Entered

ENGINEERING INVESTIGATIONS AT INACTIVE HAZARDOUS WASTE SITES

FINAL PRELIMINARY SITE ASSESSMENT REPORT

Stauffer Chemical -
Whittaker Subdivision
Town of Lewiston

Site No. 932034
Niagara County

Prepared for:
New York State
Department of
Environmental Conservation
50 Wolf Road, Albany, New York 12233
Thomas C. Jorling, *Commissioner*

Division of Hazardous Waste Remediation
Michael J. O'Toole, Jr., *Director*

By:
E.C. JORDAN CO.
Portland, Maine

December 1992

VOLUME I

NYSDEC SUPERFUND STANDBY CONTRACT
WORK ASSIGNMENT NO. D002472-6.1

FINAL PRELIMINARY SITE ASSESSMENT REPORT
VOLUME I

STAUFFER CHEMICAL - WHITTAKER SUBDIVISION
LEWISTON, NEW YORK

SITE NO. 932034
NIAGARA COUNTY

Prepared for:

New York State Department of Environmental Conservation
Albany, New York

Submitted by:

E.C. Jordan Co.
Portland, Maine

December 1992

Prepared by:

Deborah H.S. Cianchette
Deborah H.S. Cianchette, R.G.
Site Manager
E.C. Jordan Co.

Submitted by:

Glenn L. Daukas, P.G.
Project Manager
E.C. Jordan Co.

Approved by:

William J Weber
William J. Weber
NSSC Program Manager
E.C. Jordan Co.

FINAL PRELIMINARY SITE ASSESSMENT REPORT
STAUFFER CHEMICAL - WHITTAKER SUBDIVISION SITE

TABLE OF CONTENTS

TABLE OF CONTENTS
(continued)

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

REFERENCES

APPENDICES (VOLUME II)

FINAL PRELIMINARY SITE ASSESSMENT REPORT
STAUFFER CHEMICAL - WHITTAKER SUBDIVISION SITE

LIST OF FIGURES

LIST OF TABLES

LIST OF TABLES
(continued)

1.0 EXECUTIVE SUMMARY

E.C. Jordan Co. (Jordan) is submitting this Preliminary Site Assessment (PSA) Report to the New York State Department of Environmental Conservation (NYSDEC) for the Stauffer Chemical-Whittaker Subdivision site. This report was prepared in response to Work Assignment No. D002472-6.0 and 6.1, and in accordance with requirements of the NYSDEC Superfund Standby Contract between Jordan and NYSDEC, Contract No. D002472 (November 1989).

The Stauffer Chemical-Whittaker Subdivision site was listed by NYSDEC on the Registry of Inactive Hazardous Waste Disposal Sites as a Class 3 hazardous waste site not presenting a significant threat to the public health or the environment. The Stauffer Chemical-Whittaker Subdivision site is located in the Town of Lewiston, Niagara County, New York (Figure 1). It is the northern extension of Love Canal, located in Niagara Falls, New York. The excavation of the northern portion of the canal began near the turn of the century; however, it was never completed to join the southern extension because of poor economic conditions. The canal excavation was approximately 100 feet wide, 2,000 feet long, and 10 feet deep.

Between 1930 and 1952, the canal was filled with approximately 50,000 to 75,000 cubic yards of wastes. Since 1952, the area has been developed with residential homes. Numerous investigations have been conducted at the site, but the wastes in the canal have not been analyzed for the hazardous waste characteristics: Extraction Procedure (EP) Toxicity, corrosivity, reactivity, and ignitability; therefore, it has not been possible to determine if these wastes are hazardous as defined by 6 New York State Codes, Rules and Regulations Part 371 (May 1990); however, limited analyses are available to document the presence of hazardous constituents in groundwater.

To obtain data to confirm the presence or absence of hazardous waste, PSA Task 3 and 4 activities were conducted simultaneously at the site by Jordan personnel. The investigation included the drilling of 18 soil borings inside and outside the canal boundaries, with seven completed as monitoring wells, and the collection of three surface water samples and five sediment samples from on-site catchbasins. The subsurface soil and sediment samples were analyzed for characteristics of EP Toxicity for metals, reactivity, corrosivity, and ignitability, and the U.S. Environmental Protection Agency (USEPA) Target Compound List (TCL) of organic and inorganic compounds. The surface water samples were analyzed for only the full suite of USEPA TCL organic and inorganic compounds.

The results of these analyses were used to determine if hazardous waste disposal occurred at the site and whether the site poses a potential threat to public health or the environment. To evaluate which compounds are site contaminants, the validated analytical results were compared to background concentrations, if available, and/or standards established by NYSDEC or USEPA.

The presence of hazardous waste cannot be documented at the site because none of the samples exceeded regulatory limits for RCRA hazardous waste characteristics, and even though promulgated state and federal standards were exceeded in both groundwater and surface water at the Stauffer Chemical - Whittaker Subdivision site, the site classification should be revised from a Class 3 site to a Delisted site. One groundwater sample from MW-1 exceeds the New York State Class GA groundwater standard and the federal Maximum Contaminant Level and Maximum Contaminant Level Goal of 5 micrograms per liter (μg/L) for trichloroethylene; three monitoring wells (MW-1, MW-2, and MW-6) have inorganic compounds that exceed promulgated standards for one or all of the following inorganic compounds: antimony, barium, chromium, and lead; one surface water sample (SW-1 and SW-1 Dup) exceeds the New York State surface water Class D and the federal Ambient Water Quality Criteria standard of 1 μg/L for phenol and 4-methylphenol; and three surface water samples (SW-1, SW-2, and SW-3) have inorganic compounds that exceed promulgated standards for one or all of the following nine inorganic compounds: zinc, cyanide, nickel, antimony, arsenic, lead, iron, mercury, and vanadium. Based on this data and a strict interpretation of Article 27, Title 13, of the *Environmental Conservation Law*, because the presence of hazardous waste has not been documented, and although the exceedance of promulgated state and federal standards for groundwater and surface water has been confirmed, this site does not meet the definition of hazardous waste sites. Therefore, this site will be delisted and referred to the Division of Water for further necessary action for the contravention of groundwater and surface water standards.

2.0 PURPOSE

The Stauffer Chemical - Whittaker Subdivision site is located in North Love Canal in the Whittaker Subdivision in the Town of Lewiston, Niagara County, New York (see Figure 1).

The Stauffer Chemical-Whittaker Subdivision site is a suspected inactive hazardous waste site that has been listed by the New York State Department of Environmental Conservation (NYSDEC) on the Registry of Inactive Hazardous Waste Disposal Sites. This site (Site No. 932034) has been classified in the NYSDEC Registry since 1985 as a Class 3 hazardous waste site not presenting a significant threat to the public health or the environment. The Site Report Form for the Stauffer Chemical - Whittaker Subdivision site is in Appendix I. The site was listed originally on the NYSDEC Registry in 1983 as a Class 2a site, indicating there was insufficient information to document hazardous waste disposal and/or assess the potential risks to public health or the environment. The site was reclassified in 1985.

The purpose of conducting the Preliminary Site Assessments (PSA) at the Stauffer Chemical - Whittaker Subdivision site was to provide the information necessary to reclassify it into one of the following classifications as defined by 6 New York State Codes, Rules, and Regulations (NYCRR) Part 375:

Class 1 -	Causing or presenting an imminent danger of causing irreversible or irreparable damage to the public health or environment - immediate action required
Class 2-	Significant threat to public health or the environment - action required
Class 2a-	Temporary classification assigned to sites that have inadequate and/or insufficient data for inclusion in any of the other classifications
Class 3-	Does not present a significant threat to public health or the environment - action may be deferred
Class 4-	Site is properly closed - requires continued management

Class 5-	Site properly closed, no evidence of present or potential adverse impact - no further action is required
Delist-	Site where hazardous waste disposal is not documented

To classify a site as a Class 2 site, sufficient information must be obtained to establish that hazardous waste has been disposed at the site. Once hazardous waste deposition has been determined the regulations require that the potential for significant threat to public health or the environment must be determined. The following is the procedure that should be used in classifying a Class 2 site.

A. The presence of hazardous waste or deposition of hazardous waste, as defined in 6 NYCRR 371.1(d), which has been disposed of at the site, includes:

   1. Listed hazardous waste under the Resource Conservation and Recovery Act (RCRA) - show presence by documentation, analytical data, or combination of both (refer 6 NYCRR 371.4).

   2. Characteristic Hazardous Waste - run tests for the characteristics: Extraction Procedure (EP) Toxicity, ignitability, corrosivity, and reactivity (6 NYCRR 371.3, b, c, d and e).

      Ignitability: to determine whether a waste will ignite and cause hazard (refer to 6 NYCRR 371.3b).
      Corrosivity: to determine the relative corrosive property of the waste due to its highly alkaline or acidic nature (refer to 6 NYCRR 371.3c).
      Reactivity: to determine the violent reactive nature of a waste that will generate toxic gases or explosive reaction, and so forth (refer to 6 NYCRR 371.3d).
      EP Toxicity: to assess the leachability of certain contaminants from a waste matrix (refer to 6 NYCRR 371.3e).

   3. Polychlorinated Biphenyl (PCB) - defined as hazardous waste if level exceeds 50 parts per million (ppm) or it can be shown that the source contained PCBs above 50 ppm (refer to 6 NYCRR 371.4e).

B. Presence of Significant Threat - Significant threat to the environment or public health caused by the release of hazardous substances, which includes but is not limited to the following violations of environmental or health standards:

1. Ambient Surface Water Standards set by the Division of Water.
2. Ambient Groundwater Standards set by the Division of Water.
3. Drinking Water Standards set by the Department of Health.
4. Ambient Air Quality Standards set by the Division of Air Resources.
5. Guidance Values for contaminants in soil that will be of environmental or health concern.
6. Damage to Natural Resources, Fish, and Wildlife.

This information is used to support the recommendation for follow-up action.

