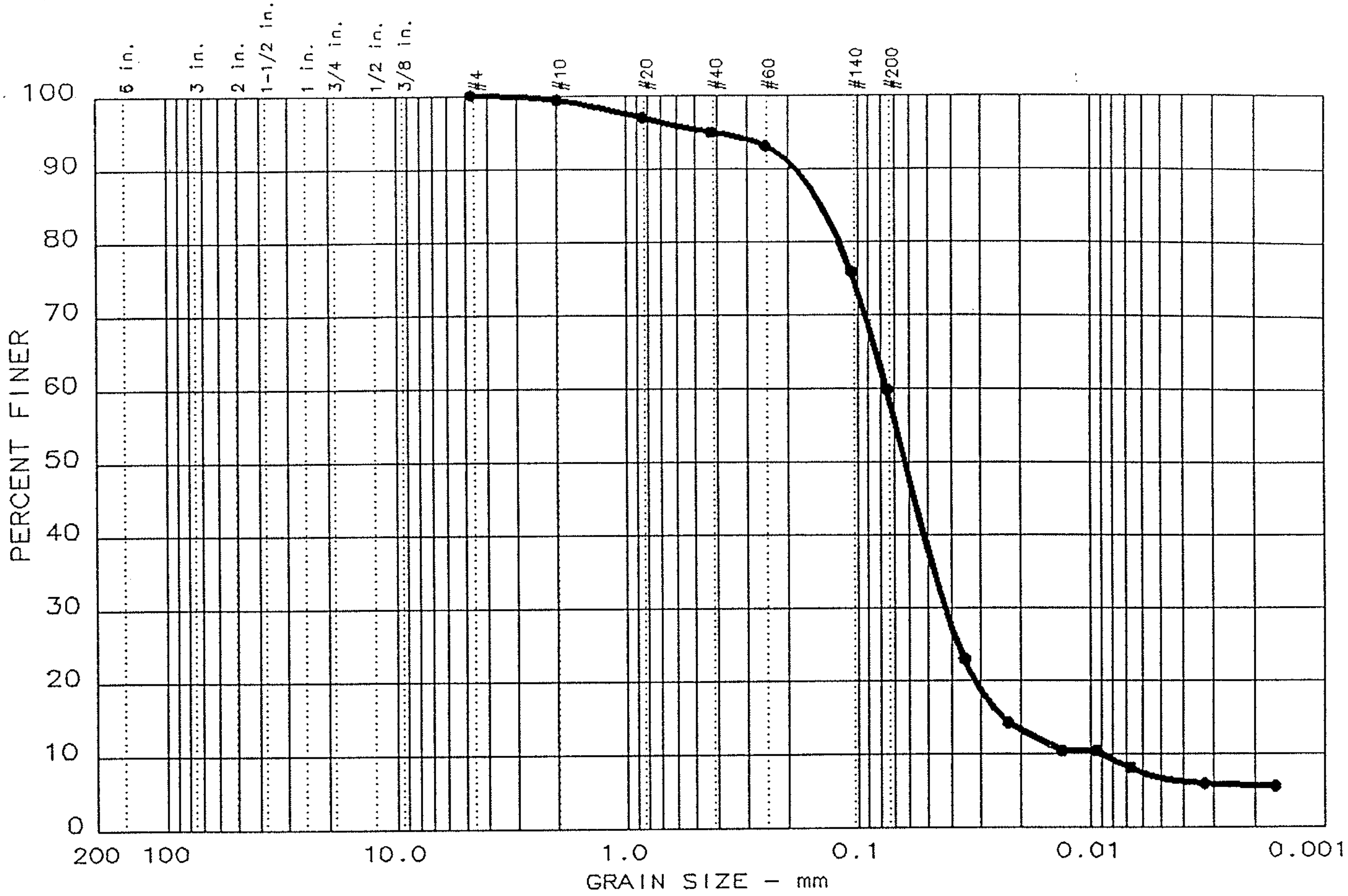
Date: 25 MARCH 1998

KIBER
ENVIRONMENTAL
SERVICES, INC.

Remarks:

Figure No. ______

PARTICLE SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	3	0.0	0.0	40.2	53.2	6.6

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			0.142		0.0624	0.0422	0.0240	0.0089	2.66	8.4

MATERIAL DESCRIPTION	USCS	AASHTO
● Dark Grey Sandy Silt		

Project No.: 2800
Project: CUMBERLAND BAY
● Location: P-1900

Date: 25 MARCH 1998

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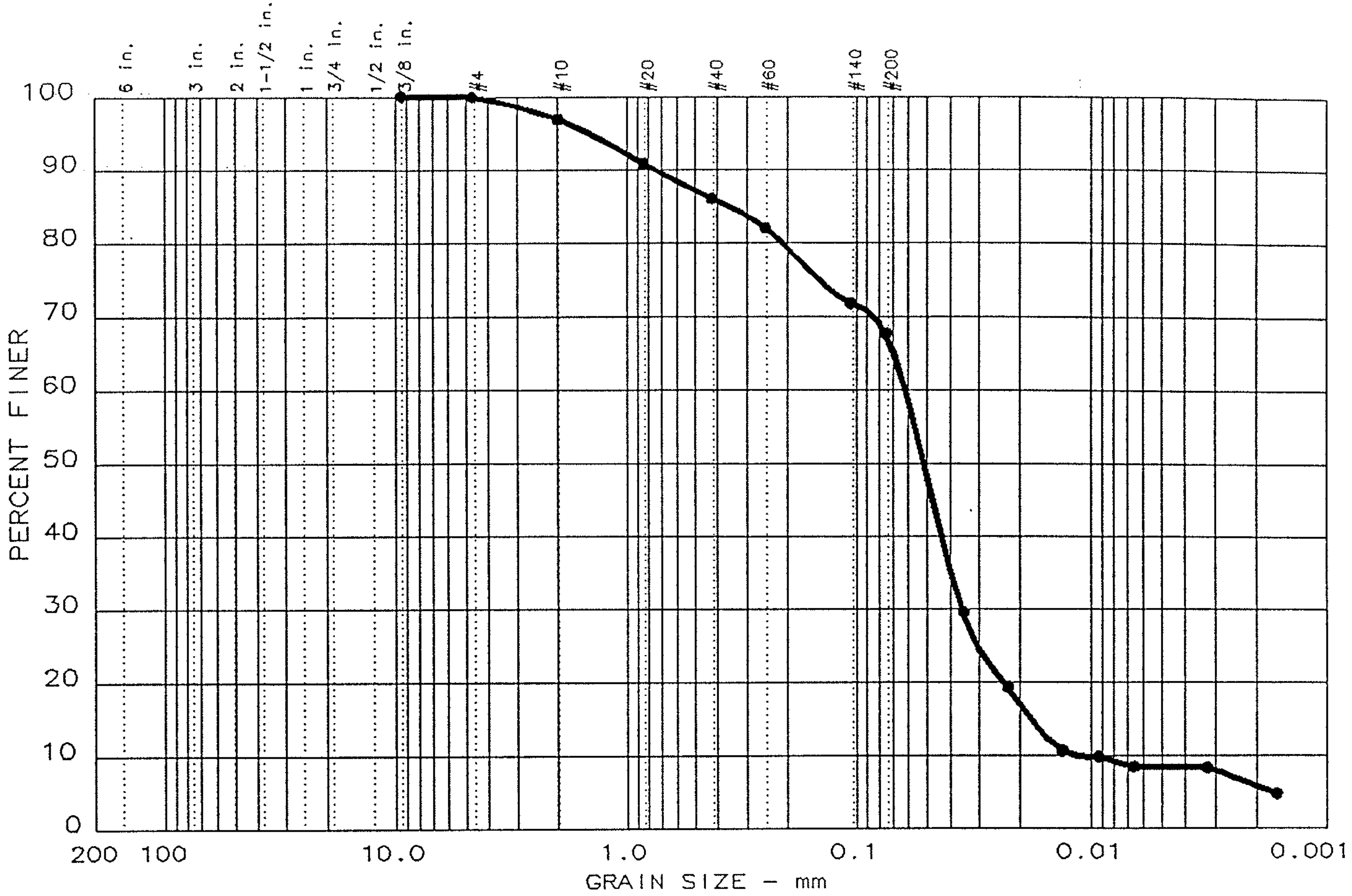
ENVIRONMENTAL
SERVICES, INC.

Remarks:

Figure No. 1

PARTICLE SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	20	0.0	0.1	32.2	59.3	8.4

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			0.359		0.0515	0.0355	0.0178	0.0118	1.74	5.2

MATERIAL DESCRIPTION	USCS	AASHTO
● Dark Grey Sandy Silt		

Project No.: 2800
Project: CUMBERLAND BAY
● Location: P 2300

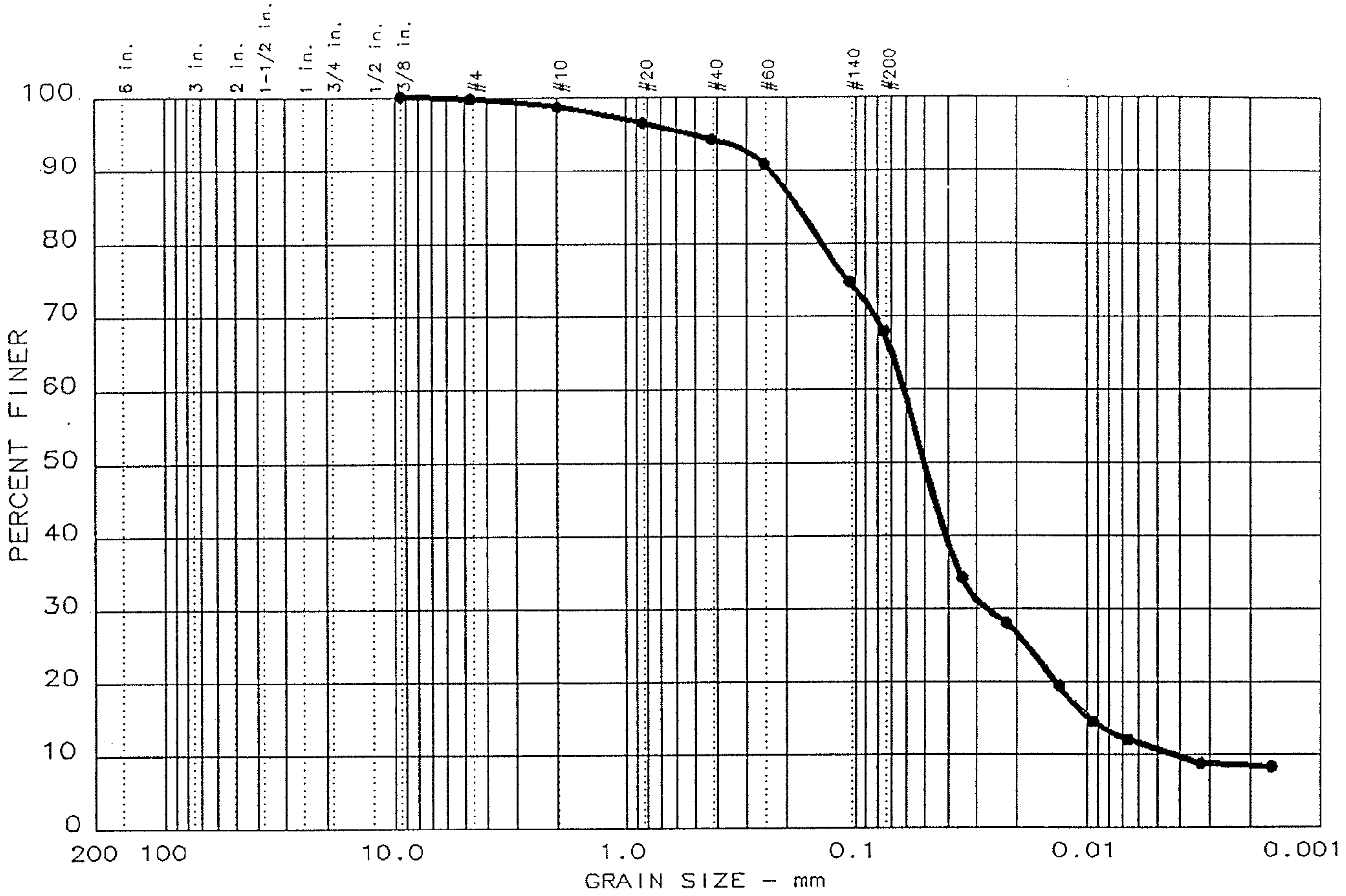
Date: 25 MARCH 1998

KIBER
ENVIRONMENTAL
SERVICES, INC.