NYSDEC has developed a standardized procedure for performing PSAs, consisting of the following six tasks:

Task 1 - Data Records Search and Assessment

Task 2 - Work Plan Development

Task 3 - Site Investigation

Task 4 - Subsurface Investigation

Task 5 - Draft PSA Report

Task 6 - Final PSA Report

Under Work Assignment No. D002472-6.0, Jordan personnel conducted Task 1, Data Records Search and Assessment, at the site (E.C. Jordan Co., 1990). Task 1 activities did not develop adequate data on which to base a delist or reclassification recommendation. Therefore, NYSDEC issued a new Work Assignment (Work Assignment No. D002472-6.1) for Jordan to continue the PSA process at the site. A site-specific work plan was developed that presented a technical scope of work and schedule to perform PSA Tasks 3, 4, 5, and 6 (E.C. Jordan Co., 1992b). At NYSDEC's request, Tasks 3 and 4 activities were combined into one field investigation effort. The objectives of the combined activities were:

- to determine the presence or absence of hazardous waste by collecting subsurface soil and waste materials from the canal for analysis of EP Toxicity, RCRA hazardous waste characteristics, and Target Compound List (TCL) parameters;
- to determine contravention of standards to document significant threat by collecting groundwater samples from upgradient, downgradient, and within the canal monitoring wells for analysis;
- to evaluate whether hazardous waste was deposited on site and whether there is a contravention of standards to document significant threat by collecting surface water and sediment samples from on-site catch basins for analysis.

This Draft PSA Report prepared under Task 5 evaluates the subsurface soil/waste data collected from the soil borings within and outside the canal, and surface water and sediment data collected in the on-site drainage ditches, to confirm the presence or absence of hazardous waste at the site as defined by 6 NYCRR Chapter X, Parts 700-705. The data have been evaluated by Jordan personnel to determine if any wastes present a significant threat to public health or the environment by comparing groundwater and surface water analytical results to applicable New York State and federal standards. In addition, soil analytical results are compared to site background concentrations as well as acceptable background ranges for the Eastern United States and New York State to identify possible site contaminants.

This PSA Report includes the background information and site history presented in the Task 1 Report (E.C. Jordan Co., 1990). This PSA Report also includes a summary of the activities conducted during the combined Tasks 3 and 4 investigation, a summary of the laboratory data, and recommendations to delist or reclassify the site.

In addition to the PSA Report, Jordan has completed the U.S. Environmental Protection Agency (USEPA) Form 2070-13 ("Site Inspection Form"), and made the necessary modifications to the NYSDEC "Additions/Changes to Registry of Inactive Hazardous Waste Disposal Site" Form. These forms are included in this Report as Appendices G and H.

3.0 SCOPE OF WORK

NYSDEC recommended that Task 3 and Task 4 activities be combined into one field investigation effort at the Stauffer Chemical - Whittaker Subdivision site. These combined field activities included the following:

- A preliminary site survey to mark the boundaries of the buried canal to identify soil boring and monitoring well locations.
- A geophysical survey to clear boring locations for subsurface structures and utilities.
- Advancement of 18 soil borings for subsurface soil sampling to fully characterize the fill material in the former disposal area and to confirm the presence or absence of hazardous waste in the buried canal and to facilitate installation of seven monitoring wells.
- Installation, development, and sampling of seven monitoring wells to evaluate groundwater flow direction and quality to assess the potential threat of contaminants to public health or the environment by comparing the laboratory analytical results to promulgated state and federal standards.
- Collection and analysis of surface water and sediment samples to evaluate the potential threat of contaminants to public health or the environment.
- A final site survey to develop a base map showing the locations of the buried canal, test borings, monitoring wells, surface water, and sediment sample exploration locations.

The combined Tasks 3 and 4 field activities began with an initial site survey on May 13, 1992, and ended with the groundwater, surface water, and sediment sampling activities on June 30, 1992.

3.1 GENERAL FIELD INVESTIGATION PROCEDURES

General procedures related to sample collection, packaging, labeling, and shipment; health and safety; equipment calibration; and decontamination are provided in the Program Quality Assurance Project Plan (QAPP) (E.C. Jordan Co., 1992a) and the site-specific work plan and QAPP (E.C. Jordan Co., 1992b). Site-specific procedures related to health and safety, equipment calibration, decontamination, and containerization and disposal of site-related wastes are discussed in the following paragraphs.

3.1.1 Site Health and Safety Program and Monitoring

A site-specific Health and Safety Plan (HASP) was prepared and included with the Task 2 Work Plan (E.C. Jordan Co., 1992b). As specified in the HASP, all field activities were performed at modified Level C dermal protection (i.e., Level D respiratory protection and Level C dermal protection).

Throughout the drilling program, Jordan personnel regularly monitored the air in the breathing zone at each borehole and at the perimeter of the exclusion zone for total volatile organic compounds (VOCs) with a Photovac TIP® photoionization detector (PID), and upwind and downwind of each borehole for particulates using a hand-held MIE Miniram® aerosol monitor. The concentrations of VOCs and particulates in the breathing zone were below the action levels required for an upgrade to Level C respiratory protection throughout the program. In addition, Jordan personnel monitored for potential combustible atmospheres using an Industrial Scientific® Model MX-241 oxygen/lower explosive limit (O_2/LEL) meter during the drilling program. Unsafe working conditions were not encountered during the field investigation.

3.1.2 Equipment Calibration Procedures

For each day that a piece of monitoring equipment was used or planned to be used, Jordan personnel calibrated the equipment according to the manufacturer's instructions and/or as described in the Program QAPP (E.C. Jordan Co., 1992a). Calibrated equipment included the PID; O_2/LEL meter; MIE Miniram® aerosol monitor; Yellow Spring Instrument® (YSI) Model 3580 water quality meter to measure temperature, temperature-compensated specific conductivity, and Ph; and a Hach® Model 2100P turbidity meter.

3.1.3 Decontamination Procedures

Nondisposable sampling equipment was decontaminated between discrete sample collections according to the procedures described in Subsection 4.3 of the Program QAPP (E.C. Jordan Co., 1992a). At the beginning of the drilling program, between boreholes, and at the end of the drilling program, the drill rig and associated equipment and materials were steam-cleaned on site in a mobile self-contained decontamination trailer. Smaller tools and sampling equipment were decontaminated on site using a deionized water- Liquinox soap wash, followed by a deionized water rinse.

3.1.4 Containerization and Disposal of Site-Related Materials

Drill cuttings, development water, decontamination fluids, and disposable personal protective equipment were containerized on site in U.S. Department of Transportation (DOT)-approved 55-gallon drums. The drums were labeled and transported by Jordan's drilling subcontractor, Parratt-Wolff, to Lewiston's old town garage at 50 Model City Road for temporary storage. According to NYSDEC, these wastes were nonhazardous; therefore, the drums did not need to be manifested as hazardous waste, and a licensed hazardous waste hauler was not required to transport the drums off site (May, 1992).

Purge water generated from the monitoring wells before groundwater sampling was containerized in 5-to-10-gallon plastic containers provided by NYSDEC, in accordance with the procedures developed for the site and discussed in detail in the site-specific work plan (E.C. Jordan Co., 1992b). The containers were transported by Jordan and NYSDEC personnel in a NYSDEC vehicle to Lewiston's old town garage and consolidated in 55-gallon DOT-approved drums. As with the materials described above, NYSDEC did not consider the purge water to be a hazardous waste (May, 1992).

3.2 GEOPHYSICAL SURVEY

On May 26 and 27, 1992, Jordan personnel conducted a ground-penetrating radar (GPR) survey with a GSSI System III GPR unit (see Appendix A for the detailed report). Three hundred and 500-megahertz antennas were used for profiling. The unit was calibrated over an on-site sewer line of known depth. A more detailed description of the GPR method is discussed in the Program QAPP in Subsection 4.8.1 (E.C. Jordan Co., 1992a). Eighteen proposed drilling locations were surveyed to verify that the proposed intrusive explorations were clear of underground utilities (i.e., gas lines, water mains, and sewer lines) and other underground structures (i.e., leachfields and septic tanks). The survey also provided depths to bedrock at some locations in the northern portion of the site, specifically in the areas between Elliott Drive and the Niagara Escarpment.

Because of underground utilities in the front yards of some residences, initial locations were moved to less sensitive locations. In general, staked locations were not moved more than 5 feet from their original positions.

3.3 SOIL BORING EXPLORATIONS

Eighteen test borings were advanced on site by Jordan's subcontractor, Parratt-Wolff of East Syracuse, New York. Seven of these test borings were completed as monitoring wells. The placement, purpose, and rationale associated with these borings and wells are discussed in the following subsections.

3.3.1 Soil Borings

To investigate the presence of contamination in the former canal, 18 borings were advanced at the site during the combined Tasks 3 and 4 field activities (Figure 2). The location of the former canal was inferred from available aerial photographs and construction plans. Based on these photographs and plans, representatives of Om Popli, the survey subcontractor, marked the approximate boundaries of the former canal in the field with wooden stakes and flagging on May 13, 1992. The marked boundaries of the canal were considered when placing exploratory test borings and monitoring wells. Boring and well placements were adjusted, as needed, based on the results of the geophysical survey (see Subsection 3.2).

The drilling program was started on May 26, and completed on May 29, 1992. Fourteen borings were placed within the canal boundaries and four were placed outside the boundaries. Table 1 lists the location, purpose, and total depth for each of the borings and the screen installation depths for the monitoring wells. The eighteen borings were advanced through the overburden using 4.25-inch inside diameter (ID) hollow-stem augers (HSAs) to HSA or split-spoon refusal.

To facilitate the installation of monitoring wells MW-3, MW-5, MW-6, and MW-7, the borings were advanced a minimum of 10 feet below the bedrock surface using spun casing and an HX (2.5-inch ID) core bit. Rock was cored using a 5-foot-long, 2.5-inch ID core barrel. The core depth, recovery length, rock quality, and description for each retrieved core were recorded on rock core logs (see Appendix B).