Remarks:

Figure No. 1

PARTICLE SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	4	0.0	0.3	31.8	57.2	10.7

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			0.178		0.0502	0.0273	0.0098	0.0042	2.90	14.7

MATERIAL DESCRIPTION	USCS	AASHTO
● Dark Grey Sandy Clayey Silt		

Project No.: 2800

Project: CUMBERLAND BAY

● Location: Q 2400

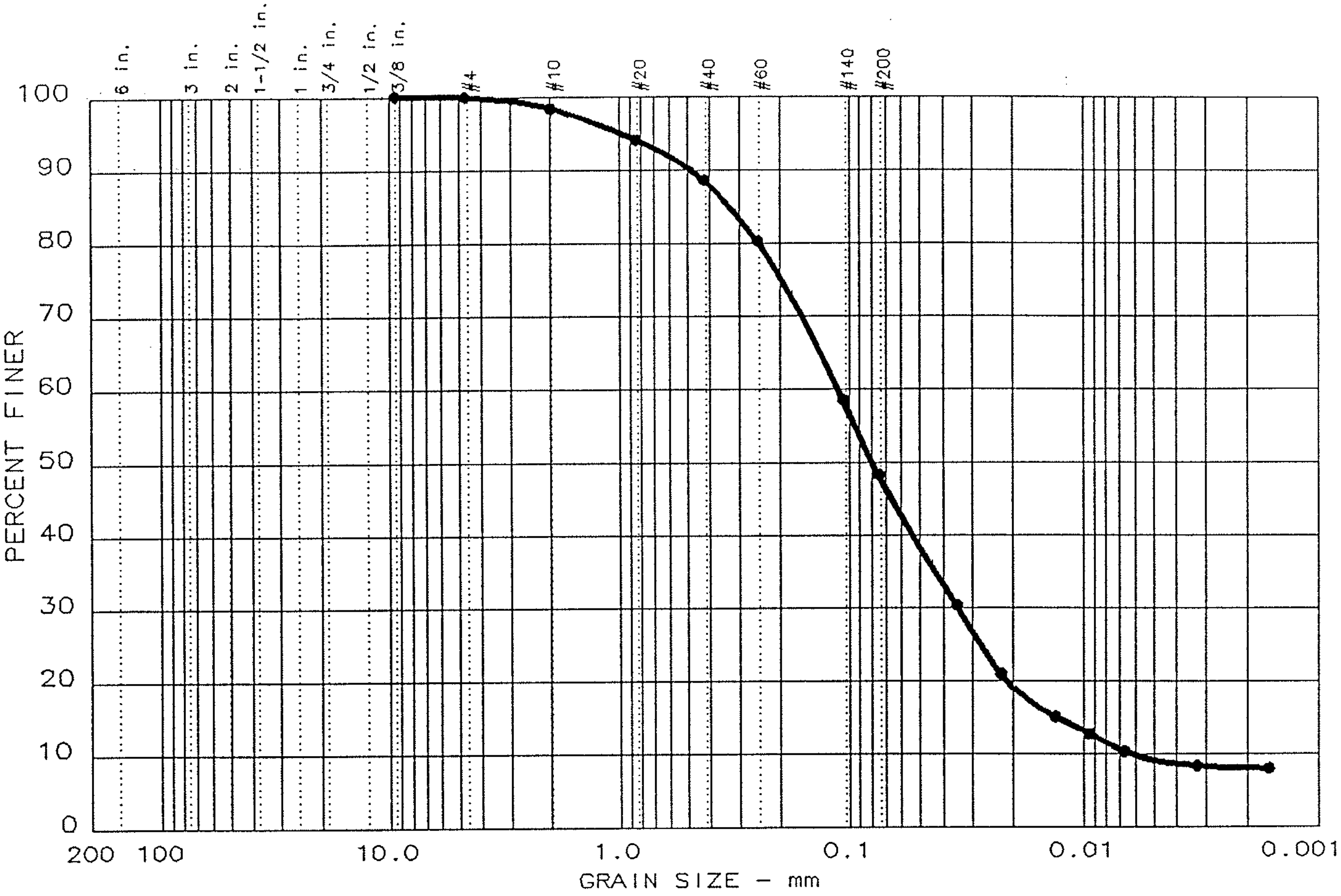
Date: 25 MARCH 1998

KIBER
ENVIRONMENTAL
SERVICES, INC.

Remarks:

Figure No. 1

PARTICLE SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	5	0.0	0.0	51.6	39.2	9.2

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			0.327	0.111	0.0794	0.0343	0.0132	0.0063	1.68	17.6

MATERIAL DESCRIPTION	USCS	AASHTO
● Dark Grey Clayey Silty Sand		

Project No.: 2800
Project: CUMBERLAND BAY
● Location: R 2100

Date: 25 MARCH 1998

KIBER
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SERVICES, INC.

Remarks:

Figure No. 1

APPENDIX G

Sludge Separation Study

Table 1

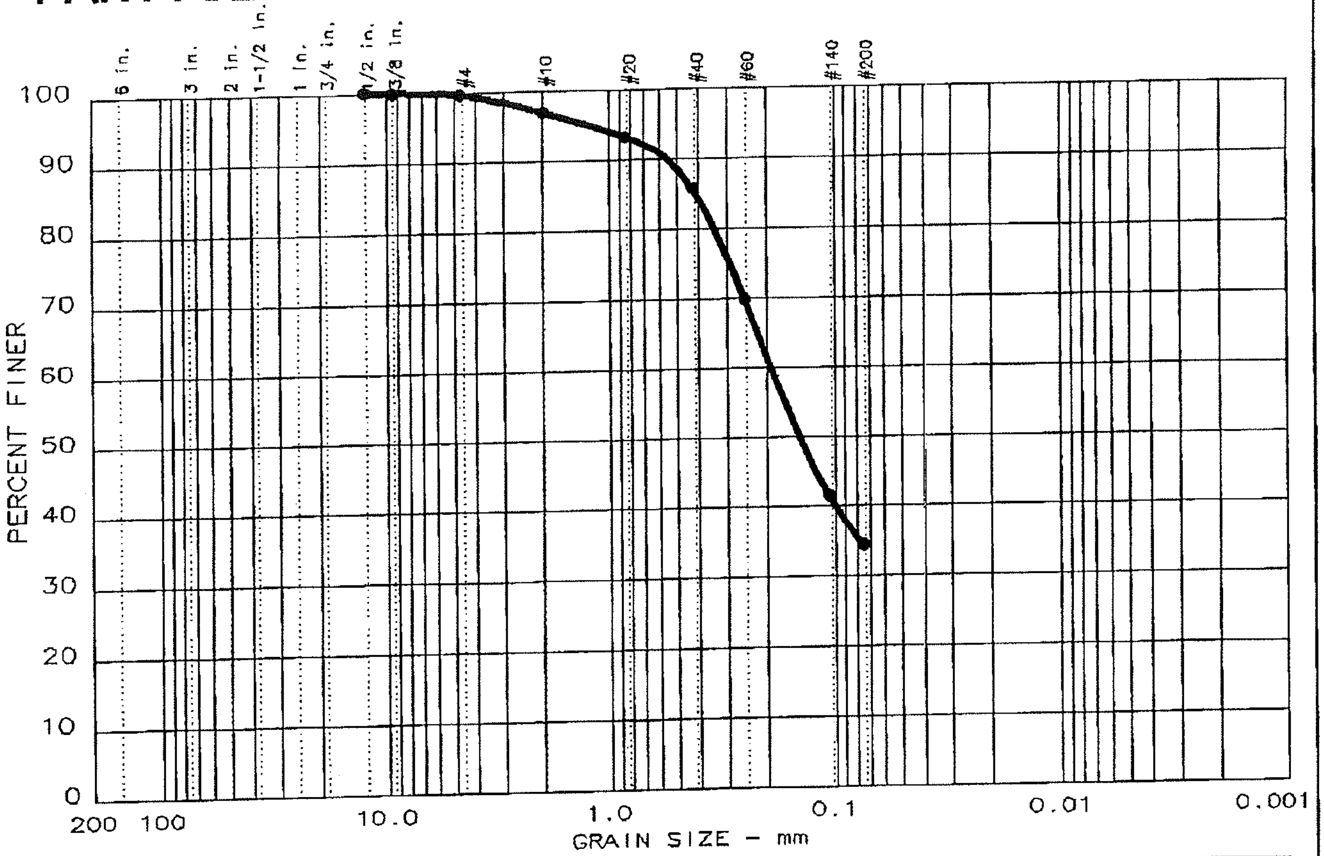
Sludge Separation Study

Cumberland Bay Sludge Bed Site

Sludge Fraction (Fraction Retained on Referenced Sieve)		TOC ppm	PCBs (mg/kg - ppm)			
			Aroclor -1242	Aroclor -1254	Aroclor -1260	Total PCBs
#10	2 millimeters	9,600	4.3	3.1	0.82	8.22
#20	800 microns	5,300	3.1	1.7	1.3	6.1
#40	400 microns	61,000	3.3	0.9	1.3	5.5
#60	250 microns	33,000	1.4	ND 0.17	ND 0.17	1.4
#140	100 microns	8,200	1.4	ND 0.17	ND 0.17	1.4
#200	75 microns	12,000	1.1	ND 0.17	ND 0.17	1.4
Passing #200	< 75 microns	30,000	2.3	0.4	0.74	3.44

Note: Concentrations are in parts per million (ppm).
ND = Not detected (followed by practical quantitation limit).
Gradational Analysis performed by Kiber Environmental Laboratory, Atlanta, GE
PCB Analysis performed by Scilab Albany, Inc., Latham, NY

PARTICLE SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	19	0.0	0.5	65.2	34.3	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			0.411	0.190	0.143					

MATERIAL DESCRIPTION	USCS	AASHTO
● Dark Gray Clayey Silty Sand		

Project No.: 2800
Project: CUMBERLAND BAY
● Location: Composite Sample

Date: 26 May 1998

KIBER
ENVIRONMENTAL
SERVICES, INC.

Remarks:

Figure No. 1

APPENDIX H

Solomon Liquids Bench Test

Superior

Superior Special Services, Inc.
P.O. Box 1323
Fond du Lac, Wisconsin 54936-1323
(920) 923-9000
FAX (920) 923-9010
http://www.superspecial.com

February 24, 1998

Rust Environmental & Infrastructure
12 Metro Park Road
Albany, NY 12205
Attn: Ms. Helen H. Mongillo

Re: Cumberland Bay / Lake Champlain, NY

Dear Ms. Mongillo:

Michael Hodges of Solomon Liquids (SL) asked us at Superior Special Services, Inc. (SSSI) to pass along to your company the results of their bench tests. As you will note the results look favorable for the SL technology. SL / SSSI have been sharing experiences and pooling our combined expertise in an effort to develop cost effective alternatives to the conventional approaches on environmentally sensitive and contaminated sediment sites. We are convinced that our combined resources can achieve this goal.

As always, we at Superior Special Services, Inc. are available at your convenience to address any comments or answer any questions you may have concerning our company or its capabilities.

Sincerely,

Rick L. Chianelli
Manager, Marine Services

Solomon Venture

Solomon Liquids

PROJECT 97_019
SAMPLE CHARACTERIZATION REPORT

February 11, 1998

Sample Provided By:
Rust Environment & Infrastructure
12 Metro Park Road
Albany, NY 12205

Sample Source: Cumberland Bay/Lake Champlain, NY

Sample Quantity & Description: Approximately 4 gallons of waterway sediment composed primarily of biogenic/humic materials.

Objective of Characterization: To acquire general information relative to the composition and properties of the subject sample. Specifically, to evaluate the subject sample's amenability to solids recovery and dewatering operations contemplated by the client.

Analysis, Measurements, & Testing: Particle Size Distribution (sieve), Propensity to Flocculate.

Characterization Summary & Feasibility Evaluation: Please reference the enclosed document:
Sample Characterization and Testing Report

Visual inspection of the lake sediment sample provided by Rust E&I showed it to be composed primarily of humates in varying states of decomposition. The distribution of particle sizes in the sample, tabulated and plotted in the enclosed document, typifies a normal distribution, with approximately 71% of the sample's mass having a diameter larger than 75μm (200-mesh). Coarse to medium sand-sized solids were present in quantities adequate for efficient recovery by conventional separation equipment. Overall, the size distribution data suggest that the lake sediments can be successfully recovered using Solomon Venture's systems, provided the subject sample is representative of the majority of sediments.

Characterization Summary & Feasibility Evaluation:

In conjunction with traditional dewatering methods, Solomon Venture's system includes a proprietary separation step requiring flocculation of fine-sized solids. Testing to evaluate the amenability of the subject sample was undertaken as part of the characterization effort. Testing was conducted on a prepared sample consisting of fine-sized solids (minus 28-mesh) at a pulp density of about 11.5% solids by weight.

Five tests established at least 2 cationic flocculants as suitable for flocculating the subject sample. Additionally, a preferred flocculant concentration was identified. Moisture determinations performed on recovered solids averaged 80%. It is important to note that the moisture content of bench-scale batch test-produced flocculated solids cannot and does not predict field performance of Solomon's technology. Test-produced product solids always contain more moisture than those produced in full-scale operations.

Based on information provided by Rust E&I and acquired during sample characterization, continuous separation, dewatering and recovery of the subject sediment using Solomon Venture's technology is recommended.

Solomon Venture

Sample Characterization & Testing Report

Sample ID

SL P/N: 97_019 Source: Lake Champlain/Cumberland Bay Composite ? ☐ By: RLS

Date: Feb-98 SL ID#: 97_019.1 Individual ? ▨ NB# & Page: 1000-137

MEASUREMENTS

97_019.1

	pH	ORP	Dissolved Oxygen	Conductivity	Specific Gravity	Settled Pulp Density	TDS	Organic Component
	std units	abs. millivolts	mg/L	µS	g/cc	% Solids w/w	mg/L	%, LOC*
Water	NM	NM	NM	NM	NM	NM	NM	▨
Solids	▨	▨	▨	▨	NM	28.4%	▨	NM

*LOC = Loss-On-Combustion @ 625°C; TDS = Total Dissolved Solids; NM = Not Measured; IP=In Progress; NR=Not Requested; ND=Not Detected

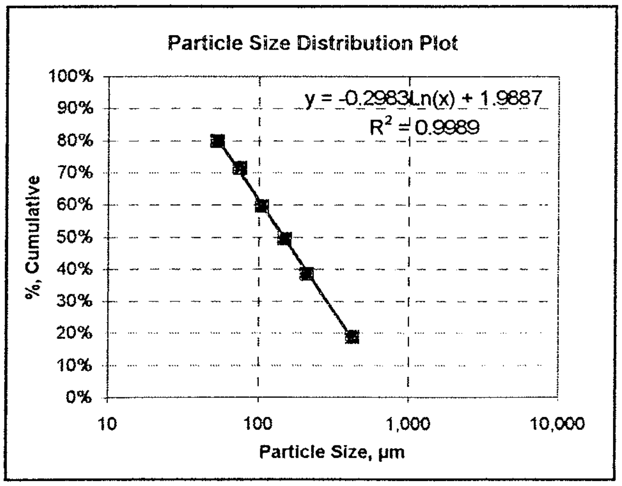
Specific gravity by pycnometer; TDS determined gravimetrically.

SEDIMENT PARTICLE SIZE DISTRIBUTION BY WEIGHT

97_019.1

Sediment Sample

Mesh	Microns	% in Fraction Direct	% in Fraction Cumulative
+10	>1700	5.2%	5.2%
10x35	425	13.5%	18.7%
35x65	212	19.7%	38.4%
65x100	150	10.9%	49.3%
100x150	106	10.3%	59.5%
150x200	75	11.8%	71.4%
200x270	53	8.4%	79.8%
-270	<53	20.2%	100.0%
	Total:	100.0%	



Note: Plus 10 mesh & minus 270 mesh fractions not plotted.