Subsurface split-spoon soil samples were collected for visual observation from each test boring and at least one soil sample from each boring was submitted for laboratory analysis. Split-spoon samples were collected continuously from the ground surface in the 14 borings advanced within the canal boundaries, and at 5-foot intervals beginning at ground surface in the four borings advanced outside the canal boundaries.

Soil samples were collected according to the procedures in Subsection 4.6.4.1 in the Program QAPP (E.C. Jordan Co., 1992a). Samples were collected using a 2-foot-long, 2-inch-ID stainless steel split-spoon sampler. For visual characterization, split-spoon samples were collected continuously from the ground surface to bedrock refusal in all the borings advanced within the canal boundaries, and at 5-foot intervals from ground surface to bedrock refusal in the borings advanced outside the canal boundaries. The soil retrieved from the split-spoon samplers was described using the Unified Soil Classification System and screened with a PID. Sample descriptions, PID measurements, blow counts, and sample recovery were recorded on soil boring logs (see Appendix B).

Where required, soil samples were collected from the split-spoon samplers and containerized for submittal for laboratory analysis (see Subsection 3.4.2 for further discussion of soil sampling and analysis).

Source Area Borings and Monitoring Wells. Fourteen borings were drilled within the boundaries of the former canal to depths ranging from 3.9 to 18.8 feet below ground surface (bgs). The purpose of drilling these borings in the canal was to sample and analyze representative subsurface soil/waste material from within the buried canal. Eleven borings within the canal were backfilled with grout and clean fill (TB-8 through TB-18). Three borings within the canal were completed as monitoring wells (TB-1/MW-1, TB-2/MW-2, and TB-3/MW-3). The purpose of installing monitoring wells in the canal was to collect and analyze representative groundwater samples from the buried canal to evaluate whether contaminants in the canal pose a significant threat to public health or the environment.

Upon completion, the 11 borings in which monitoring wells were not installed were backfilled up to 5 feet bgs with a bentonite/Portland cement grout. The upper 5 feet were backfilled with clean sand and topsoil to minimize problems with future landscape activities by property owners.

Crossgradient Soil Borings and Monitoring Wells. The remaining four borings were completed as monitoring wells outside the boundaries of the canal (TB-4/MW-4 through TB-7/MW-7). Monitoring well MW-4 was installed on the western side of the southern end of the former canal, in a location inferred to be upgradient of the canal based on available hydrologic data. The purpose of this well was to provide background soil and groundwater quality data with which to compare other data from within and downgradient of the canal. This monitoring well was determined not to be an upgradient monitoring well, but a crossgradient well once groundwater elevation data was evaluated.

Monitoring well MW-5 was installed near the edge of the Niagara Escarpment northeast of the northern end of the former canal, in a location inferred to be downgradient of the canal based on available hydrologic data. The purpose of this well was to provide downgradient soil and groundwater quality data to compare with other data from within and upgradient of the canal to evaluate whether contaminants in the buried canal pose a potential threat to public health or the environment. Once groundwater data was evaluated for the site this monitoring well was determined to be a crossgradient well, not a downgradient well. It was anticipated that this monitoring well might not encounter groundwater before reaching the designated depth discussed in the Work Plan (E.C. Jordan Co., 1992b). It was agreed by Jordan and NYSDEC to install the well at the designated depth. The monitoring well was dry after installation procedures were complete.

Monitoring wells MW-6 and MW-7 were installed along the drainage ditch paralleling the eastern edge of the former canal, in locations inferred to be cross-gradient of the canal based on available hydrologic data. The purpose of these wells was to provide cross-gradient groundwater quality data to compare with promulgated state and federal standards and with other data from within and crossgradient of the canal, particularly with respect to the potential migration of contaminants toward the Tuscarora Indian Reservation (where private drinking water supplies are located). Soil samples were not collected for analysis.

3.3.2 Monitoring Well Installation

Seven of the 18 test borings were completed as shallow monitoring wells that were installed at a maximum of 20 feet bgs (TB/MW-1 through TB/MW-7). Except for monitoring well MW-5 (which is dry), the wells were screened below the water table, which averages approximately 6 feet bgs.

The following guidelines were followed with respect to placing a well screen in overburden or bedrock (E.C. Jordan Co., 1992b):

- During boring advancement, if the thickness of saturated overburden was greater than or equal to 3 feet, then the boring was advanced to bedrock refusal only, and the well was set in overburden (i.e., MW-1, MW-2, and MW-4).
- During boring advancement, if the thickness of saturated overburden was less than 3 feet, then bedrock was cored no less than 10 feet but no more than 15 feet below bedrock surface, and the well was set in bedrock (i.e., MW-3, MW-5, MW-6, and MW-7).

The predetermined maximum depth of any well was 15 feet bgs. In the case of MW-5 (the crossgradient (north) well near the edge of the Niagara Escarpment), groundwater was not encountered within 15 feet of the ground surface. However, as agreed to with NYSDEC, the well screen for MW-5 was set in bedrock from 9 to 14 feet bgs despite the fact that groundwater was not encountered.

The monitoring wells are constructed of 2-inch ID Schedule 40 flush-jointed polyvinyl chloride (PVC) risers with 5-foot-long, 2-inch ID Schedule 40 PVC well screens with 0.010-inch machined slots. The sandpack installed around the well screens is Morie #0 grade fine silica sand. The sandpack extends approximately 1 to 2 feet above the top of each screen. An Enviroplug seal of bentonite chips ranging from 1 to 6 feet long was installed above each sandpack. The upper 5 feet of each borehole was backfilled with clean silica sand.

All wells were completed with flush-mounted road boxes concreted into place, over the well riser. Well risers were covered with locking compression caps. Overburden and bedrock monitoring well construction logs are in Appendix C.

3.3.3 Well Development

The monitoring wells were developed on June 2, 1992. No wells were developed less than 24 hours after installation. Monitoring well MW-5 was dry during the development effort; therefore, no development was necessary at this location. Development activities were overseen by Jordan personnel and Glenn May of

NYSDEC Region 9. Mr. May verbally approved the completion of development for each well.

All wells were developed using Teflon® bailers and dedicated nylon bailer line by Parrott-Wolff personnel. Additional water was removed from MW-1 and MW-2 using a peristaltic pump. The pH, specific conductivity, temperature, and turbidity of well development water were measured periodically during the development of each well.

When consistent turbidity readings of 50 nephelometric turbidity units (NTUs) or less after surging were recorded, the well was considered adequately developed. In instances when turbidity values higher than 50 NTUs after surging were obtained, Mr. May of NYSDEC Region 9 determined the completion of development based on other factors such as volume of water purged, stabilization of field parameters, and time elapsed. In most cases, the water became significantly clearer after settling for an hour or more, or after pumping without surging (bailing). Well development records are in Appendix D.

3.4 ENVIRONMENTAL SAMPLING AND ANALYSIS

The combined Tasks 3 and 4 sampling and analysis program included subsurface soil and sediment sampling to confirm or deny the presence of hazardous wastes in the buried canal, as well as groundwater and surface water sampling and analysis to evaluate the potential contaminant threat to public health and the environment (E.C. Jordan Co., 1992b). The sampling and analysis program for each medium is discussed below, and is summarized in Table 2.

3.4.1 Surface Soil

The New York State Department of Health (NYSDOH) collected six surface soil samples at the Stauffer Chemical-Whittaker Subdivision site in June 1992. The analytical results were not available from the NYSDOH at the time of production for this report.

3.4.2 Subsurface Soil

The purpose of the subsurface soil sampling and analysis program was to confirm the presence or absence of hazardous waste and to fully characterize the fill material in the former disposal area. Subsurface soil and waste samples were collected from all borings advanced (1) within the boundaries of the canal to characterize the materials buried in the canal; (2) crossgradient of the canal to provide crossgradient (west and east) soil and/or groundwater quality data with which to compare the data from within the canal; and (3) crossgradient (north) of the canal to assess whether groundwater and soil quality have been adversely impacted by potential contamination migrating from wastes buried in the canal. Samples submitted for analysis were selected based on visual observations, field screening for total VOCs using a PID, and headspace readings taken from the reference samples collected in each boring. Analytical samples were collected from the split-spoons using a stainless steel spatula, and containerized in appropriate containers supplied by Jordan's laboratory subcontractor, NYTEST Environmental, Inc. (NYTEST) of Port Washington, New York, for the analyses requested. A maximum of one sample per boring was submitted for laboratory analysis, except for TB/MW-6 and TB/MW-7, where no soil samples were collected for analysis. In some instances, the volume required for all the requested analyses could not be retrieved from a single split-spoon; in such cases, additional soil was collected and composited from the next sequential split-spoon sample.

Soil samples were submitted for the following laboratory analyses: RCRA hazardous waste characteristics (ignitability, Method 1010 or 1020; corrosivity, Method 9045; reactivity, Method Analytical Services Protocol [ASP] Vol. 3, Part XV; and EP Toxicity for metals, Method 1310; TCL VOCs, Method 91-1; TCL semivolatile organic compounds (SVOCs), Method 91-2; TCL pesticides and PCBs, Method 91-3; and TCL inorganics, Series 200 CLP-M Method (NYSDEC, ASP, 1991).

Visual descriptions of soil samples are in the boring logs in Appendix B. A summary of environmental samples collected and submitted for laboratory analysis is provided in Table 2. Analytical results are discussed in Subsection 4.4.2.

3.4.3 Groundwater

The purpose of the combined Tasks 3 and 4 groundwater sampling and analysis program was to characterize groundwater quality within and crossgradient of the canal to evaluate whether a potential threat to public health or the environment exists by evaluating whether a contravention of promulgated state and/or federal standards has occurred.

Except for monitoring well MW-5 (the crossgradient [north] well), which was dry at the time of sampling, the groundwater samples were collected from the newly installed wells on June 29 and 30, 1992. Groundwater sampling occurred approximately three weeks after well development was completed.

Before sampling, water level measurements were obtained from the newly installed wells. The depth to water ranged from 2.55 feet bgs in MW-2 to 10.34 feet bgs in MW-4 (Table 3).

Groundwater samples were collected according to the procedures in Subsection 4.6.1 of the Program QAPP (E.C. Jordan Co., 1992a). Upon removing the riser cap, the headspace of each well was screened for total VOCs with a PID. This information was recorded on the groundwater field sample data records in Appendix D.

Before sampling, the volume of standing water in each well was calculated, and a minimum of three times this volume was purged except in wells MW-3 and MW-6, which were bailed dry before three well volumes could be removed and were sampled without further purging after they recharged. During sampling, purge water was monitored for temperature, pH, specific conductivity, and turbidity.

Groundwater samples from each of the sampled wells were submitted for the following laboratory analyses: TCL VOCs, Method 91-1; TCL SVOCs, Method 91-2; TCL pesticides and PCBs, Method 91-3; and TCL inorganics, Series 200 CLP-M Method (NYSDEC, ASP, 1991). Groundwater samples to be submitted for inorganics analysis were not filtered in accordance with NYSDEC procedures as outlined in the NYSDEC Analytical Services Protocol (ASP).

Field data including temperature, specific conductivity, pH, and turbidity as well as visual descriptions of the groundwater samples are provided in the field sampling records in Appendix D. A summary of environmental samples collected and submitted for laboratory analysis is in Table 2. Analytical results are discussed in Subsection 4.4.2.

3.4.4 Surface Water and Sediment

The purpose of the combined Tasks 3 and 4 surface water and sediment sampling and analysis program was to characterize surface water and sediment in surficial drainage areas near the canal to evaluate whether any contaminants are present in the drainage ditch that pose a potential threat to public health or the environment. Sediment samples were also collected for analysis to provide additional data to confirm the presence or absence of hazardous waste at the site.

The surface water and sediment samples were collected on June 30, 1992, according to the procedures in Subsections 4.6.2 and 4.6.3, respectively, in the Program QAPP (E.C. Jordan Co., 1992a).

Five collocated surface water and sediment sample locations were established for the combined Tasks 3 and 4 sampling activities in the site-specific work plan (E.C. Jordan Co., 1992b). Surface water and sediment samples SW/SD-1, SW/SD-2, and SW/SD-3 were collected from catch basins that receive runoff from the roads, yards, and drainage ditches that parallel Elliott Drive and Escarpment Drive, as well as a drainage ditch that flows between the backyards of residences on Elliott and Escarpment Drives (Figure 3). At these locations, surface water samples were obtained before collection of the sediment samples. The sediment samples SD-4 and SD-5 were collected from the drainage ditch that parallels Cleghorn Drive to the east (see Figure 3). Surface water samples were not collected from these locations because the catch basins were dry at the time of sampling.

Surface water samples from locations SW-1, SW-2, and SW-3 were submitted for the following laboratory analyses: TCL VOCs, Method 91-1; TCL SVOCs, Method 91-2; TCL pesticides and PCBs, Method 91-3; and TCL inorganics, Series 200 CLP-M Method (NYSDEC, ASP, 1991). Surface water samples submitted for inorganic analyses were not filtered in accordance with NYSDEC procedures that are outlined in the NYSDEC ASP.

Sediment samples from locations SD-1 through SD-5 were submitted for the following laboratory analyses: RCRA hazardous waste characteristics (ignitability, Method 1010 or 1020; corrosivity, Method 9045; reactivity, Method ASP Vol. 3, Part XV; and EP Toxicity for metals, Method 1310; TCL VOCs, Method 91-1; TCL SVOCs, Method 91-2; TCL pesticides and PCBs, Method 91-3; and TCL inorganics, Series 200 CLP-M Method (NYSDEC, ASP, 1991).

Field measurements including temperature, pH, specific conductivity, and turbidity as well as visual descriptions of surface water and sediment samples are provided in the field sampling records in Appendix D. A summary of environmental samples collected and submitted for laboratory analysis is in Table 2. Analytical results are discussed in Subsection 4.4.2.

3.4.5 Data Validation

The laboratory analytical program, described in detail in the site-specific work plan (E.C. Jordan Co., 1992b), was designed to provide the detail necessary to determine whether hazardous wastes as defined by 6 NYCRR Part 371 exist in the buried canal, and if any buried wastes pose a significant threat to human health or the environment. The number of samples collected from the site and analyses performed were chosen to meet the project objectives.

The analytical procedures used for soil, groundwater, surface water, and sediment samples collected during the field program comply with the NYSDEC ASP of December 1991. Samples were analyzed for TCL VOCs, TCL SVOCs, TCL pesticides and PCBs, and TCL inorganics, as well as EP Toxicity for metals and RCRA hazardous waste characteristics using NYSDEC ASP methods. Quality control (QC) samples included field duplicates, equipment blanks, trip blanks, and matrix spike/matrix spike duplicate samples. Samples were analyzed by Jordan's laboratory subcontractor NYTEST.

NYTEST generated the analytical results in accordance with protocols specified by NYSDEC for the New York State Superfund Program. The QC procedures outlined in the NYSDEC ASP provide a preliminary level of assurance of data quality. The analytical QC procedures required by the NYSDEC ASP are listed in Table 4.

Data validation was performed on the laboratory deliverables (i.e., analytical results and raw data) by experienced data reviewers and the project chemist. The analytical protocols generated data of Level II and Level IV data quality, which are adequate to support risk assessment, site characterization, evaluation of remediation alternatives, engineering design, and monitoring during implementation.

Analytical results are included in Appendix E in the following three tabular formats:

- Table 1 - Laboratory Report of Analysis: Presents analytical results and qualifiers as reported by the laboratory.
- Table 2 - Validation Summary Table: Presents analytical results with the appropriate data validation qualifiers.
- Table 3 - Summary Table: Presents validated results greater than the Contract Required Quantitation Limit (CRQL) and Sample Quantitation Limit.

Analytical data qualifiers appear on each data table in Appendix E, as appropriate, and are applied by the laboratory or data validator. The descriptions of these qualifiers are listed in Table 5.

3.4.6 Data Evaluation

The following subsections summarize data evaluation results for TCL VOCs, TCL SVOCs, TCL pesticides and PCBs, TCL inorganics, EP Toxicity metals, and RCRA hazardous waste characteristics. A detailed assessment of the data validation results is in Appendix E.

Volatile Organic Compounds. In general, the VOC data are acceptable and suitable for their intended use. Acetone, methylene chloride, and 2-butanone were reported in laboratory method blanks; therefore, the sample data were qualified accordingly. These compounds are considered to be common laboratory contaminants and the results were within NYSDEC ASP requirements. The sediment sample analyses were either ("J'd") or ("R'd") by the data validation process because the percentage of solids was below the 50 and 90 percent requirement specified in the NYSDEC ASP.

Semivolatile Organic Compounds. In general, the SVOC data are acceptable and suitable for their intended use. Because laboratory method blanks contained bis(2-ethylhexyl)phthalate, sample results were qualified accordingly. This compound is considered a common laboratory contaminant and the results were within NYSDEC ASP requirements. The sediment sample analyses were either ("J'd") or ("R'd") by the data validation process because the percentage of solids was below the 50 and 90 percent requirement specified in the NYSDEC ASP.

Pesticides and PCBs Analyses. In general, most of the pesticides and PCB data are acceptable and suitable for their intended use. The surrogate recovery for samples SCMW002XXX92XX, SCMW002XXX92XD, and SCBS014X0792XX was 0 percent; therefore, the non-detected results were qualified as rejected ("R"). The holding time for sample SCSD003XXX92XX was grossly exceeded; therefore, the non-detected results were rejected during the validation process. The sediment sample analyses were either ("J'd") or ("R'd") by the data validation process because the percentage of solids was below the 50 and 90 percent requirement specified in the NYSDEC ASP. All rejected results should be considered unusable.

Inorganic Analyses. Most inorganic data are acceptable as presented and suitable for their intended use. Potassium results were rejected in some samples because the continuing calibration standard exceeded the acceptance limit. Results for copper, manganese, selenium, and cadmium were rejected in some samples because the sample spike recovery was outside the acceptance range. The rejected results for these elements should be considered unusable. Many inorganic results were qualified as estimated ("J") for minor QC problems as outlined in Appendix E. These represent criteria that must be monitored, but do not require corrective action by the laboratory. The users of these results should consider that estimated results could be biased low. However, these QC problems are considered minor and the data should be considered usable.

EP Toxicity Metals. The EP Toxicity metals data are acceptable as presented and suitable for their intended use. Similar to the inorganics data, many results were qualified as estimated. However, these QC problems are considered minor, and the data should be considered usable.

RCRA Hazardous Waste Characteristics. The RCRA hazardous waste characteristics data are acceptable as presented and suitable for their intended use.

3.4.7 Data Quality Objectives

Data quality objectives are based on the premise that different data uses require different levels of data quality. Data quality refers to the degree of uncertainty of analytical data with respect to precision, accuracy, representativeness, completeness, and comparability (PARCC). These objectives are established based on site conditions, the purpose of the field program, and the knowledge of the measurement systems used to generate analytical data. The laboratory data quality in terms of meeting the PARCC objectives are discussed in the following subsections.

Precision and Accuracy. Precision and accuracy of laboratory data were monitored through review of duplicate analyses (precision), and surrogate/matrix spike recovery (accuracy). Laboratory analytical data were reviewed to provide Level III and Level IV data quality. In general, the data are acceptable in terms of meeting precision and accuracy requirements established in the ASP. Non-compliant samples are discussed in Appendix E.

Representativeness. Measurements were taken so that laboratory results were as representative of the media (i.e., soil) and environmental conditions as possible. Sampling protocols were developed to ensure that collected samples represented the media. Sample handling protocols (i.e., chain-of-custody, storage, and transportation) were sufficient to protect the representativeness of the sample. Proper documentation established that protocols were followed and sample identification and integrity confirmed.

Completeness. The characteristic of completeness is a measure of the amount of valid data obtained compared to the amount that was expected to be obtained. As discussed above, four samples for pesticide analysis were rejected. In addition, the sediment samples were rejected because the percentage of solids was below the amount required by the NYSDEC ASP. All other laboratory samples were collected and analyzed as required by the Work Plan (E.C. Jordan Co., 1992b).