NUTRIENT ANALYSIS

97_019.1

Sample ID		pH	Ammonia Nitrogen	Nitrate Nitrogen	Phosphate Phosphorus	Potassium	Calcium	Specific Conductance
	Unit:	Std	mg/kg					µmhos
97_019.1	Sediment:	Not Requested						
	Recommended Levels:	6-7	10-40	50-150	25-40	50-75	1000-3000	<60

Sample Characterization & Testing Report

FLOCCULATION TESTING 97_019.1

Test #	Pulp Density	Coagulants/Flocculants		Dosage	Recv'd Solids	Remarks
		ID	Conc.	lbs/dry ton	% Moisture	
1	~11.5%	SLF-075	0.20%	2.41	~81%	Good to excellent; high recovery w/strong floccules
2	**~11.5%**	**SLF-077**	**0.20%**	**1.86**	**~80%**	**Excellent; high recovery, robust, large flocs**
3	~11.5%	SLF-075	0.10%	1.25	NM	Unsatisfactory; smallish, soft floccules
4	~11.5%	SLF-077	0.10%	1.24	~81%	Improvement over T3; some hydro-sheeting
5	~11.5%	SLF-078	0.10%	0.87	~78%	Improvement over T3; soft flocs, fair recovery

Best test(s) denoted by **bold** typeface.

APPENDIX I

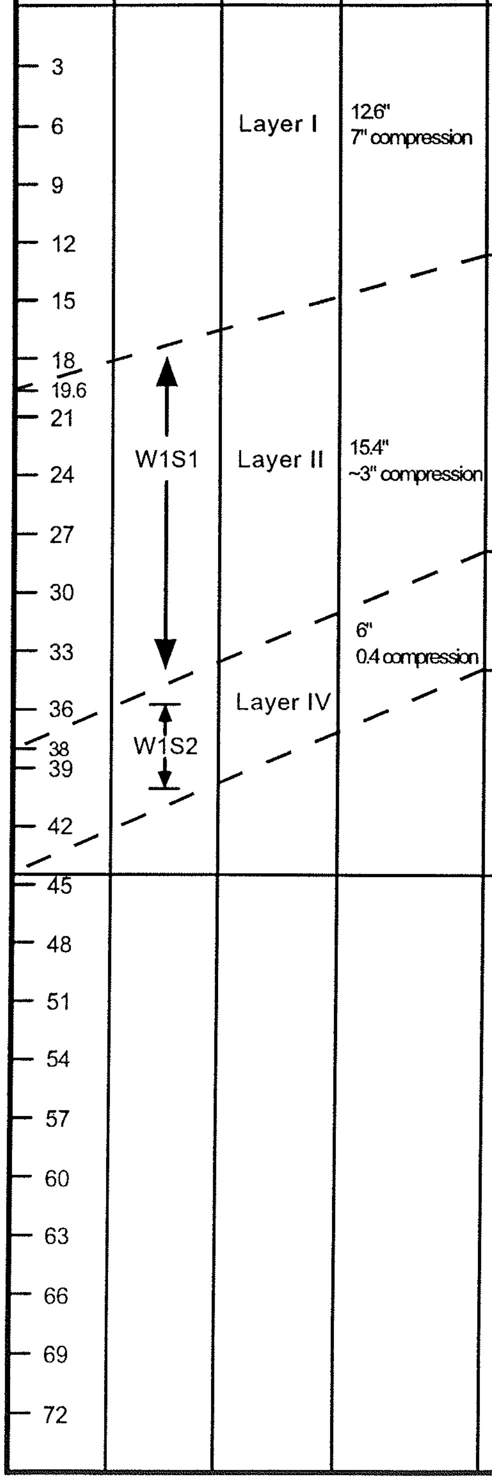
December 1997 Shoreline Core Logs

Boring Log

Boring No. W-1

PROJECT: Cumberland Bay IRM	CONTRACTOR: RUST E&I	Page 1 of 1
PROJECT NO: 39304.10006	LOCATION: Cumberland Bay, Plattsburgh, NY	DATE: 12/4/97
SURFACE ELEVATION: 95.87	DATUM: Lake Champlain - Ferry Dock	

Depth Below Grade	Sample ID	Stratum	Recovered Thickness (inches)	SAMPLE DESCRIPTION, REMARKS, AND STRATUM CHANGES



<u>Organic Mat:</u>
Dark reddish-brown, highly fiberous, organic materials, roots, plant fiber, some woody chips. Somewhat loose and wet.

12.6"

Soft, wet, bluish-gray and black, poorly graded, medium to mostly fine SAND, with Silt. Somewhat laminated with occasional layers of coarse sand-sized wood chips <1/4" thick. Abundant organic matter.

28.0"

Medium dense, wet, dark green-gray (10G 4/1), medium to fine SAND, little fine Gravel, occasional organic material.

34.0"

No sludge encountered.

Total Boring Depth = 44.4"

<u>Notes:</u>

Drive = 3.7'
In tube = 2.55'
Recovery = 2.55'
Loss = 0"
Compression = 14"
Expansion = 3.6"

Firm @ 1.05'

Boring Log

Boring No. W-2

PROJECT: Cumberland Bay IRM	CONTRACTOR: RUST E&I	Page 1 of 1
PROJECT NO: 39304.10006	LOCATION: Cumberland Bay, Plattsburgh, NY	DATE: 12/4/97
SURFACE ELEVATION: 95.90	DATUM: Lake Champlain - Ferry Dock	

Depth Below Grade	Sample ID	Stratum	Recovered Thickness (inches)	SAMPLE DESCRIPTION, REMARKS, AND STRATUM CHANGES
3 6 9 12 15	W2 (0-1)	Layer I	15" recovery 5" compression	Organic Mat: Dark brown, loose, wet, highly fiberous organic material with abundant woody chips. 12" - 15": Strong petroleum-like odor. 15.0"
18 20 21		Layer II	8" 0 compression	Loose, wet, black and greenish black mostly medium to fine sand, trace fine gravel, abundant organic material. 23.0"
24				Blue gray fine SAND, layers of black organics (WOOD). 25.5"
27 28	W2S1	Layer III	5" 8.8" compress.	Dark green-gray organic SILT (SLUDGE). 28.0"
30 33 36 39 41.8 42 45 48 51		Layer III Grading into Layer IV	23" recovery	Medium dense, wet, dark greenish-gray (5Gy 4/1) mostly fine SAND. Thinly laminated layers of white-gray Silt, abundant organic material throughout. 51.0"
54 57 60 63 64.8 66	W2S2		0 recovery	Bottom of sludge >51.0" Total Boring Depth = 67.2"
69 72				

Notes:

Drive = 5.6'
In tube = 4.1'
Recovery = 3.9'
Loss = 0.2'
Compression = 18"
Expansion = 0"

Firm @ 0.7'
Soft @ 1.1'
Stiff @ 1.4'
Soft @ 1.8'
Hand driven to ~ 1.4' (soft)

Firm @ 4.1'
Relatively soft @ bottom

Boring Log

Boring No. W-3

PROJECT: Cumberland Bay IRM	CONTRACTOR: RUST E&I	Page 1 of 1
PROJECT NO: 39304.10006	LOCATION: Cumberland Bay, Plattsburgh, NY	DATE: 12/4/97
SURFACE ELEVATION: 95.76	DATUM: Lake Champlain - Ferry Dock	

Depth Below Grade	Sample ID	Stratum	Recovered Thickness (inches)	SAMPLE DESCRIPTION, REMARKS, AND STRATUM CHANGES
3				
6		Layer I	12" recovery 13" compression	Organic Mat: Dark reddish-brown, highly fiberous, soft, wet, very compressible, organic fiber, peat-like.
9				
12				12.0"
15				Loose, wet, dark green-gray medium to mostly fine SAND, layers of wood chips.
18			6" recovery 0 compression	18.0"
21		Layer II		Blue-gray organic SILT with layers of whitish gray wood pulp.
~~24~~ 25				
27				28" Coarse gravel-sized wood chips.
~~30~~ 31				
33				33" Fine gravel-sized wood chips.
36			25" recovery 11" compression	36.0"
39				Dark blue-gray, highly organic SILT, abundant wood chips and fibers, grading downward to very fine SAND.
42		Layer III		43.0"
45				Bottom of sludge > 5.6'.
48	W-3			
51				
54				
57				
60				
63				
66				
67				Total Boring Depth = 67.2"
69				
72				

Notes:
Drive = 5.6'
In tube = 3.5'
Recovery = 3.5'
Loss = 0"
Compression = 25.2"
Expansion = 1.2"

1st Attempt (3' tube)	2nd Attempt (6' tube)
Hand Drive 1.2'	Hand Drive 1.0'
Soft @ bottom	2"x4" Drive 3.1'
Peat in bottom	Sludge to 5.6'

Boring Log

Boring No. W-4

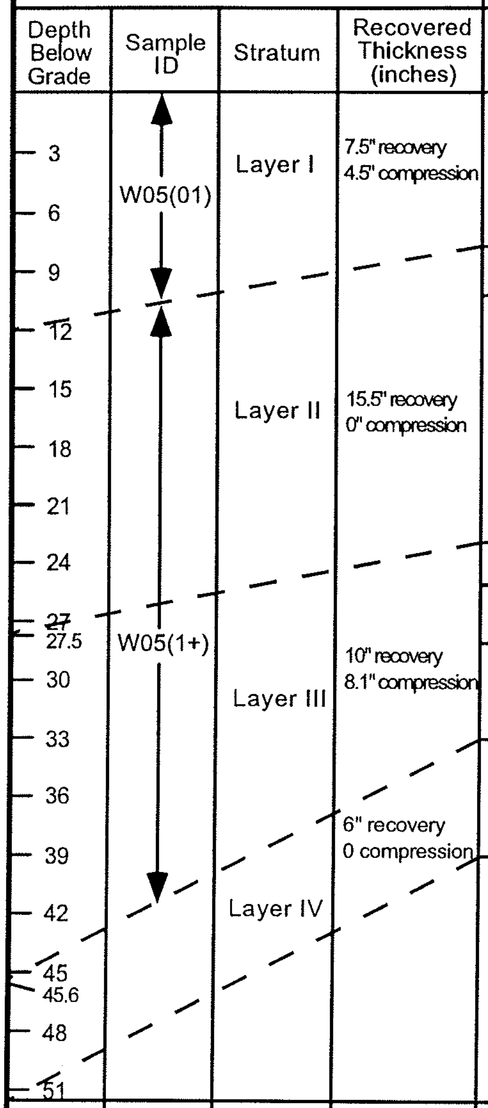
PROJECT: Cumberland Bay IRM	CONTRACTOR: RUST E&I	Page 1 of 1
PROJECT NO: 39304.10006	LOCATION: Cumberland Bay, Plattsburgh, NY	DATE: 12/4/97
SURFACE ELEVATION: 96.77	DATUM: Lake Champlain - Ferry Dock	

Depth Below Grade	Sample ID	Stratum	Recovered Thickness (inches)	SAMPLE DESCRIPTION, REMARKS, AND STRATUM CHANGES
3		Layer I	5" recovery 8.8" compression	Organic Mat: Dark reddish-brown, highly fiberous, organic materials. 5.0"
6 9 12 13.8 15 18 21 24 27		Layer II	23" recovery 0" compression	Loose, wet, poorly graded, light brown (7.5 yr 6/3) mostly medium to fine SAND. Abundant organic fiber, occasional fine gravel. SAND grades downward to a medium to mostly fine SAND at ~20". Oxidation boundary at 15", color change to gray, no lithology change. 28.0"
30 33 36 39	W4S1	Layer III	10" recovery 0 compression	Very soft, wet, blue-gray organic SILT, frequent layers of fine gravel sized wood chips. 38.0"
42		Layer IV	6" recovery 0 compression	Medium dense blue-gray fine SAND, occasional layers of wood fiber. 44.0"
~~45~~ 46 48 51	W4S2			Bottom of Sludge <46". Total Boring Depth = 52.8"
54 57 60 63 66 69 72				Notes: Drive = 4.4' In tube = 3.6' Recovery = 3.8' Loss = 0" Compression = 9.6" Expansion = 2.4" 5.8' length tube Stiff @ 4.0'

Boring Log

Boring No. W-5

PROJECT: Cumberland Bay IRM	CONTRACTOR: RUST E&I	Page 1 of 1
PROJECT NO: 39304.10006	LOCATION: Cumberland Bay, Plattsburgh, NY	DATE: 12/4/97
SURFACE ELEVATION: 96.02	DATUM: Lake Champlain - Ferry Dock	



SAMPLE DESCRIPTION, REMARKS, AND STRATUM CHANGES

<u>Organic Mat:</u>
Very dark yellow-red-brown (5 yr 2.5/2), highly fiberous, organic fiber and silt.

7.5"

Soft, wet, dark blue-gray organic Silt, trace fine SAND, non-plastic, occasional laminations.

10.0"

Loose to medium dense, wet, light gray, mostly medium to fine SAND, interlayered with brown coarse to mostly medium Sand and fine Gravel. Abundant organic material.

23.0"

Soft, wet, whitish gray, platy, paper pulp.

25.0"

Soft, wet, dark gray, non-plastic, silt.

28.0"

Soft, wet, light gray, highly organic, fiberous, woody, silt.

33.0"

Medium dense, wet, gray, fine SAND, trace Silt and Gravel, occasional organics.

39.0"

Sludge bottom <46" dbg.