Comparability. The characteristic of comparability reflects both internal consistency of measurements taken at the site and the expression of results consistent with other organizations reporting similar data. The requirement has been met through the use of NYSDEC ASP methods and through the data validation process.

3.5 ELEVATION SURVEY AND BASE MAP PREPARATION

On May 13, 1992, Jordan's survey subcontractor, Om Popli, conducted an initial site survey to stake the boundaries of the buried canal as inferred from old aerial photographs and construction plans.

A final elevation survey of the site was performed by Om Popli, after completion of Jordan's combined Tasks 3 and 4 sampling activities. Om Popli surveyed the elevation and horizontal location of the buried canal, 11 test borings, seven monitoring wells, five surface water sampling locations, and three sediment sampling locations. In addition, the residential lot boundaries and associated street addresses and owners were included on Om Popli's map. The map prepared by Om Popli was used by Jordan as a base map when preparing all figures. This map and the accompanying survey report are included as Appendix F.

4.0 SITE ASSESSMENT

4.1 SITE HISTORY

Excavation on the northern extension of Love Canal (where the Whittaker Subdivision is located) began near the turn of the century; however, it was never completed to join the southern extension (located in Niagara Falls, New York) because of declining economic conditions (E&EE, 1989). The excavation was approximately 100 feet wide, 2,000 feet long, and 10 feet deep, and trended north-south from the edge of the Niagara Escarpment (which trends east-west in this area) to Upper Mountain Road. The site was subsequently covered and developed. Whittaker Subdivision, a residential development, is now located directly over the former disposal site. The site encompasses approximately 5 acres and consists of private residences (Figure 4).

From 1930 to 1952, an estimated 50,000 to 75,000 cubic yards of asbestos, concrete cell parts, reactor linings, scrap sulfur, graphite, scrap metal, silicon, zirconium and titanium oxides, flux containing fluorides, cinders, and phenols reportedly were disposed of in the canal excavation. From 1930 to 1946, wastes were disposed of in the canal by Niagara Smelting, a subsidiary of Stauffer Chemical, and from 1946 to 1952, wastes were disposed of in the canal by Stauffer Chemical (E&EE, 1989). According to local residents, Union Carbide allegedly disposed of material in the canal; however, this has never been confirmed. Local residents reported seeing Union Carbide trucks dumping brown sludge into the canal, and one resident reported that wastes splattered from a Union Carbide truck damaged the paint on his car (USEPA, 1979).

The canal is clearly visible in 1951 aerial photographs, and was surrounded by several unpaved roads, other disturbed areas, and a few residences (USDA, 1951). Waste disposal in the canal reportedly was discontinued in 1952, and the canal was filled in with cinders and slag, as well as white and yellow material (USEPA, 1979). One to 2 feet of fill possibly cover the canal, and many driveways and street beds are underlain by slag (E&EE, 1989).

Between 1952 and 1958, numerous residential homes and streets were built on and in the vicinity of the filled-in canal. Aerial photographs dated 1958 clearly illustrate new homes constructed on top of and adjacent to the canal (USDA, 1958).

Discolored materials have been observed during several excavations in the neighborhood. In the 1970s, discolored debris and lumps of sulfur were encountered during excavation of the sanitary sewer (Young, per. comm., 1990; E&EE, 1989). In 1988, discolored soil and fill including a blue-green, paste-like material with a musty odor were encountered during excavations for an inground pool at 1140 Escarpment Drive. Brought to the surface, the material was used to regrade parts of the property. Since then, there reportedly has been no problem with growing grass in the regraded area. The former owner of this home, however, had trouble growing grass in a 50-by-50 foot area beneath which the blue-green material was later encountered (Adams, per. comm., 1990).

Along the escarpment at 1153 Escarpment Drive, settling problems reportedly occurred during construction of an inground pool on that property (Adams, per. comm., 1990). In 1962, a resident on Jarrett Drive replaced a corroded 6-inch cast-iron water pipe beneath his property (USEPA, 1979). Elevated chlorides in subsurface materials and sulfates in groundwater possibly contributed to the deterioration of pipes and concrete (Dominion, 1979).

Numerous investigations have been conducted at the site including: an investigation by the USEPA in 1979 (no sampling); a subsurface investigation by Dominion Soil Investigation, Inc. (Dominion) in 1979, during which subsurface soil and groundwater samples were collected; a preliminary assessment for USEPA by NUS Corporation (NUS) in 1987 (no sampling); a Phase I Investigation for NYSDEC by Ecology and Environment Engineering (E&EE) in 1989 (no sampling); and a site inspection by NUS under USEPA supervision in 1990 (shallow soil samples were collected).

Agricultural crops from Escarpment and Elliott Drives were analyzed, for pesticides and herbicides only, for the Town of Lewiston in 1980. The Niagara County Health Department (NCHD) analyzed water and sediment samples from an on-site drainage ditch in 1988, and water from basement sumps overlying the canal in 1989. In addition, in 1991 the NYSDOH collected a sump sample for analysis and NYSDEC collected two sediment/waste samples for analysis. The results of the previous analyses are discussed in Subsection 4.4.1.

4.2 SITE TOPOGRAPHY

Topography at the Stauffer Chemical - Whittaker Subdivision site is fairly flat, ranging from 616 feet above mean sea level (MSL) at the northern end of the canal to approximately 635 feet MSL at the southern end of the canal. The site is bordered on the north by the east-west trending Niagara Escarpment, with a vertical drop of approximately 200 feet (NYSDOT, 1976a and b). Ground surface appears to slope slightly to the north and south away from the center of the site. The canal is faintly discernible in some places by slight mounding of the ground surface.

On-site surface water runoff is drained by storm drainage ditches constructed parallel to the east-west and north-south trending roads. The storm drains converge at the corner of Escarpment and Cleghorn Drives at the northeastern corner of the site, from which they flow northward to discharge along the escarpment.

No wetlands were observed on site; however, cattails and loosestrife occur seasonally along the banks of the drainage ditch that parallels Cleghorn Drive. East of Cleghorn Drive are the fairly flat fields of the Tuscarora Indian Reservation. Several Class II state-regulated wetlands occur within a 3-mile radius of the site. The closest state-regulated wetland is located farther than 1 mile to the southwest of the site along the banks of Fish Creek (NYSDEC, 1980). A habitat for Gentianopsis procera (Fringed Gentian), considered an endangered species by the State of New York, is mapped along Six Mile Creek (NYSDEC, 1990).

4.3 SITE GEOLOGY AND HYDROLOGY

The regional and site-specific geology and hydrology for the Stauffer Chemical - Whittaker Subdivision site are discussed below.

Regional

The surficial geology of the area is characterized by thin veneers of glacial till, glaciolacustrine clays, silts, and fine sands, and isolated glacial meltwater sand and gravel deposits (E&EE, 1989). Surface soils are mapped as poorly drained silty loam (USDA, 1972). Permeability of overburden deposits is estimated to range from 1×10^{-4} to 1×10^{-6} centimeters per second (cm/sec) (E&EE, 1989).

Regional bedrock consists of fairly flat-lying sedimentary rocks. Lockport Dolomite comprises the upper 20 to 40 feet of rock, underlain by Rochester Shale. Lockport Dolomite is characterized by an upper, fractured, fairly permeable section approximately 10 to 25 feet thick (estimated permeability of

1×10^{-2} to 1×10^{-4} cm/sec), and a lower, less fractured, less permeable stratum. In some areas, a low-permeability clay unit separates the upper and lower strata, creating artesian conditions (E&EE, 1989).

Regional groundwater flow is primarily north, toward the Niagara Escarpment (E&EE, 1989). Vertical gradients are not known; however, a downward component toward the fractured bedrock surface has been suggested (Dicky, per. comm., 1990). The groundwater at the site is classified as GA in accordance with 6 NYCRR Parts 700-705.

Site-specific

To develop specific information about site geology, drilling was conducted and 18 borings were advanced during the combined Tasks 3 and 4 subsurface investigation. Site stratigraphy is interpreted in one geologic profile within the canal. The profile location and orientation is shown in Figure 5. The profile in Figure 6 is constructed with a 40-to-1 vertical scale exaggeration.

Site surface soils consist of approximately 3 to 15 feet of loose, unconsolidated saturated fill and glaciolacustrine deposits overlying fractured Lockport Dolomite bedrock (see Figure 6). The thickness of the overburden decreases from south to north (toward the Niagara Escarpment). Fill was encountered in all borings. Fill material varied across the site, but consisted mainly of brown, red-brown, and gray sandy silt and silty clay with fragments of brick, coal, glass, fibrous material, and organic material. Much of this material is interpreted to be backfilled native soil. In the southern portion of the site, fill material consisted primarily of black clayey, tarry material with lenses of very soft gray sludge; black, tarry, gravel, and organic silts; and yellow to white powdery material interspersed with silt, sand, clay, and black gravel. This material was encountered 2 to 5 feet bgs, primarily between TB-8 and TB-12, ranging in thickness from 4 to 8 feet. Material from TB-2/MW-2, drilled in the buried canal, included blue, red, green, yellow, and gray pieces of synthetic matter along with white foundry sand, black and white fibrous material, and wood fragments. PID readings between 6 and 12 ppm were obtained from the samples collected from this boring. This is the only boring where the soil samples registered above background levels on the PID. In borings TB-17, TB-18, and TB-5/MW-5, fill was encountered directly overlying bedrock.

Undisturbed strata was encountered in the remainder of the borings and consisted of glaciolacustrine deposits composed of light brown to reddish brown dense clayey silt with traces of fine-to-coarse sand and fine gravel. The native material was discernible by the presence of laminations in the clayey silt.

The groundwater flow directions at the site cannot be contoured due to the fact that the wells on-site monitor two distinct water-bearing zones (overburden and bedrock); however, the generalized groundwater flow is north toward the Niagara Escarpment. The purpose of this investigation was not to fully assess the hydrogeology of the area, but to obtain groundwater chemical data that would characterize site contamination.

The most prominent local surface water body is the New York Power Authority Reservoir, a 2.5-square-mile reservoir less than a half-mile south of the site. The reservoir is maintained at 655 feet above MSL. Fish Creek is the closest natural surface water body to the site, located less than a half-mile southwest of the site. Fish Creek flows westward toward the Niagara River (which is approximately 2 miles west of the site), and is a Class D stream suitable for fishing (NYSDOT, 1976; E&EE, 1989).

Irrigation and drinking water supplying the Town of Lewiston is obtained through the Niagara County Water District and derived from the Niagara River (Kenney, per. comm., 1990). East of the site, however, the main source of drinking water for residents (more than 1,000 people) of the Tuscarora Indian Reservation is from wells or natural springs. The wells range in depth from 25 to 100 feet, depending on their location on the Reservation. Irrigation water from the wells and springs is used to water lawns and small garden plots on the Reservation (Henry, 1987).

4.4 CONTAMINATION ASSESSMENT

This subsection presents the results of previous investigations at the site and the results of the combined Tasks 3 and 4 field investigation conducted by Jordan in 1992.

4.4.1 Results of Previous Investigations

Wastes allegedly disposed of in the former canal excavation include asbestos; concrete cell parts; reactor linings; scrap sulfur; graphite; scrap metal; silicon; zirconium and titanium oxides; and flux containing fluorides, cinders, and phenols. These waste materials are not listed hazardous wastes as defined by 6 NYCRR Part 371; however, during previous investigations, the wastes were not analyzed for EP Toxicity to determine their hazardous waste characteristics (May, 1990). Results of previous sampling and analysis programs are discussed below.

In 1979, USEPA conducted a noninvasive investigation of the site during which no samples were collected. After reviewing available information and interviewing local residents, USEPA concluded that the canal contained materials that are not dangerous to public health and do not pose a safety hazard, and that the residents interviewed did not appear to be concerned about the area or the fill material. Furthermore, the report concluded that "no private wells were found or hinted to be in the area and the use of public water supply indicates no potentially contaminated groundwater is used as a drinking water supply" (USEPA, 1979).

Also in 1979, the Town of Lewiston retained Dominion to perform a subsurface investigation and analytical program to determine if hazardous materials were present in the canal. Dominion personnel drilled 18 shallow boreholes to refusal (not greater than 17 feet) (Figure 8) and characterized the subsurface materials as consisting primarily of sulfur compounds, with occasional lumps of sulfur, magnesium, and phosphorus. Subsurface materials from the boreholes were analyzed for sulfur, phosphorus, manganese, magnesium, cyanide, fluoride, nitrates, phosphate, phenol, and chloride. Analytical results of the material indicated elevated concentrations of cyanide, fluoride, chloride, and phenols in the soils that could pose potential hazards (Dominion, 1979). Two detected parameters, fluorides and phenols, are considered toxic, and concentrations of cyanide and nitrates exceeded acceptable U.S. Public Health Department standards and therefore warranted further investigation, according to State Health Commissioner David Axelrod (Niagara Gazette, 1979). Dominion also installed standpipes in the boreholes from which they sampled groundwater for analysis of pH and sulfates. Concentrations of sulfates exceeded state drinking water standards (Dominion, 1979; NYSDEC, 1986).

Vegetables from gardens on Escarpment and Elliott Drives were analyzed for pesticides and herbicides for the Town of Lewiston Water Pollution Control Center in 1980 by Aro Corporation. Results of the sampling and analysis were reportedly not indicative of an "environmental problem" (Bidell, 1980; Aro, 1980).

NUS performed a Potential Hazardous Waste Site Preliminary Assessment for USEPA in 1987. Based on their review of available documentation and a site visit, NUS recommended that additional work be performed to determine whether groundwater seepage from the escarpment is contaminated, and if subsurface soils and groundwater beneath the site contain elevated concentrations of fluorides, sulfur, and phenols that could potentially pose a health threat (NUS, 1987).

In 1989, E&EE completed a Phase I investigation of the site for NYSDEC. Based on the data reviewed and a site visit, E&EE recommended that additional soil samples be collected for analysis of RCRA hazardous waste characteristics or priority pollutants, and that groundwater be analyzed for priority pollutants and monitored to evaluate potential waste migration (E&EE, 1989).

The NCHD collected one water and sediment sample from the drainage ditch along Cleghorn Drive in 1988, where brown staining of sediment had been observed (see Figure 7). The NCHD stated that the presence of unnatural material in the drainage ditch was "strong evidence that contaminants are leaving the former disposal area" (Hopkins, 1988). Analytical results of the sediment indicated that no Hazardous Substance List (HSL) organics were detected and that concentrations of metals were within expected background levels for area soils.

NCHD subsequently surveyed area residents, and collected water samples in 1989 from two basement sumps from 1176 and 1179 Jarrett Drive overlying the canal where sediment similar to that in the drainage ditch was observed. Results from one basement, at 1176 Jarrett Drive, indicated PCBs, some elevated metals, and relatively low concentrations of a few pesticides, VOCs, and SVOCs. Based on the results of their survey and sampling, NCHD concluded that the potential for direct contact with waste material or leachate exists, and that additional sampling should be conducted (NCHD, 1989).

In 1990, NUS collected five shallow soil samples (zero to 2 feet deep) for analysis of TCL parameters (Note: the TCL replaced the HSL). The locations of these samples are shown in Figure 7. Several polycyclic aromatic hydrocarbons (PAHs), VOCs, and heavy metals were detected at two locations sampled (Table 6); however, NUS stated that "the concentrations of these substances are considered normal and do not pose a threat to human health" (NUS, 1990). PAHs and VOCs were not detected at the other three locations. In addition, NUS concluded that although the potential for groundwater contamination exists, no target populations for surface water or groundwater exposure are downgradient of the site. NUS recommended that the USEPA take no further action at the site (NUS, 1990). These recommendations were based on USEPA's criteria for hazardous waste site investigations and, therefore, may not reflect NYSDEC's recommendations for further action at this site.

Results of the 1991 NYSDOH sampling of the basement sump at 1176 Jarrett Drive indicated that no organic compounds for which the water was analyzed were detected, and that detected inorganic compounds were at concentrations considered to be naturally occurring in groundwater. According to NYSDOH, "the results indicate that there are presently no apparent human exposures to chemicals associated with the inactive landfill" (Hettrick, 1991).

In 1991, NYSDEC collected samples of a white, gel-like substance from two locations in an on-site drainage ditch (see Figure 7). Sample A61301 was analyzed for VOCs, chlorinated herbicides, and EP Toxicity for metals; sample A61302 was analyzed for SVOCs, chlorinated herbicides, EP Toxicity for metals, and total metals. Analytical results indicated several SVOCs in sample A61302, and that "concentrations of lead and chromium are above the general clean-up levels selected for rural locations" (May, 1991).

4.4.2 Results of Task 3 and 4 Sampling and Analysis

This subsection describes laboratory analytical results for all samples collected during the combined Tasks 3 and 4 field investigation and identifies site contaminants that exceed New York State or federal standards. Identification of site contaminants was accomplished by evaluating the concentration range of each contaminant detected above the CRQL or Method Detection Limit in each sample medium on the basis of:

- actual background concentrations, where available
- published background concentrations
- analytical results of associated quality assurance (QA)/QC samples (i.e., field, trip, and laboratory blanks)
- comparison to established New York State and federal groundwater, surface water, and soil standards where applicable

To evaluate which compounds are potential site contaminants, the validated analytical results were compared to background concentrations and/or standards established by NYSDEC or USEPA. A site contaminant is a chemical detected in environmental samples from a site at concentrations exceeding appropriate background levels and/or applicable standards. The specific methods used to evaluate the laboratory results are described in the following paragraphs.

For soil samples, organics detected at concentrations above the detection limit will be considered potential site contaminants unless they can be attributed to laboratory or sampling contamination. Inorganic concentrations will be compared to the background concentrations. The New York Region background concentrations were established by using soil data compiled by the NYSDEC Wildlife Resources Center (McGovern, 1988). The New York Region concentration ranges are for soils from uncontaminated and undisturbed areas of New York far from any sources of pollution. These values might not be representative of background levels in highly industrialized regions, such as Buffalo; therefore, background concentration data for the Eastern United States has also been included. An inorganic compound will be considered a potential site contaminant if the concentration of that compound exceeds either of these ranges and/or those of site background samples.

For groundwater, concentrations of organic and inorganic compounds will be compared to both New York State and federal standards. The primary standards for comparison are New York State Class GA groundwater standards. If a compound has no associated Class GA standard, concentrations are compared to New York State Drinking Water Standards or federal Maximum Contaminant Levels (MCLs) and Maximum Contaminant Level Goals (MCLGs). If the concentration of a compound exceeds the appropriate standard, the contaminant is determined to be site-related.

For surface water, concentrations of organic and inorganic compounds are compared to both New York State and federal standards, as well as background concentrations detected in upgradient samples. The primary standards for comparison are New York State Class D surface water quality criteria and federal Ambient Water Quality Criteria (AWQC) values. If the concentration of a compound exceeds the appropriate standard, it is compared to background concentrations to evaluate whether the contaminant is site-related. If the concentration of a compound is less than the appropriate standard, but greater than background concentrations, it still will be considered a potential site contaminant. If no standards exist for a compound, its concentration is compared to background concentrations to evaluate whether it is a potential site contaminant.

The analytical results of the QA/QC blanks are considered to screen out matrix interferences, detect contamination introduced to the samples during and after collection, and detect contamination of laboratory equipment.

The analytical results for each sample medium are presented in separate subsections. Within the subsection for each sample medium, where applicable, analytical results are discussed in the following order: upgradient (background) samples, on-site (in the canal) samples, crossgradient samples, and downgradient samples.