Total Boring Depth = 51.6"

<u>Notes:</u>

Drive = 4.3'
In tube = 3.2'
Recovery = 3.3'
Loss = 0"
Compression = 13.2"
Expansion = 1.2"

6.1' tube length
Hand push to 1.0'
Firm @ 3.71'
Hard @ 4.3'

Boring Log

Boring No. W-6

PROJECT: Cumberland Bay IRM	CONTRACTOR: RUST E&I	Page 1 of 1
PROJECT NO: 39304.10006	LOCATION: Cumberland Bay, Plattsburgh, NY	DATE: 12/4/97
SURFACE ELEVATION: 96.13	DATUM: Lake Champlain - Ferry Dock	

Depth Below Grade	Sample ID	Stratum	Recovered Thickness (inches)	SAMPLE DESCRIPTION, REMARKS, AND STRATUM CHANGES
3 6		Layer I	5" recovery 6" compression	Organic Mat: Loose, wet, dark red-brown, highly fiberous, organic material. 5.0"
9		Layer II	7" recovery 0" compression	Soft, wet, light gray organic Silt, abundant woody fibres. 9.0"
11 12				Very loose, very coarse, wood chips. 12.0"
15				3" GAP IN CORE. 15.0"
18 21 24	W6S1	Layer II grading to Layer III	9.5" recovery 0" compression	Medium dense, very moist, poorly graded, blue-gray mostly medium to fine SAND, occasional layers (<1/8") of coarse SAND sized wood chips. 24.5"
27 27.5				4.5" GAP IN CORE. 29.0"
30 32.5		Layer III	5" recovery	Soft, wet, platy, light gray to whitish, paper pulp. 34.0"
33 36 37.5		Layer III	5" recovery 0 compression	Medium dense, moist, blackish and dark gray medium to fine SAND; occasional wood chips, layers of coarse black SAND. 39.0"
39 42 45 48				Sludge bottom <48", probably at ~41" dbg. Total Boring Depth = 48.0"
51 54 57 60 63 66 69 72				

Notes:

Drive = 4.0'
In tube = 3.4'
Recovery = 2.8' (two gaps)
Loss = 9.3"
Compression = 7.2"
Expansion = 3.6"

6.1' tube
Hand push to 0.9'
Hard @ 4.0'

Boring Log

Boring No. W-7

PROJECT: Cumberland Bay IRM	CONTRACTOR: RUST E&I	Page 1 of 1
PROJECT NO: 39304.10006	LOCATION: Cumberland Bay, Plattsburgh, NY	DATE: 12/4/97
SURFACE ELEVATION: 96.70	DATUM: Lake Champlain - Ferry Dock	

Depth Below Grade	Sample ID	Stratum	Recovered Thickness (inches)	SAMPLE DESCRIPTION, REMARKS, AND STRATUM CHANGES
3 6 9	W7(0-1)	Layer I	9" recovery ~2" compression	Organic Mat: Very soft, wet, dark reddish-brown, highly fiberous, peat like organic material. 9.0"
11 12 15 18		Layer II	11" recovery 0" compression	Loose, wet, dark gray and blue-gray mostly medium to fine SAND; abundant organic material. 20.0"
21 22 24 27 30	W7S1	Layer III	13" recovery 19.6" compression	Interlayered, loose, wet blue-gray medium to fine SAND, with black, coarse Sand and fine Gravel, occasional layers of wood chips >10mm diameter, up to 1" thick. Laminations of gray-black Silt. 33.0"
33 36				Medium dense, moist, dark green fragments, medium to mostly fine SAND. 36.0"
39 42 45 48 51 54.6 57.6	W7S2	Layer IV	3" recovery	Sludge bottom < 45". Total Boring Depth = 57.6"
60 63 66 69 72				

Notes:

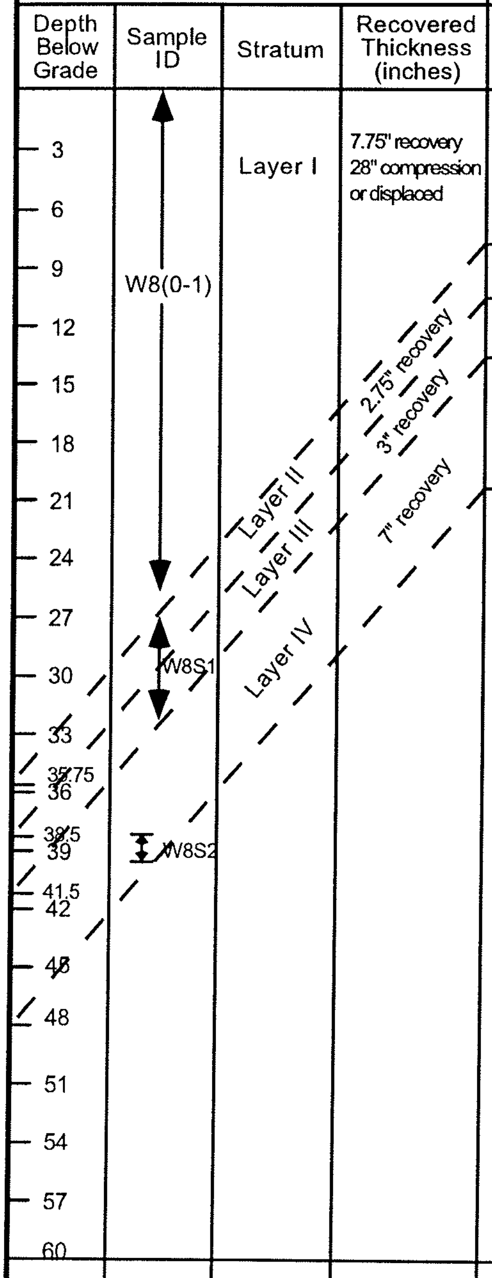
Drive = 4.8'
In tube = 3.0'
Recovery = 3.0"
Loss = 0
Compression = 12"
Expansion = 0"

6.1' length tube
Hand push to 0.9'
Firm @ 0.9'-1.7'
Soft @ 1.7'
Firmer from 3.0'-4.0'
Stiff @ 4.0'
Cone plug at 4.0'

Boring Log

Boring No. W-8

PROJECT: Cumberland Bay IRM
CONTRACTOR: RUST E&I
Page 1 of 1
PROJECT NO: 39304.10006
LOCATION: Cumberland Bay, Plattsburgh, NY
DATE: 12/4/97
SURFACE ELEVATION: 95.72
DATUM: Lake Champlain - Ferry Dock



SAMPLE DESCRIPTION, REMARKS, AND STRATUM CHANGES

Organic Mat:
Very loose, wet, dark red-brown, highly fiberous, organic material.
7.75"

Loose, wet, dark gray medium to mostly fine SAND and wood chips and fiber.
10.5"

Loose, wet, blue-gray, mostly medium to fine SAND.
13.5"

Medium dense, wet, blue gray fine SAND, occasional organics.
20.4"

Sludge bottom < 41.5".

Total Boring Depth = 60.0"

63	
66	
69	
72	

Notes:

New Location
Drive = 5.0'
In tube = 2.6'
Recovery = 1.7'
Loss = 0.9' = 10.8"
Compression = 28.6"
Expansion = 0"
3.9' driven by hand
Hard @ 4.5'
Broken tip at bottom

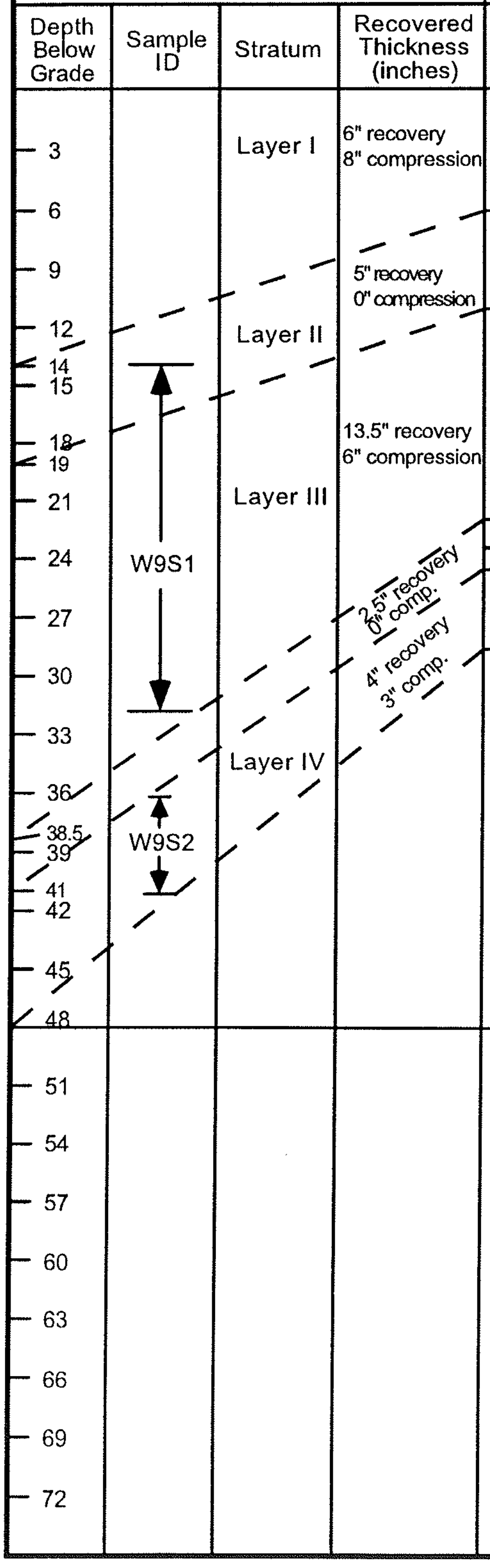
1st Re-attempt
Drive = 5.8' (4.0' in tube)
Recovery = 0
Hand push to 1.4' (compressed 1.0')
Soft to 4.0' (compressed to 1.3')

2nd Re-attempt
Drive = 5.6' (3.5' in tube)
Recovery = 0

Boring Log

Boring No. W-9

PROJECT: Cumberland Bay IRM	CONTRACTOR: RUST E&I	Page 1 of 1
PROJECT NO: 39304.10006	LOCATION: Cumberland Bay, Plattsburgh, NY	DATE: 12/4/97
SURFACE ELEVATION: 97.16	DATUM: Lake Champlain - Ferry Dock	



SAMPLE DESCRIPTION, REMARKS, AND STRATUM CHANGES

Organic Mat & Topsoil:
Soft and loose, moist, dark red-brown fine SAND and organic Silt; abundant plant roots and humic material. — 6.0"

Interlayered topsoil and large wood chips (>10mm). — 11.0"

PAPER SLUDGE
Layers of pulp, wood chips and fragments.
Black stain and petroleum-like odor 13.5"-15". — 22.0"

Medium dense, wet, blue-gray fine SAND. — 23.5"

Piece of wood, willow or ash. — 24.5"

Medium dense, wet, blue-gray, fine SAND. — 28.5"

Sludge bottom <41".

Total Boring Depth = 48.0"

Notes:

Drive = 4.0'	6.1' tube
In tube = 2.4'	Hand push to 1.2'
Recovery = 2.4'	Becoming Firm @ 2.7'
Loss = 0	Stiff @ 3.5'
Compression = 19.2"	
Expansion = 0"	

Boring Log

Boring No. W-10

PROJECT: Cumberland Bay IRM
CONTRACTOR: RUST E&I
Page 1 of 1
PROJECT NO: 39304.10006
LOCATION: Cumberland Bay, Plattsburgh, NY
DATE: 12/4/97
SURFACE ELEVATION: 96.90
DATUM: Lake Champlain - Ferry Dock

Depth Below Grade	Sample ID	Stratum	Recovered Thickness (inches)	SAMPLE DESCRIPTION, REMARKS, AND STRATUM CHANGES
3	W10(0-1)	Layer I	4" recovery 5" compression	<u>Organic Mat:</u> Dark red-brown, highly fiberous, organic materials. 4.0"
6				
9				
12				
15		Layer II	21" recovery 0" compression	Medium dense, wet, blue-gray, medium to fine SAND. Layers of wood chips and organic fibers.
18				
21				
24				25.0"
27				
30			9" recovery 12" compression	Very loose, saturated, highly organic Silt, occasional bits of wood.
33		Layer III		34.0"
36	W10S1		2' recovery, 0" comp.	Medium dense, wet, blue-gray very fine SAND. 36.0"
39				
42		Layer IV		Sludge bottom < 51".
45				
48				
51				Total Boring Depth = 53.0"
54				
57				
60				
63				
66				
69				
72				

<u>Notes:</u>

Drive = 4.4' (53")
In tube = 3.0' (36")
Recovery = 3.0" (36")
Loss = 0"
Compression = 17"
Expansion = 0"

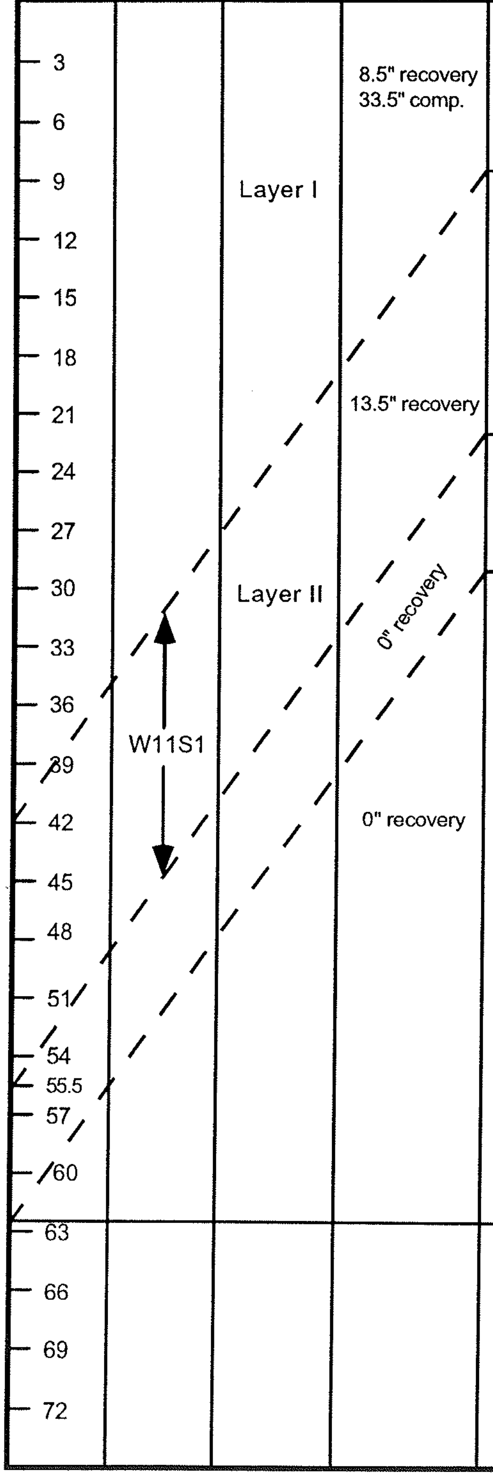
6.1' in tube
Soft @ 2.5'
0.5' Comp.
Very stiff @ 4.0

Boring Log

Boring No. W-11

PROJECT: Cumberland Bay IRM	CONTRACTOR: RUST E&I	Page 1 of 1
PROJECT NO: 39304.10006	LOCATION: Cumberland Bay, Plattsburgh, NY	DATE: 12/5/97
SURFACE ELEVATION: 97.12	DATUM: Lake Champlain - Ferry Dock	

Depth Below Grade	Sample ID	Stratum	Recovered Thickness (inches)	SAMPLE DESCRIPTION, REMARKS, AND STRATUM CHANGES



Organic Mat and Muck:
Dark reddish-brown, highly fiberous, saturated, organic materials and very soft mud.

8.5"

Medium dense, blue gray medium to find SAND, occasional layers of woody fiber and chips.

22.0"

Very soft, loose, easy drive for 8.5" (3.5'-4.2').

29.0"

No sludge collected
Bottom layer not encountered

Total Boring Depth = 62.4"

Notes:

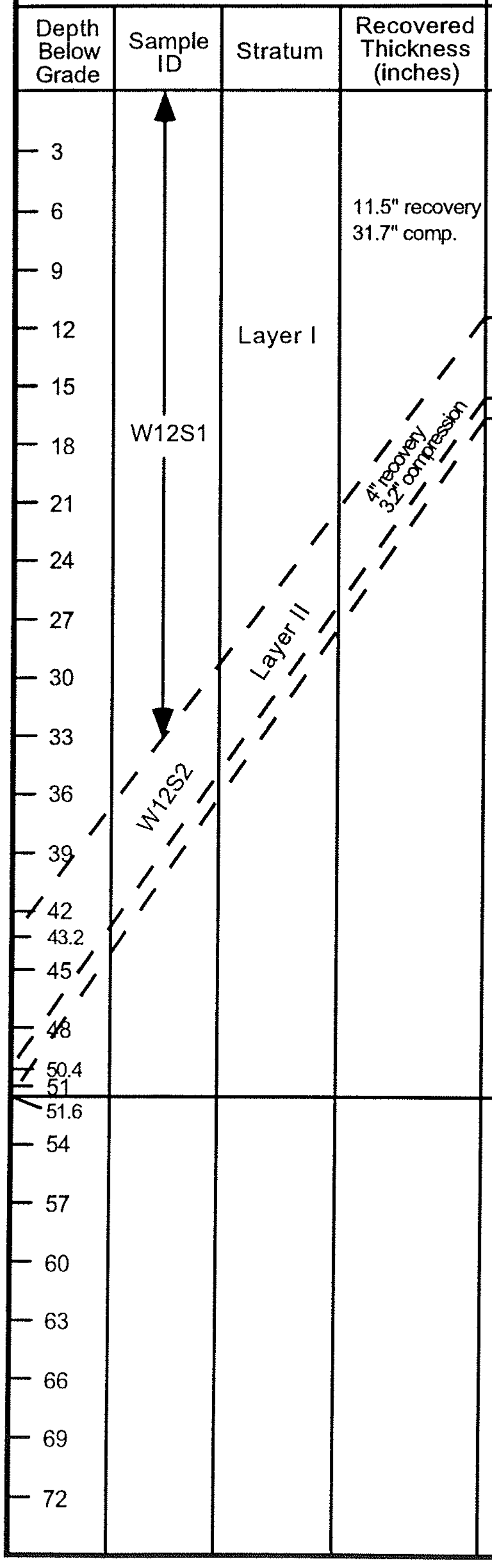
Drive = 5.2'
In tube = 1.7'
Recovery = 1.75'
Loss = 0"
Compression = 42"
Expansion = 0"

6.1' Tube
3.5' hand push - 10.8" core
4.2' very firm

Boring Log

Boring No. W-12

PROJECT: Cumberland Bay IRM	CONTRACTOR: RUST E&I	Page 1 of 1
PROJECT NO: 39304.10006	LOCATION: Cumberland Bay, Plattsburgh, NY	DATE: 12/5/97
SURFACE ELEVATION: 96.98	DATUM: Lake Champlain - Ferry Dock	



SAMPLE DESCRIPTION, REMARKS, AND STRATUM CHANGES

Organic Mat & Muck.

Oily stained appearance 11.0'-11.5'.

11.5"

Medium dense, wet, blue-gray medium to mostly fine SAND, occasional layers of organic fiber, wood chips, roots.

15.5"

1.2" core loss

16.7"

No sludge encountered.

Total Boring Depth = 51.6"

Notes:

Drive = 4.3"
In tube = 1.4'
Recovery = 1.2'
Loss = 1.2"
Compression = 34.9"
Expansion = 1.2"

6.1' tube
3.7' Hand push (0.9' in tube)
4.3' HARD (Refusal)

Boring Log

Boring No. W-13

PROJECT: Cumberland Bay IRM	CONTRACTOR: RUST E&I	Page 1 of 1
PROJECT NO: 39304.10006	LOCATION: Cumberland Bay, Plattsburgh, NY	DATE: 12/5/97
SURFACE ELEVATION:	DATUM: Lake Champlain - Ferry Dock	

Depth Below Grade	Sample ID	Stratum	Recovered Thickness (inches)	SAMPLE DESCRIPTION, REMARKS, AND STRATUM CHANGES
3 6		Layer I	6" recovery 26" comp.	Organic Mat and Muck: Dark reddish-brown, highly fiberous, saturated, organic material with black/dark brown very loose mud. Stained with oily substance at 6" 6.0"
9 12				Interlayered, mostly medium to fine SAND and wood chips, paper pulp, and sludge. Heavy oil staining, strong odor. 14.0"
15 18 21 24 27 30	W13S1	Layer II/III	7" recovery 6.6" compression 18" recovery 0" compression	Medium dense, saturated, blue-gray medium to mostly fine SAND. 32.0"
32 33 36 39 42 45 45.6 48 51 54 57 60 63		Layer IV		Total Boring Depth = 63.6"
66 69 72				Notes: Drive = 5.3' In tube = 2.6' Recovery = 2.6' Loss = 0" Compression = 32.4" Expansion = 0" Hand push to 2.6' (0.5' in tube) Stiff @ 3.8' (1.1' in tube) Hard @ 5.3' (2.6' in tube)

Boring Log

Boring No. W-14

PROJECT: Cumberland Bay IRM	CONTRACTOR: RUST E&I	Page 1 of 1
PROJECT NO: 39304.10006	LOCATION: Cumberland Bay, Plattsburgh, NY	DATE: 12/5/97
SURFACE ELEVATION:	DATUM: Lake Champlain - Ferry Dock	

Depth Below Grade	Sample ID	Stratum	Recovered Thickness (inches)	SAMPLE DESCRIPTION, REMARKS, AND STRATUM CHANGES
3		Layer I	9" recovery 10.8" comp.	Red brown coarse sand sized wood chips and medium fine SAND.
6				
9				9.0"
12				
15				
18				
19.8				
21				Loose, saturated, highly fiberous, layered pulp, sludge, and wood chips. Layers of multi-hued sludge - green, red, blue, green-gray and purple. <u>SLUDGE</u>
24				
27			30" recovery 22.2" comp.	
30		Layer III		
33				
36	W14S1			
39				39.0"
42				
45				Drive did not reach bottom of sludge bed. Sludge bottom > 72".
48				
51				
54				
57				
60				
63				
66				
69				
72				Total Boring Depth = 72.0"

Notes:

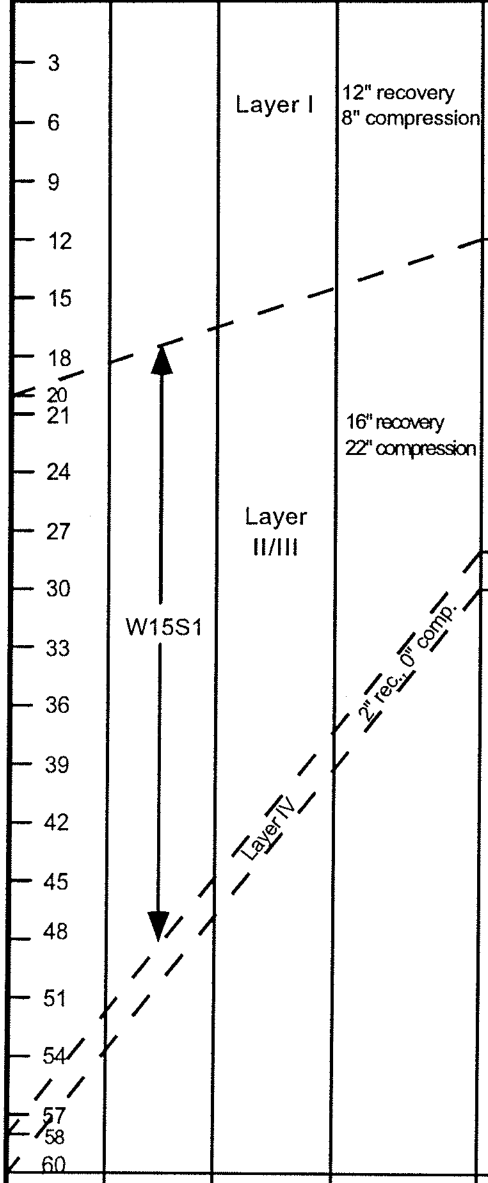
Drive = 6.0' In tube = 3.1'	Recovery = 3.1" Loss = 0	Compression = 33" Expansion = 2"	Hand push to 1' (0.3' in tube) Very soft @ 6.0'

Boring Log

Boring No. W-15

PROJECT: Cumberland Bay IRM	CONTRACTOR: RUST E&I	Page 1 of 1
PROJECT NO: 39304.10006	LOCATION: Cumberland Bay, Plattsburgh, NY	DATE: 12/5/97
SURFACE ELEVATION:	DATUM: Lake Champlain - Ferry Dock	

Depth Below Grade	Sample ID	Stratum	Recovered Thickness (inches)	SAMPLE DESCRIPTION, REMARKS, AND STRATUM CHANGES



Organic Mat and Soil:
Humic mat ~8" thick, abundant roots, wood fiber, leaves, etc. over a loose, moist, red-brown, medium fine SAND and Silt.

12.0"

Interlayered blue-gray medium SAND, wood chips, pulp, and sludge.

21" Black stained, pungent odor, tarry appearance and texture.

28.0"

Medium dense, wet, blue-gray, medium to mostly fine SAND.

30.0"

Bottom of sludge ~ 58" dbg.

Total Boring Depth = 60.0"

63
66
69
72

Notes:

Drive = 5.0'
In tube = 2.5'
Recovery = 2.5'
Loss = 0"
Compression = 30"
Expansion = 0"

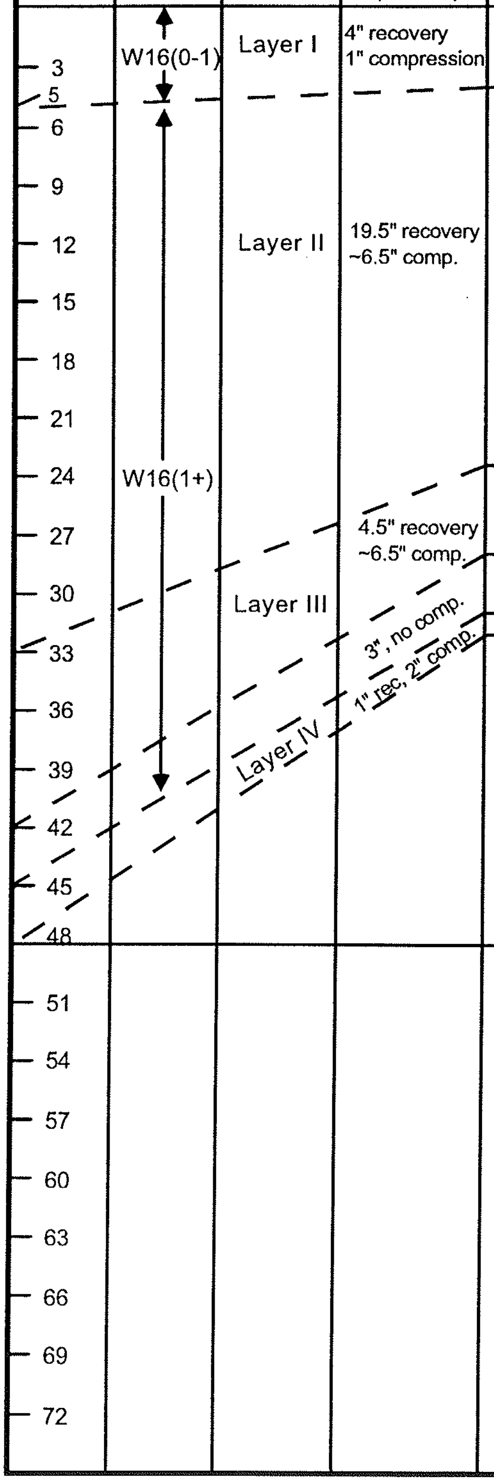
6.1 tube
Hand push to 1.2' (0.5' in tube)
Very firm @ 5.0'

Boring Log

Boring No. W-16

PROJECT: Cumberland Bay IRM	CONTRACTOR: RUST E&I	Page 1 of 1
PROJECT NO: 39304.10006	LOCATION: Cumberland Bay, Plattsburgh, NY	DATE: 12/5/97
SURFACE ELEVATION:	DATUM: Lake Champlain - Ferry Dock	

Depth Below Grade	Sample ID	Stratum	Recovered Thickness (inches)	SAMPLE DESCRIPTION, REMARKS, AND STRATUM CHANGES



<u>Organic Mat & Soil:</u>
Dark brown organic fiber with reddish brown medium to fine Sand and Silt. 4.0"

Loose, wet, red brown, mostly coarse to medium SAND, little fine Gravel, layers of wood chips, abundant plant fibre.

23.5"

Whitish gray paper pulp interlayered (<1/2") with gray and red-brown Silty-clay highly organic sludge. 28.0"

Block of wood. 31.0"

Medium dense, wet, blue-gray, medium to mostly fine SAND. 32.0"

Bottom of sludge < 42".

Total Boring Depth = 48.0"

<u>Notes:</u>

Drive = 4.0'
In tube = 2.6'
Recovery = 2.6'
Loss = 0"
Compression = 16"
Expansion = 0"

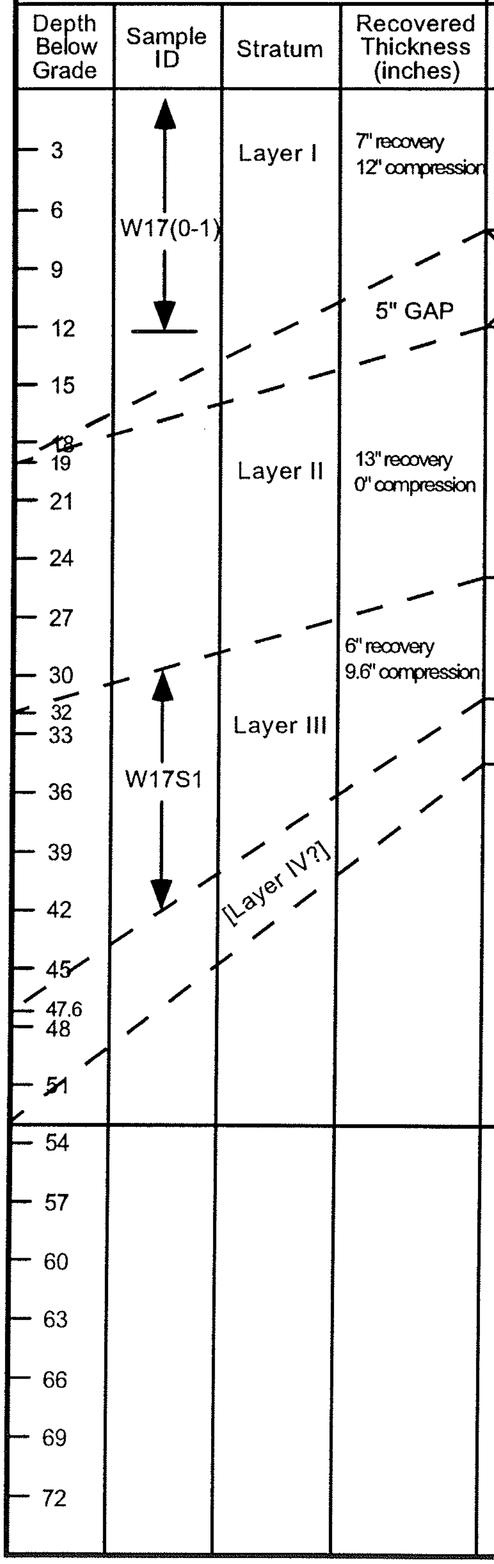
6.1' tube
Hand push to 0.4'
Soft to 3.6' (2.4' in tube)
Very hard @ 4.0

Boring Log

Boring No. W-17

PROJECT: Cumberland Bay IRM	CONTRACTOR: RUST E&I	Page 1 of 1
PROJECT NO: 39304.10006	LOCATION: Cumberland Bay, Plattsburgh, NY	DATE: 12/5/97
SURFACE ELEVATION:	DATUM: Lake Champlain - Ferry Dock	

SAMPLE DESCRIPTION, REMARKS, AND STRATUM CHANGES



Organic Mat:
Loose, moist, reddish-brown, highly fiberous, organic material.