Subsurface Soil

Subsurface soil samples were collected from 18 soil borings: one crossgradient (west) boring (TB-4/MW-4), 14 on-site soil borings (TB-8 through TB-18 and TB-1/MW-1 through TB-3/MW-3) drilled in the buried canal, two crossgradient borings (TB-6/MW-6 and TB-7/MW-7), and one crossgradient (north) boring (TB-5/MW-5). The soil samples were analyzed for TCL VOCs, TCL SVOCs, TCL inorganics, TCL pesticides and PCBs, RCRA hazardous waste characteristics, and EP Toxicity for metals. Three VOCs, 17 SVOCs, 11 pesticides, two PCBs, and 20 inorganic compounds were detected above the CRQL in the subsurface soil samples. Analytical results are summarized in Tables 7, 8, 9, 10, and 11. Analytical results are discussed in the following order: crossgradient (west), in the canal, crossgradient (east), and crossgradient (north).

<u>Crossgradient (west).</u> Soil boring TB-4 was drilled as a crossgradient boring. One soil sample was collected from 5 to 7 feet bgs. No VOCs were detected (see Table 7). Two SVOCs, di-n-butylphthalate and bis(2-ethylhexyl)phthalate, were detected above the CRQL at concentrations of 2,000 and 2,800 micrograms per kilogram (μg/kg), respectively (see Table 8). No pesticides or PCBs were detected above the CRQL (see Table 9). Fifteen inorganic compounds were detected in the sample; however, concentrations are less than the published background ranges for all compounds except calcium (see Table 10). Arsenic was detected at a concentration of 2.6 milligrams per kilogram (mg/kg), which is below the published range for New York of 3 to 12 mg/kg and within the published range of less than 0.1 to 73 mg/kg for the Eastern United States.

Calcium was detected at a concentration of 53,600 mg/kg, which is greater than the published range of 130 to 35,000 mg/kg for New York but within the range of 100 to 280,000 mg/kg for the Eastern United States. Lead was detected at a concentration of 4.1 mg/kg, which is below the published range of less than 10 to 300 mg/kg for the Eastern United States. There is no published range for New York. Potassium was detected at a concentration of 2,400 mg/kg, which is below the published range of 8,500 to 43,000 mg/kg for New York but within the published range of 50 to 37,000 mg/kg for the Eastern United States. Analytical results for RCRA hazardous waste characteristics and EP Toxicity for metals were below regulatory limits (see Table 11).

In the Canal. Borings (TB-1 through TB-3) and (TB-8 through TB-18) were drilled in the canal to collect samples of the waste and fill. Three VOCs were detected above the CRQL (see Table 7). These compounds are: acetone, trichloroethylene (TCE), and tetrachloroethylene (PCE). Acetone was detected in 10 samples at concentrations ranging from 14 to 120 μg/kg. TCE and PCE were detected in one soil sample (SB-9 at 2 to 4 feet) at 18 and 30 μg/kg, respectively.

Seventeen SVOCs were detected (see Table 8). Four of the compounds, hexachloroethane, naphthalene, butylbenzylphthalate, and benzo(g,h,i)perylene, were detected in one sample each. Hexachloroethane was detected in TB-10 in the 2-to-4-foot sample at a concentration of 440 μg/kg. Naphthalene was detected in TB-16 in the 2-to-4-foot sample at a concentration of 1,000 μg/kg. Butylbenzylphthalate was detected in TB-17 in the 0-to-2-foot sample at a concentration of 660 μg/kg. Benzo(g,h,i)perylene was detected in TB-14 in the 5-to-7-foot sample at a concentration of 4,900 μg/kg.

Fluorene was detected in two samples, TB-14 in the 2-to-4-foot sample and TB-16 in the 2-to-4-foot sample at 2,000 and 1,200 μg/kg, respectively. Bis(2-ethylhexyl)phthalate was detected in TB-17 in the 0-to-2-foot sample at 2,100 μg/kg.

Five SVOCs, phenanthrene, di-n-butylphthalate, fluoranthene, pyrene, and chrysene were detected with the highest frequency in the subsurface soil samples (see Table 8). Phenanthrene was detected in 11 samples with concentrations ranging from 380 to 24,000 μg/kg. Di-n-butylphthalate was detected in 10 samples with concentrations ranging from 430 to 2,000 μg/kg. Fluoranthene was detected in 10 samples with concentrations ranging from 470 to 18,000 μg/kg. Pyrene was detected in eight samples with concentrations ranging from 420 to 18,000 μg/kg. Chrysene was detected in seven samples with concentrations ranging from 480 to 11,000 μg/kg.

The remaining six compounds: anthracene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, and indeno(1,2,3-c,d)pyrene were each detected in three to four samples. The concentrations were as follows: anthracene ranged from 1,300 to 6,200 μg/kg; benzo(a)anthracene ranged from 530 to 8,600 μg/kg; benzo(b)fluoranthene ranged from 840 to 5,200 μg/kg; benzo(k)fluoranthene ranged from 490 to 4,900 μg/kg; benzo(a)pyrene ranged from 1,200 to 7,200 μg/kg, and indeno(1,2,3-c,d)pyrene ranged from 490 to 5,800 μg/kg.

Eleven pesticides and two PCBs were detected above the CRQL in the soil samples obtained from the borings drilled in the canal (see Table 9). The pesticides were beta-BHC, heptachlor, aldrin, heptachlor epoxide, endosulfan I, dieldrin, 4,4'-dichlorodiphenyldichloroethylene (DDE), endrin, endosulfan II, 4,4'-dichlorodiphenyltrichloroethane (DDT), and gamma-chlordane. The PCBs were Aroclor-1248 and Aroclor-1260. The compounds were detected in a small subset of soil samples. Eight of the soil samples yielded concentrations above the CRQL. These samples were from TB-8 and the duplicate collected at TB-8 in the 8-to-10-foot sample, TB-9 in the 2-to-4-foot sample, TB-10 in the 2-to-4-foot sample, TB-11 in the 8-to-10-foot sample, TB-12 in the 4-to-6-foot sample, TB-14 in the 5-to-7-foot sample, and TB-17 in the 0-to-2-foot duplicate sample. The soil samples from TB-9, TB-10, and TB-12 contained the most contaminants. In TB-9, heptachlor, endosulfan I, 4,4'-DDE, gamma-chlordane, Aroclor-1248 and Aroclor-1260 were detected. In TB-10, aldrin, heptachlor epoxide, endosulfan I, and gamma-chlordane were detected. In TB-12, heptachlor epoxide, dieldrin, endosulfan II, and Aroclor-1260 were detected. The remaining samples contained one to three compounds.

Twenty inorganics were detected in the subsurface soil samples above the CRQL (see Table 10). Aluminum was detected in all the samples at concentrations ranging from 3,220 to 45,800 mg/kg. All the samples except one are within the range of 7,000 to 100,000 mg/kg for the Eastern United States. There is no soil standard for aluminum in New York. Antimony was detected in all but three of the samples at concentrations ranging from 17.9 to 945 mg/kg. There are no published ranges for the Eastern United States or New York. Arsenic was detected in all but three samples at concentrations ranging from 2.8 to 28.9 mg/kg, which falls within the acceptable range of 0.1 to 73 mg/kg for the Eastern United States. Six samples exceeded the New York range of 3 to 12 mg/kg and two samples are below the New York range.

Barium was detected in all but two of the samples in concentrations ranging from 64.5 to 241 mg/kg, which is within both the range for the Eastern United States (10 to 1,500 mg/kg) and the range for New York (15 to 600 mg/kg). Calcium was detected in all the samples at concentrations ranging from 4,000 to 259,000 mg/kg, which falls within the published range of 100 to 280,000 mg/kg for the Eastern United States, but 16 samples exceeded the published range for New York of 130 to 35,000 mg/kg. Chromium was detected in all samples at concentrations ranging from 10.4 to 127 mg/kg, which is within the acceptable ranges for the Eastern United States (1 to 1,000 mg/kg) and for New York (1.5 to 35,000 mg/kg). Cobalt was detected in 11 of the samples with concentrations ranging from 12.3 to 33 mg/kg, which is within the acceptable ranges for both the Eastern United States (less than 0.3 to 70 mg/kg) and New York State (2.5 to 60 mg/kg).

Copper was detected in all the samples at concentrations ranging from 14 to 20,000 mg/kg. Eight of the samples had concentrations of copper that exceeded the published range of less than 1 to 700 mg/kg for the Eastern United States. No range has been developed for New York. Iron was detected in all the soil samples with concentrations ranging from 8,610 to 39,900 mg/kg, which is within the published range of 100 to 100,000 mg/kg for the Eastern United States. No range has been developed for New York. Lead was detected in all the samples with concentrations ranging from 11.6 to 786 mg/kg. Four of the samples exceeded the published range of lead (10 to 300 mg/kg) for the Eastern United States. No range has been developed for New York.

Magnesium was detected in all the samples with concentrations ranging from 3,030 to 80,800 mg/kg. One sample from TB-15 yielded a concentration of 80,800 mg/kg, which is greater than the published range of 50 to 50,000 mg/kg for the Eastern United States. No range has been published for New York. Manganese was detected in all the samples at concentrations that ranged from 107 to 2,320 mg/kg, which is within the acceptable range of less than 2 to 7,000 mg/kg for the Eastern United States and the published range for New York of 50 to 5,000 mg/kg.

Mercury was detected in 11 of the samples at concentrations ranging from 0.14 to 132 mg/kg. One sample from TB-9 yielded a concentration of 132 mg/kg, which is greater than the published range of 0.01 to 3.4 mg/kg for the Eastern United States. No range has been developed for New York. Nickel was detected in all the samples at concentrations ranging from 12.7 to 1,070 mg/kg. One sample, TB-2, had a concentration of 1,070 mg/kg for nickel, which is greater than the published range of less than 5 to 700 mg/kg for the Eastern United States. Eighteen samples exceeded the published range of 0.5 to 25 mg/kg for New York. Potassium was detected in all but four samples at concentrations ranging from 1,330 to 4,110 mg/kg. This range is within the published range for the Eastern United States (50 to 37,000 mg/kg), but below the published range for New York of 8,500 to 43,000 mg/kg.