7.0"

GAP IN CORE 5"

12.0"

Loose, wet, red-brown, tan, and black (Hematite) mostly medium to fine SAND, with layers (<1/2") of wood chips and organic fiber.

25.0"

Somewhat loose, saturated, red-brown and blue-gray, highly organic Silt and wood pulp. SLUDGE.

31.0"

3.6" loss in extraction.

34.6"

Bottom of sludge >31".

Total Boring Depth = 53.0"

Notes:

Drive = 4.4'	6.1' tube
In tube = 2.6'	Hand push to 1.4' (0.4' in tube)
Recovery = 2.7'	Firm @ 4.0' (2.2' in tube)
(less 0.4' GAP = 2.3')	Hard @ 4.4' (2.6' in tube)
Loss = 0.3'	
Compression = 21.6"	
Expansion = 0"	

Boring Log

Boring No. W-18

PROJECT: Cumberland Bay IRM	CONTRACTOR: RUST E&I	Page 1 of 1
PROJECT NO: 39304.10006	LOCATION: Cumberland Bay, Plattsburgh, NY	DATE: 12/5/97
SURFACE ELEVATION:	DATUM: Lake Champlain - Ferry Dock	

Depth Below Grade	Sample ID	Stratum	Recovered Thickness (inches)	SAMPLE DESCRIPTION, REMARKS, AND STRATUM CHANGES
3 6	W18(0-1)	Layer I	7" recovery 5" compression	<u>Organic Mat:</u> Dark reddish brown, highly fiberous, peat like material. 7.0"
9 12 15 18 21		Layer II	14" recovery 0" compression	Loose, wet, light olive-brown (2.5Y 5/4) medium to mostly fine SAND layers (<1/4") of light blue-gray medium dense very fine SAND and organic fibers. 21.0"
24 26 27 30 33 36 39		Layer III	20" recovery 3" compression	Loose, saturated, green gray (10G 6/1) mostly medium to fine SAND, frequent organic matter interlayered (<2") with dark blue-gray fine Sand and Silt, wood chips, organic Silt, paper pulp. <u>SLUDGE.</u> 41.0"
42	W18S1		3" recovery 0" comp.	Medium dense, saturated, gray fine SAND. 44.0"
45 48 49 51	W18S2	Layer IV		Bottom of sludge ~48" dbg. Total Boring Depth = 52.0"
54 57 60 63 66 69 72				<u>Notes:</u>

Drive = 52" (4.3')
In tube = 44" (3.6')
Recovery = 44" (3.6')
Loss = 0"
Compression = 8"
Expansion = 0"

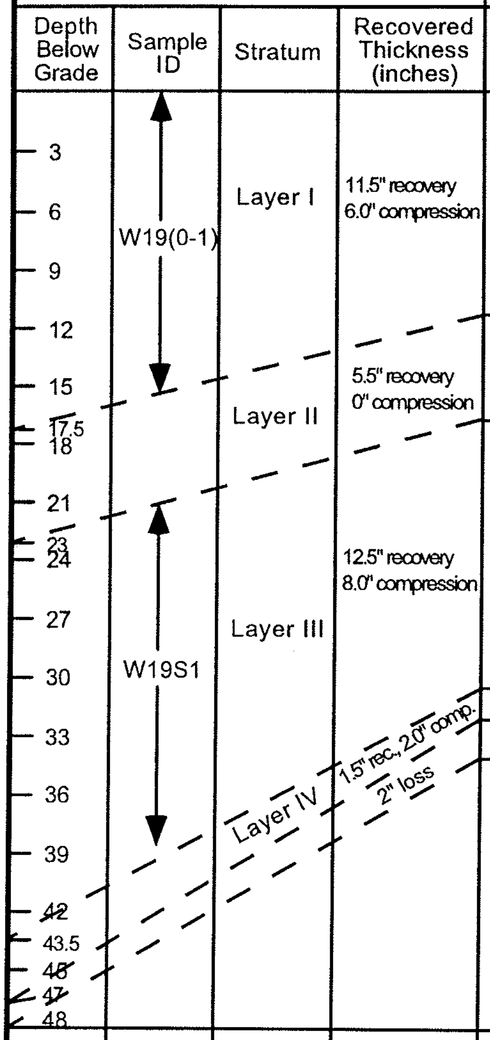
6.1' tube
Hand push to 0.6'
Soft to 3.5' (3.0 in tube)
Hard @ 42'

Boring Log

Boring No. W-19

PROJECT: Cumberland Bay IRM	CONTRACTOR: RUST E&I	Page 1 of 1
PROJECT NO: 39304.10006	LOCATION: Cumberland Bay, Plattsburgh, NY	DATE: 12/5/97
SURFACE ELEVATION:	DATUM: Lake Champlain - Ferry Dock	

Depth Below Grade	Sample ID	Stratum	Recovered Thickness (inches)	SAMPLE DESCRIPTION, REMARKS, AND STRATUM CHANGES



<u>Organic Mat:</u>
Dark red-brown, loose, moist, highly fiberous, organic material with fine Sand and Silt.

11.5"

Loose, wet, blue-gray mostly medium to fine SAND; occasional bits of organics.

17.0"

Interlayered loose, wet, blue-gray medium to fine SAND, and wood chips.

30.5"

Medium dense, saturated, blue-gray fine SAND.

32.0"

34.0"

Bottom of Sludge ~46" dbg.

Total Boring Depth = 48.0"

<u>Notes:</u>

Drive = 4.0'
In tube 2.8'
Recovery = 2.7'
Loss = 2"
Compression = 16"
Expansion = 0"

6.1' tube
Hand push to 1.1' (0.7' in tube)
Firm @ 3.3' (2.3 ft in tube)
Hard @ 4.0' (2.8 ft in tube)

Boring Log

Boring No. W-20

PROJECT: Cumberland Bay IRM	CONTRACTOR: RUST E&I	Page 1 of 1
PROJECT NO: 39304.10006	LOCATION: Cumberland Bay, Plattsburgh, NY	DATE: 12/5/97
SURFACE ELEVATION:	DATUM: Lake Champlain - Ferry Dock	

Depth Below Grade	Sample ID	Stratum	Recovered Thickness (inches)	SAMPLE DESCRIPTION, REMARKS, AND STRATUM CHANGES
3 6 9	W20(0-1)	Layer I	10" recovery 3" compression	Organic Mat: Dark red-brown, loose, moist, highly fiberous, organic material
12 ~~13~~				10.0"
15 18		Layer II	11" recovery 0" compression	Loose, red-brown, mostly medium to fine SAND interlayered with blue-gray medium to mostly fine SAND. Abundant organics.
21 ~~24~~				21.0"
27 30 33	W20S1	Layer III	14" recovery 9" compression	Interlayered red-brown and whitish gray highly organic Silt and paper pulp. Layers of very coarse wood chips.
36				35.0" Medium dense, wet, blue-gray fine SAND. 36.0"
39 42		Layer IV	1" rec., 0" comp.	Bottom of Sludge ~47" dbg.
45 ~~47~~ 48				Total Boring Depth = 48.0"
51 54 57 60 63 66 69 72				

Notes:

Drive = 4.0 (48")
In tube 3.0 = (36")
Recovery = 3.0 (36")
Loss = 0"
Compression = 12"
Expansion = 0"

6.1' tube
Firm to 4.0
Hard @ 4.0

APPENDIX J

1998 Geotechnical Boring Logs

RUST E&I Albany, NY (518) 458-1313	Test Boring Log	Boring No. GB-98-1

PROJECT: Cumberland Bay					Sheet 1 of 2
CLIENT: New York State Department of Environmental Conservation					Job No.
DRILLING CONTRACTOR: Atlantic Testing Laboratory					Meas. Pt. Elev.: 96.56'
PURPOSE: Geotechnical Investigation for Sheetpile Wall					Ground Elev.: 83.81'
DRILLING METHOD: Drive & Wash		SAMPLE	CORE	CASING	Datum:
DRILL RIG TYPE: CME 45	TYPE	Split Spoon			Date Started: 6/3/98
GROUNDWATER DEPTH:	DIAM.	2" O.D.		4"	Date Finished: 6/3/98
MEAS. PT.:	WEIGHT				Driller: P. Davis
DATE OF MEAS.:	FALL				Inspector: D. Foti

Depth (Feet)	Sample Number	Blow Count	Casing Blow	Recovery	GEOLOGIC DESCRIPTION	REMARKS
1 2 3 4 5					Water/Depth to sludge 12.75'. Soft: Sludge and/or silty organic material. 6.0'	Note: Casing set into sediment under its own weight.
6 7	S-1	7 6 10 11	10 19	1.5'	Sludge/wd chips. 6.1' Gr Cy$, t(+) f S, t mf(+) G; Alt. $yC sm; low pl; wet; firm grades to Gr cmf(-) S, t $; wet; loose. 8.0'	Casing set @ 6.0' 0.75 pp @ 6.5'
8 9 10	S-2	14 14 17 27	18 44	1.4'	Gr f S, l $; wet; med-firm grades to . Gr $, t(-) f S; firm; wet. Gr m(-)f S, l $; med firm w. 10.0'	0.75 pp @ 9.0' Varved C @ 9.3'

RUST E&I
Albany, NY (518) 458-1313

Test Boring Log

Boring No. GB-98-1

PROJECT: Cumberland Bay

Sheet 2 of 2

CLIENT: New York State Department of Environmental Conservation

Job No.

Depth (Feet)	Sample Number	Blow Counts	Casing Blow	Recovery	Geologic Description	Remarks
	S-3	29	65	1.35'	Gr mf(+) S, t(+) $, l(-) mf(+) G; wet; dense grades to Gr mf(+) S, l(-) $, l(+) mf(+) G; v dense. 12.0'	
11		30				
		42	77			
		31				
12	S-4	35	75	0.4'	Gr mf S, l $, s(-) c(-)mf G; v dense; wet. (TILL) 14.0'	Angular gravel.
13		40				
		42	110			
		39				
14	S-5	19			Gr m(-)f S, l $, s(-) c(-)mf G; v dense; wet. (TILL) 16.0'	
		44				
15		100/6"				
		104				
16					Terminate boring @ 16.0'	

RUST E&I Albany, NY (518) 458-1313	**Test Boring Log**	**Boring No. GB-98-2**

PROJECT: Cumberland Bay
Sheet 1 of 2
CLIENT: New York State Department of Environmental Conservation
Job No.
DRILLING CONTRACTOR: Atlantic Testing Laboratory
Meas. Pt. Elev.: 96.56'
PURPOSE: Geotechnical Investigation for Sheetpile Wall
Ground Elev.: 83.16'
DRILLING METHOD: Drive & Wash
Datum:
DRILL RIG TYPE: CME 45
Date Started: 6/3/98
GROUNDWATER DEPTH:
Date Finished: 6/3/98
MEAS. PT.:
Driller: P. Davis
DATE OF MEAS.:
Inspector: D. Foti

	SAMPLE	CORE	CASING
TYPE	Split Spoon		
DIAM.	2" O.D.		4"
WEIGHT			
FALL			

Depth (Feet)	Sample Number	Blow Count	Casing Blow	Recovery	GEOLOGIC DESCRIPTION	REMARKS
1					Water/Depth to sludge 13.4'.	Casing submerged under its own weight. Wind difficulties, casing submerging increased.
2					Soft: Sludge/silty org.	
3						
4						
5					Barge movement submerged casing additional 1.0' 6.0'	
6	S-1	13 8 9 6	~10-20 ~10-20	0.9'	Ltgr f S, l(+) $; wet; loose. 8.0'	Casing set @ 6.0'
7						
8	S-2	10 15 7 6	~15 ~15	1.0'	Gr $yC/C&$, l(+) cmf(-) G grading to $&C; wet, med/firm. 10.0'	
9						
10						

RUST E&I
Albany, NY (518) 458-1313

Test Boring Log

Boring No. GB-98-2

PROJECT: Cumberland Bay

Sheet 2 of 2

CLIENT: New York State Department of Environmental Conservation

Job No.

Depth (Feet)	Sample Number	Blow Counts	Casing Blow	Recovery	Geologic Description	Remarks
11 12	S-3	16 14 10 15	15 38	0.3'	Recovered wash gravel with $yC, cmf G (unknown percentages). 12.0'	Poor recovery.
13 14	S-4	18 20 16 27	24 51	0.5' (+4" wash)	Gr cmf G, l(-) cmf(-) S, l(-) $; wet; med dense. (TILL) 14.0'	Poor recovery.
15 16	S-5	30 36 35 60	56 80	0.8'	Gr cmf G, s(-) cmf(-) S, l(-) $; wet; v dense. (TILL) 16.0'	
17 18	S-6	100/3"	215 320/10"	NR	Wash only Refusal @ 16.0' (TILL) 18.0'	

RUST E&I
Albany, NY (518) 458-1313

Test Boring Log

Boring No. GB-98-3

PROJECT: Cumberland Bay					Sheet 1 of 2
CLIENT: New York State Department of Environmental Conservation					Job No.
DRILLING CONTRACTOR: Atlantic Testing Laboratories					Meas. Pt. Elev.: 96.56'
PURPOSE: Geotechnical Investigation for Sheetpile Wall					Ground Elev.: 87.56'
DRILLING METHOD: Drive & Wash		SAMPLE	CORE	CASING	Datum:
DRILL RIG TYPE: CME 45	TYPE	Split Spoon			Date Started: 6/3/98
GROUNDWATER DEPTH:	DIAM.	2" O.D.		4"	Date Finished: 6/4/98
MEAS. PT.:	WEIGHT				Driller: P. Davis
DATE OF MEAS.:	FALL				Inspector: D. Foti

Depth (Feet)	Sample Number	Blow Count	Casing Blow	Recovery	GEOLOGIC DESCRIPTION	REMARKS
					Water/Depth to sludge/organic silt = 9.0 0.5'	soft sediment
1 2	S-1	2 1 1 2	4 11	0.8'	Br c(-)mf S, t(-) $; wet; loose. 2.5'	fine wd chips sm @ 3" to 4"
3 4	S-2	2 5 3 1	12 9	0.75'	Br c(-)mf S, t $; wet; loose. Note: wood/organic chunk/wood chunk @ 3.0' 4.5'	
5 6	S-3	2 1 4 6	10 18	1.3'	Br mf S, t $; wet; loose grades to Grbr f S, l $; t mf G; wet; med loose. 6.5'	
7 8	S-4	5 5 6 4	13 27	1.0'	Gr f S, l $; wet; med dense grades to Gr mf S, l $, t mf(+) G; wet; med loose. 8.5'	
9 10	S-5	2 4 6	22 41	0.75'	Dkgr c(+)mf S, t(-) $, t(+) mf G; wet; loose.	

RUST E&I Albany, NY (518) 458-1313	**Test Boring Log**	**Boring No.** **GB-98-3**
PROJECT: Cumberland Bay		Sheet 2 of 2
CLIENT: New York State Department of Environmental Conservation		Job No.

Depth (Feet)	Sample Number	Blow Counts	Casing Blow	Recovery	Geologic Description	Remarks
	S-5 (cont.)	7			10.3' Dkgr Cy$, t mf S; wet; med firm. 10.5'	
11 12	S-6	16 16 24 27	50 75	0.75'	Dkgr cmf S, t(-) $, l(-) c(-) mf G; wet; dense grades to Dkgr c(-)mf G, l(-) mf S, t(-) $; wet; v. dense. (TILL) 12.5'	Stop here on 6/3/98
13 14	S-7	28 25 23 26	84 72	1.1'	Dkgr c(-)mf G, s cmf S, l(-) $; wet; v. dense. (TILL) 14.5'	Resume on 6/4/98
15 16	S-8	34 31 33 36	275 176	0.8'	Dkgr c(-)mf G, s cmf S, l(-) $; v. dense; wet. (TILL) 16.5'	
17 18	S-9	23 21 26 25		1.2'	Dkgr cmf(-) S, l(-) $, s(-) mf(+) G; v. dense; wet. (TILL) 18.5'	
					Terminate Boring @ 18.5'	

RUST E&I
Albany, NY (518) 458-1313

Test Boring Log

Boring No. GB-98-4

PROJECT: Cumberland Bay	Sheet 1 of 2
CLIENT: New York State Department of Environmental Conservation	Job No.
DRILLING CONTRACTOR: Atlantic Testing Laboratory	Meas. Pt. Elev.: 96.58'
PURPOSE: Geotechnical Investigation for Sheetpile Wall	Ground Elev.: 87.28'

DRILLING METHOD: Drive & Wash		SAMPLE	CORE	CASING	Datum:
DRILL RIG TYPE: CME 45	TYPE	Split Spoon			Date Started: 6/4/98
GROUNDWATER DEPTH:	DIAM.	2" O.D.		4"	Date Finished: 6/4/98
MEAS. PT.:	WEIGHT				Driller: P. Davis
DATE OF MEAS.:	FALL				Inspector: D. Foti

Depth (Feet)	Sample Number	Blow Count	Casing Blow	Recovery	GEOLOGIC DESCRIPTION	REMARKS
1					Soft; sludge. 1.5'	Casing settled 1.5' under its own weight.
2 3	S-1	1 1 1 1	4 4	1.1'	Br c(-)mf S, t $, t(-) f G; wet; v loose. 3.5'	
4 5	S-2	2 3 5 9	19 36	1.45'	Br cmf S, t $; wet; loose. 5.1' Gr f S, l $; wet; med loose. 5.5'	
6 7	S-3	3 1 1 2	23 15	2.0'	Gr $&C grading to $yC; wet; firm. 7.5'	0.4 pp avg. @ 6.5'.
8 9	S-4	4 9 3 5	35 36	2.0'	Gr $yC; wet; firm. 8.0' Cy$, t(-) f S; wet. 8.5' Gr $yC, t(-) cm S, s c(-)mf G; wet; med dense. 9.5'	
10	S-5	48			Dkgr $, s cmf(-) S, s(+) c(-)mf G; wet; med dense.	

RUST E&I
Albany, NY (518) 458-1313

Test Boring Log

Boring No.
GB-98-4

PROJECT: Cumberland Bay

Sheet 2 of 2

CLIENT: New York State Department of Environmental Conservation

Job No.

Depth (Feet)	Sample Number	Blow Counts	Casing Blow	Recovery	Geologic Description	Remarks
11	S-5 (cont.)	44 10 12	?	0.75'	11.5'	
12 13	S-6	13 10 14 20	?	0.9'	Gr cmf S, s(-) $, s(-) c(-)mf G; wet; med dense. (TILL) 13.5'	
14 15	S-7	23 20 20 35	65 82	1.9'	Br cmf S, t(-) $, t mf G; wet; loose. 13.6' Gr c(-)mf G, l(-) $, s(-) cmf S; wet. 14.0' Gr $, t(+) f S, l(-) mf G; wet; firm. (TILL) 15.1' Dkgr cmf S, l $, l(+) c(-)mf G; wet; med dense. (TILL) 15.5'	
16 17	S-8	29 49 71 100		0.8'	Gr cmf G, s(+) cmf(-) S, l(-) $; wet; v dense. (TILL) 17.5'	
					Terminate Boring @ 17.5'	

RUST E&I Albany, NY (518) 458-1313	# Test Boring Log	**Boring No. GB-98-5**

PROJECT: Cumberland Bay	Sheet 1 of 2
CLIENT: New York State Department of Environmental Conservation	Job No.
DRILLING CONTRACTOR: Atlantic Testing Laboratories	Meas. Pt. Elev.: 96.60'
PURPOSE: Geotechnical Investigation for Sheetpile Wall	Ground Elev.: 93.1'

DRILLING METHOD: Drive & Wash		SAMPLE	CORE	CASING	Datum:
DRILL RIG TYPE: CME 45	TYPE	Split Spoon			Date Started: 6/2/98
GROUNDWATER DEPTH:	DIAM.	2" O.D.		4"	Date Finished: 6/2/98
MEAS. PT.:	WEIGHT				Driller: P. Davis
DATE OF MEAS.:	FALL				Inspector: D. Foti

Depth (Feet)	Sample Number	Blow Count	Casing Blow	Recovery	GEOLOGIC DESCRIPTION	REMARKS
					Water/Depth to sludge 3.5'. 0.0'	
0 1 2					Sludge. 2.5'	Casing set 2.5' under its own weight.
3 4	S-1	11 3 2 2	12 8	1.4'	Gr $yC, t(+) f S, l(+) m(+)f G; wet; med firm. 3.0' Gr $yC, t f S, l f G; wet. 4.5'	0.6-0.7 pp @ 4.0'
5 6	S-2	4 3 4 6	9 13	1.0'	Gr Cy$, t(+) S, l(-) f G grades to Gr $&C, t(-) S, t(+) f G; wet; med firm. 6.5'	0.25 pp @ 6.0'
7 8	S-3	4 3 3 4	11 21	0.75'	Gr Cy$, t(-) f S, t(+) mf(+) G; wet; med firm. 8.5'	0.5 pp @ 8.0'
9	S-4	10	17	NR	c G blocked shoe.	

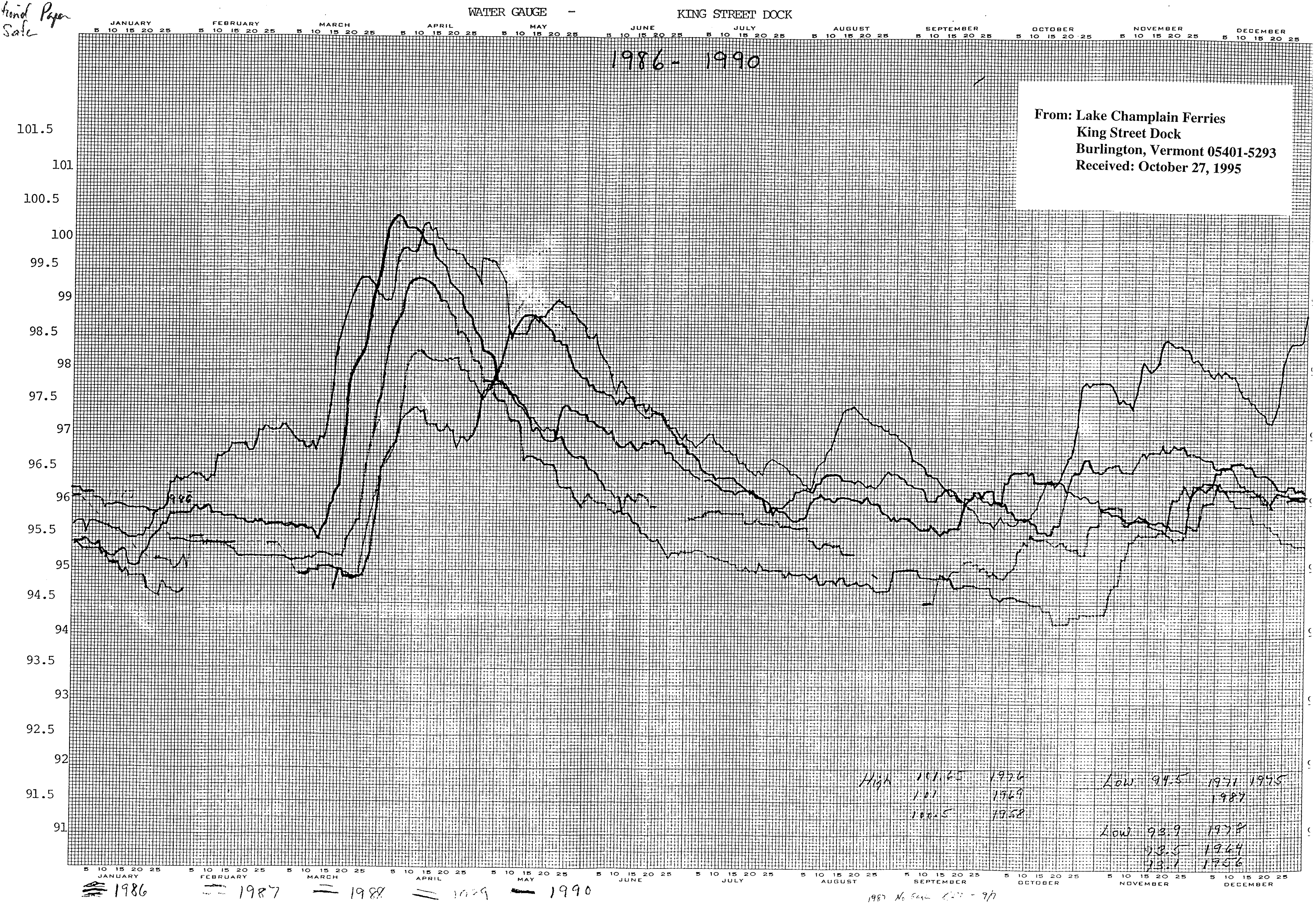
RUST E&I Albany, NY (518) 458-1313	**Test Boring Log**	**Boring No.** **GB-98-5**
PROJECT: Cumberland Bay		Sheet 2 of 2
CLIENT: New York State Department of Environmental Conservation		Job No.

Depth (Feet)	Sample Number	Blow Counts	Casing Blow	Recovery	Geologic Description	Remarks
10	S-4 (cont.)	7 10 8	47		10.5'	
11 12	S-5	5 13 18 22	35 103	0.5'	Grbl c(+)mf S, ? $, l c(-)mf G; wet. 12.5'	Note: gravel (#2) in shoe; ($ % ? due to gravel); $ washed out.
13 14	S-6	22 19 18 20	142 143	0.85'	Gr cmf G, t(+) cm S, l(+) $; wet; med dense. (TILL) 14.5'	Gravel angular.
15 16	S-7	13 14 13 14			Gr c(-)mf G, l(+) cmf S, l(-) $; wet; v dense. (TILL) 16.5'	
					Terminate boring @ 16.5'	

APPENDIX K

Lake Champlain Surface Water Levels

Additional Paper
in Safe



WATER GAUGE - KING STREET DOCK

1986 - 1990

From: Lake Champlain Ferries
King Street Dock
Burlington, Vermont 05401-5293
Received: October 27, 1995

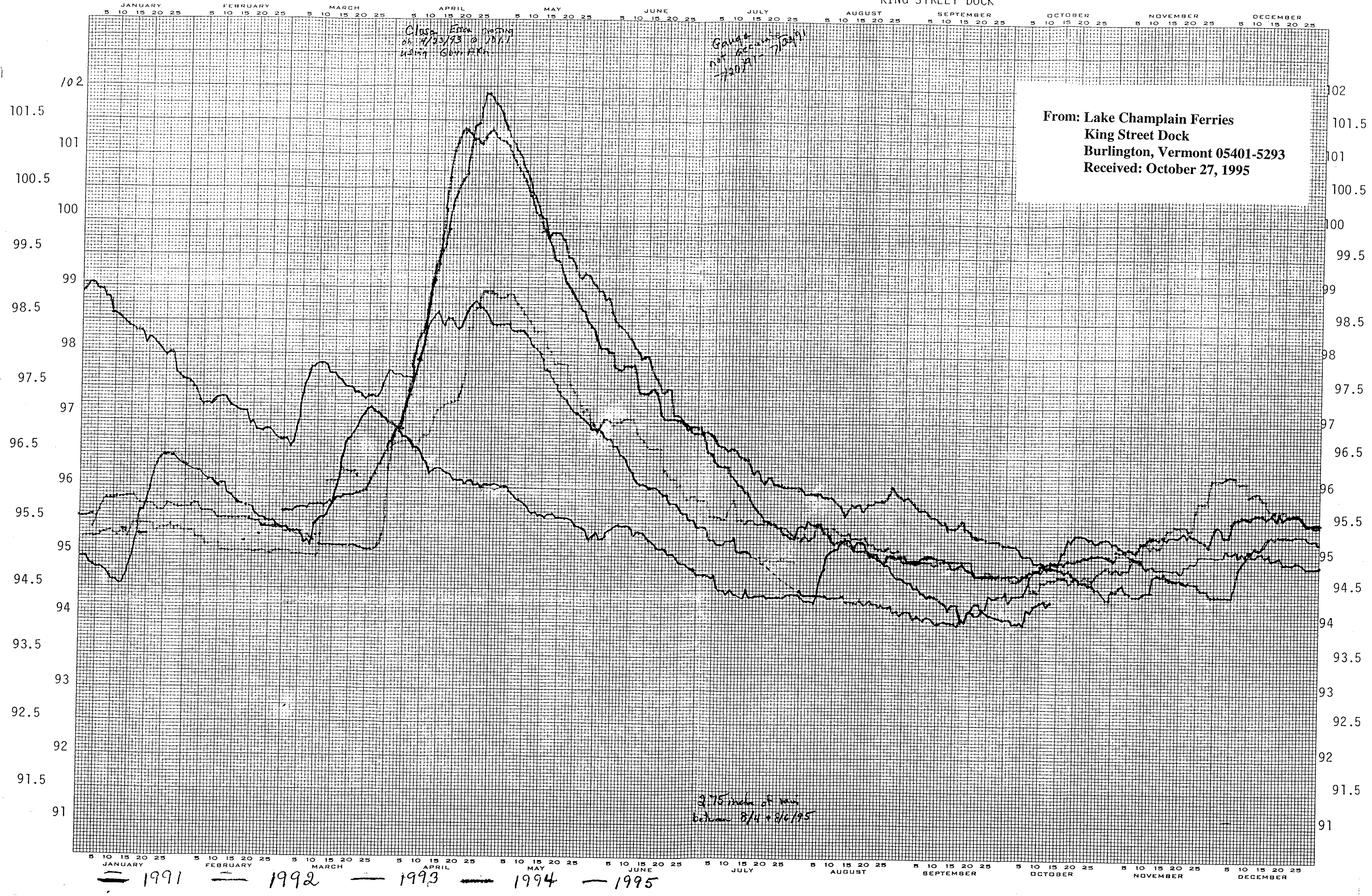
High 101.65 1976
101 1969
100.5 1958

Low 94.5 1971 1995
1987

Low 93.9 1978
93.5 1964
93.1 1956

1987 No Gage 6/27 - 9/7

WATER GAUGE - 1991 - 1995 KING STREET DOCK



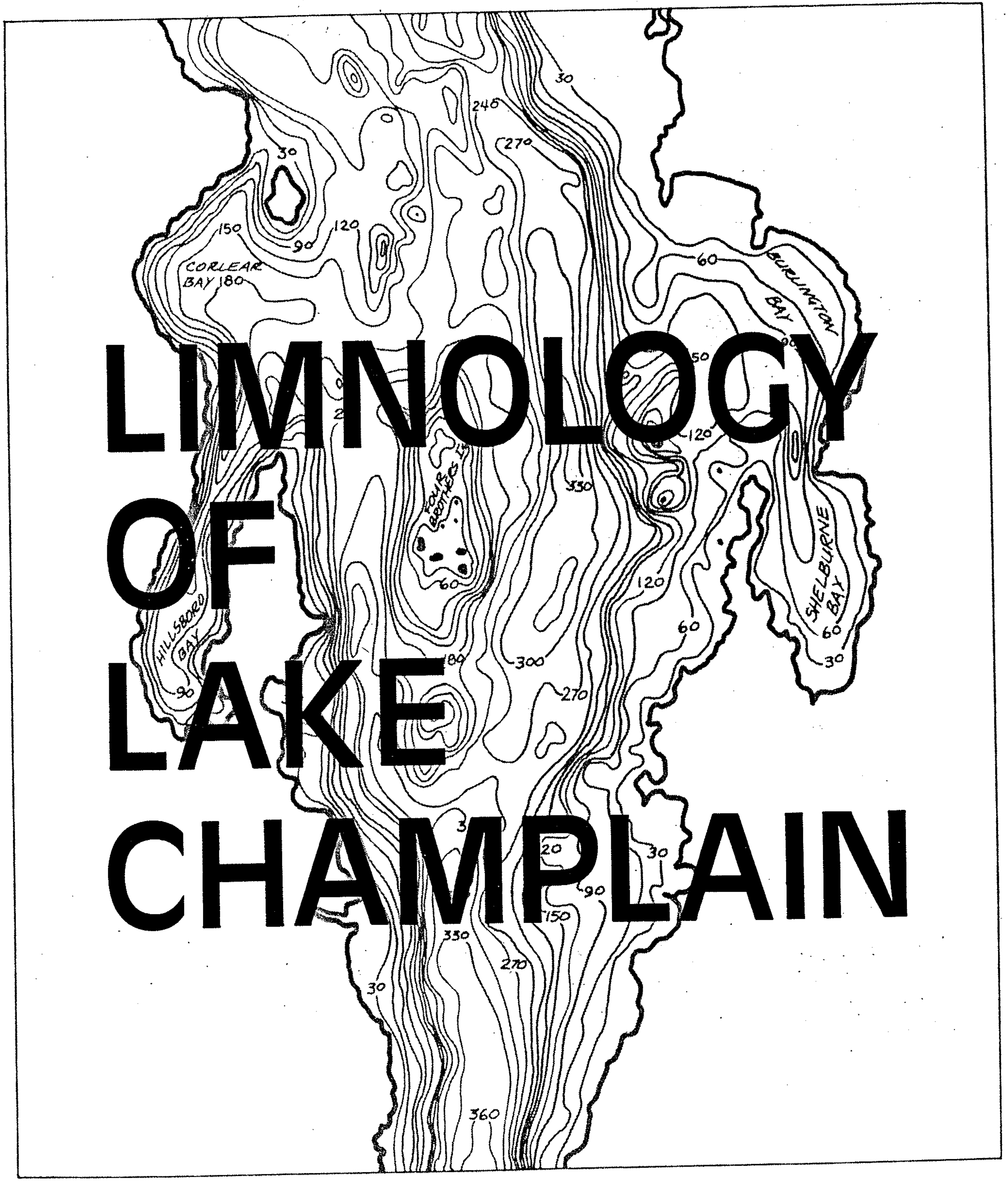
From: Lake Champlain Ferries
King Street Dock
Burlington, Vermont 05401-5293
Received: October 27, 1995

APPENDIX L

Cumberland Bay Current Direction

G. Myer

LIMNOLOGY OF LAKE CHAMPLAIN



LAKE CHAMPLAIN BASIN STUDY

LIMNOLOGY OF LAKE CHAMPLAIN

Prepared by

Glenn E. Myer

and

Gerhard K. Gruendling

State University of New York
College of Arts and Science
Plattsburgh, New York

for

Eutrophication Task Force

January, 1979

Lake Champlain Basin Study
New England River Basins Commission
177 Battery Street - The Ice House
Burlington, Vermont 05401
(802-862-8270)

and turn farther to the right of the wind as depth increases. This is the pattern of flow that would be expected if Ekman drift were the dominant feature in these near surface layers.

From all the currents measured by Myer (1977A) in the upper 5 meters (16.4 feet) of the Main Lake during the summer of 1976 it was found that when the wind was from a constant direction for less than one hour the current at 0.5 meter (1.64 feet) depth averaged 4.54° to the left of the wind direction with a standard deviation of 101.61°. When the wind was from a constant direction for at least 3 hours the flow at 0.5 meter (1.64 feet) averaged 26.50° to the right of the wind with a standard deviation of 17.32°. For a wind from a constant direction for over 6 hours the current at 0.5 meter (1.64 feet) averaged 38.75° to the right of the wind with a standard deviation of 15.15°.

Relatively shallow and restricted regions of the Main Lake do not share the strong two layer current pattern corresponding to the internal seiche or the surface drift pattern developing after many hours of constant wind. In these regions the lake water generally lacks the summer stratification due to their shallowness. The shoreline and bottom topography greatly influences the possible drift patterns. Even after long periods of nearly constant wind, the near surface drift does not flow at as large of an angle to the right of the wind as it does in the open lake. In these regions the current pattern often responds to the wind of the past several hours and the restrictions of the boundaries.

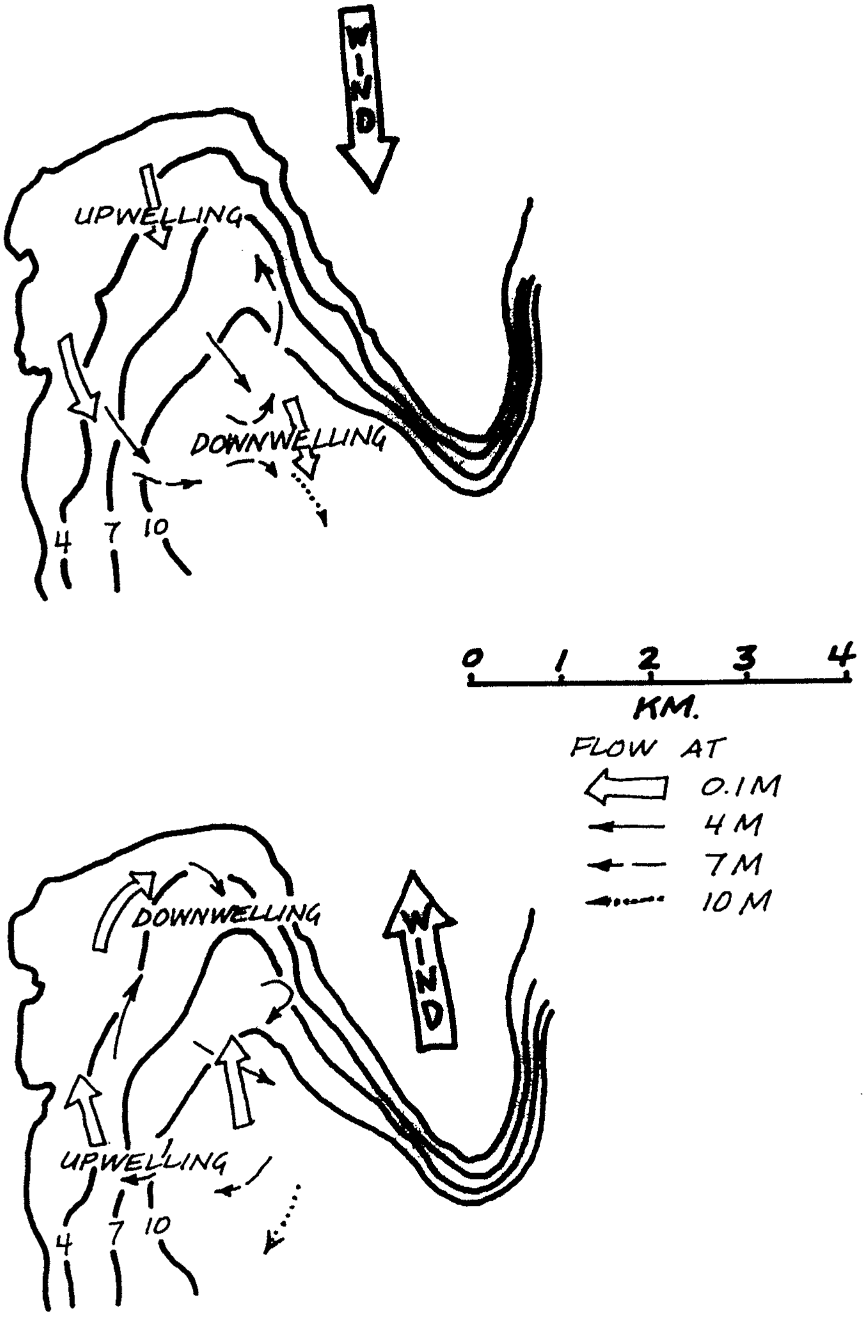
The restricted regions which have been studied in varying detail in the Main Lake include Cumberland Bay, Burlington Bay, Shelburne Bay, the region near the mouth of the Winooski River, and King Bay. Probably the best studied of these are Burlington and Cumberland Bays.

Cumberland Bay currents have been studied by Ayers (1962), Stewart (1969), Myer _et al._ (1976), and Myer (1977A). The flow pattern here, as for other shallow and restricted regions is sensitive to the local wind field. The flow pattern for

Cumberland Bay is illustrated for conditions of north and south winds in Figure 99. After the wind has been from the south for several hours the water moves into the Bay at the surface, with the greatest flow along the western half of the Bay. This surface flow curves to the east in response to the north end of the Bay and downwelling occurs in the northeastern portion of the Bay. Water flows out of the Bay at greater depth along the eastern half. Some of the water at about 5 meters (16.4 feet) depth experiences upwelling again near the western side near the mouth of the Bay. The patterns with the wind from the north is almost the reverse of that with the wind from the south with the exception of the deepest parts of the Bay.

Much of the current information in Burlington Bay has been collected by the Lake Studies Center (1965 and 1977). A considerable amount of this is presently being analyzed by Dr. Milton Potash, University of Vermont, Burlington, Vermont and is expected to be published in the near future. Figure 100 illustrates the general near surface flow in the Bay under different wind conditions extracted by the authors from the unpublished data. The arrows on the diagrams indicate the direction of flow and not the current speed. The flow has been generalized from several different days of observation for conditions of north and south wind. The flow illustrated in the harbor area of the Bay is from one days observations. It can be seen that the currents reflect the wind of the past several hours and tend to follow or be strongly influenced by shorelines. Regions of suspected upwelling can be found where the current seems to flow directly away from the shoreline. With a north or northwest wind a small gyre has been observed near the northern end of Shelburne Bay and a resulting northward flow along the extreme southeastern shoreline of Burlington Bay. This water converges with southward flowing water from behind the breakwater and flows westward away from the shoreline to the south of the breakwater. This flow is suspected to rejoin the southward flow at some distance from the shoreline.

When there is a south wind with speeds of 3.6 to 6.7 meters per second (8 to



GENERAL CURRENT PATTERN IN CUMBERLAND BAY AFTER SEVERAL HOURS OF A STEADY NORTH WIND AND AFTER SEVERAL HOURS OF A STEADY SOUTH WIND.

FIG. 99