Selenium was detected in one sample, TB-11, at a concentration of 3.1 mg/kg, which is within the range for the Eastern United States (less than 0.1 to 3.9 mg/kg). There are no published values for New York. Silver was detected in five samples at concentrations ranging from 4.1 to 29.4 mg/kg. There are no published ranges for either the Eastern United States or for New York. Sodium was detected in seven samples with concentrations ranging from 1,220 to 22,300 mg/kg, which is within the published range of 500 to 500,000 mg/kg for the Eastern United States. There is no published range for New York. Vanadium was detected in all samples except one at concentrations ranging from 14.7 to 50.4 mg/kg, which is within the published range of less than 7 to 300 mg/kg for the Eastern United States. There is no published range for New York State. Zinc was detected in all samples with concentrations ranging from 59.6 to 10,900 mg/kg. Only one sample from the soil borings (TB-10: 10,900 mg/kg) yielded a concentration greater than the published range of less than 5 to 2,900 mg/kg for the Eastern United States. There is no range for New York.

RCRA hazardous waste characteristics and EP Toxicity for metals were below regulatory limits in all samples (see Table 11).

Crossgradient (east). No samples were collected for analysis from the crossgradient borings.

Crossgradient (north). VOCs, SVOCs, pesticides, and PCBs were not detected in the sample from boring TB-5 (see Tables 7, 8, and 9).

Fourteen inorganic compounds were detected above the CRQL (see Table 10). One compound, potassium, was detected at a concentration outside the range of published values. Potassium was detected at a concentration of 1,390 mg/kg, which is lower than the published range of 8,500 to 43,000 mg/kg for New York but within the range of 50 to 37,000 mg/kg for the Eastern United States.

The samples did not exceed the regulatory limits for EP Toxicity for metals or for RCRA hazardous waste characteristics (see Table 11).

Groundwater

Seven new monitoring wells were installed during the 1992 field program (MW-1 through MW-7). One well, MW-4, is located outside of the canal to the west; three monitoring wells (MW-1, MW-2, and MW-3) are located in the canal; two monitoring wells (MW-6 and MW-7) are located crossgradient to the east and one monitoring well (MW-5) is located crossgradient to the north. All the monitoring wells were drilled with 4.25-inch ID HSAs. One round of groundwater samples was collected from the new wells. Existing wells at the site were not sampled because the integrity and well construction details were unknown. The samples were analyzed for TCL VOCs, TCL SVOCs, TCL inorganics, TCL pesticides and PCBs. Analytical results for groundwater are summarized in Tables 12 and 13. The analytical results are discussed in the following order: crossgradient (west), in the canal, crossgradient (east), and crossgradient (north).

During the groundwater sampling, selected groundwater quality parameters were measured to confirm that representative samples were collected and to provide data to assess the quality of groundwater. The following field parameters were measured by Jordan personnel during the sampling episode:

- pH
- specific conductance
- temperature
- turbidity

These parameters were measured for each well volume of groundwater purged before groundwater sampling. A YSI Model 3580 water quality monitor was used to measure temperature, temperature-compensated specific conductance, and pH. Turbidity was measured using a Hach® Model 2100P turbidity meter. The results are listed in Table 14.

For the groundwater samples, the pH values ranged from 6.40 to 7.71, which is within the pH range of 6 to 8.5 for groundwater in the United States (Hem, 1970); the specific conductivity ranged from 366 to 4,300 micromhos/centimeter; the temperature ranged from 12.8 to 16.8 degrees Centigrade; and the turbidity values ranged from 100 to greater than 200 NTUs.

Crossgradient (west). VOCs (see Table 12), SVOCs, pesticides, or PCBs were not detected above the CRQL in monitoring well, MW-4. Eight inorganics were detected above the CRQL (see Table 13). Of the eight detected inorganics, three exceeded the New York State Groundwater Quality Class GA standards: iron, magnesium, and sodium. Iron was detected at a concentration of 2,510 micrograms per liter (μg/L), which exceeds the New York State Class GA groundwater standard of 300 μg/L. Magnesium was detected at a concentration of 48,300 μg/L, which exceeds the New York State Class GA groundwater guidance value of 35,000 μg/L. Sodium was detected at a concentration of 38,500 μg/L, which exceeds the New York State Class GA groundwater standard of 20,000 μg/L. No standards have been developed for the federal MCLs and MCLGs.

In the Canal. One VOC was detected above the CRQL in the wells located in the canal (see Table 12). TCE was detected at a concentration of 10 μg/L, in MW-2, which is above the New York State Groundwater Quality Class GA standard, the federal MCL of 5 μg/L, and the federal MCLG of 0 μg/L. TCE was not detected in MW-1, MW-3, or the duplicate sample collected from MW-2. No SVOCs, pesticides, or PCBs were detected above the CRQL in any sample.

Fifteen inorganic compounds were detected in the groundwater samples from the canal, at concentrations above the CRQL (see Table 13). Of the 15, nine were detected above the New York State Groundwater Quality Class GA standards and/or the federal MCLs and MCLGs: antimony, barium, chromium, iron, lead, magnesium, nickel, sodium, and zinc. Arsenic, mercury, and silver are present at concentrations below the promulgated standards. No standards have been developed for aluminum, calcium, or vanadium.

Aluminum was detected in all samples with concentrations ranging from 4,270 to 34,500 μg/L. Calcium was also detected in all the samples with concentrations ranging from 144,000 to 645,000 μg/L. Vanadium was detected only in MW-1 at a concentration of 67.6 μg/L.

Antimony was detected in the samples at concentrations ranging from 235 to 315 μg/L, which exceeds the guidance value of 3 μg/L for New York State Class GA groundwater quality criteria and the proposed federal MCL and MCLG concentrations of 6 μg/L. Antimony was not detected in MW-3. Barium was detected in one sample from MW-1 at a concentration of 381 μg/L, which exceeds the federal MCL and MCLG of 2 μg/L, but is below the New York State Class GA standard of 1,000 μg/L. Chromium was detected in all the samples with concentrations ranging from 11.2 to 147 μg/L, which exceeds the New York State Class GA groundwater standard of 50 μg/L and the federal MCL and MCLG of 100 μg/L. The concentration detected in MW-3 was 11.2 μg/L, which is below any reported standards.

Iron was detected in all the samples with concentrations ranging from 3,480 to 160,000 μg/L, which exceeds the New York State Class GA groundwater standard of 300 μg/L. There are no federal MCL or MCLG standards.

Lead was detected in all the samples at concentrations ranging from 12.9 to 531 μg/L, which exceeds the New York State Class GA groundwater standard of 25 μg/L, the federal MCL based on a treatment technique value of 15 μg/L, and the federal MCLG of 0 μg/L. The concentration of lead detected in MW-3 was 12.9 μg/L, which is below the reported standards, except for the federal MCLG of 0 μg/L. Magnesium was detected in all the samples with concentrations ranging from 36,900 to 186,000 μg/L. The only standard is a guidance value of 35,000 μg/L for New York State Class GA groundwater. Nickel was detected in all the samples at concentrations ranging from 120 to 232 μg/L. There is no New York State Class GA groundwater standard but these concentrations exceed both the federal MCL and MCLG values of 100 μg/L.

Sodium was detected in all the samples with concentrations ranging from 25,900 to 106,000 μg/L, all of which exceed the New York State Class GA groundwater standard of 20,000 μg/L. There are no federal MCL or MCLG criteria. Zinc was detected in all the samples at concentrations ranging from 348 to 506 μg/L, which exceeds the New York State Class GA groundwater standard of 300 μg/L. There are no federal MCL or MCLG criteria for this compound. The concentration of zinc detected in MW-3 was 103 μg/L, which is below the reported standard.

Crossgradient (east). No VOCs (see Table 12), SVOCs, pesticides, or PCBs were detected in the crossgradient wells (MW-6 and MW-7). Seven inorganics were detected above the CRQL with four exceeding the standards (see Table 13): antimony, iron, magnesium, and sodium. Antimony was detected in MW-6 at a concentration of 76.7 μg/L. This concentration is above the New York State Class GA groundwater quality standard guidance value of 3 μg/L and the proposed federal MCL and MCLG of 6 μg/L. It was not detected in MW-7. Iron was detected at concentrations ranging from 1,000 to 1,010 μg/L, which exceed the New York State Class GA groundwater quality standard guidance value of 300 μg/L. There are no federal MCL or MCLG criteria developed for iron. Magnesium was detected in MW-6 at a concentration of 48,000 μg/L and in MW-7 at a concentration of 83,400 μg/L. These concentrations exceed the guidance value of 35,000 μg/L developed for New York State Class GA groundwater. There are no federal MCL or MCLG criteria. Sodium was detected at concentrations of 487,000 to 623,000 μg/L, which exceed the New York State Class GA groundwater standard of 20,000 μg/L. There are no federal MCL or MCLG criteria.

Crossgradient (north). A groundwater sample could not be collected from the crossgradient (north) well (MW-5) because it was dry during the sampling program.

Surface Water

During surface water sampling activities, the drainage ditch parallel to Cleghorn Drive to the east was dry. Five surface water sample locations were proposed in the Task 2 Work Plan, but only three samples (SW-1 through SW-3) were collected because of the lack of surface water in the catch basins. No samples are considered to be representative of background conditions. The surface water on the site does not have a New York State classification; therefore, for the purpose of evaluating whether a threat to human health or the environment exists, the surface water was compared to New York State Class D water quality criteria, at the request of NYSDEC.

During surface water sampling, selected water quality parameters were measured to ensure that representative samples were collected and to provide data to assess the quality of surface water. The following field parameters were measured by Jordan personnel during the sampling episode:

- pH
- specific conductance
- temperature
- turbidity

These parameters were measured for each surface water sample. A YSI Model 3580 water quality monitor was used to measure temperature, temperature-compensated specific conductance, and pH. Turbidity was measured using a Hach turbidity meter. The system was calibrated daily with appropriate standards in accordance with the procedures presented in the Program QAPP (E.C. Jordan Co., 1992a). The results are summarized in Table 15.

For the surface water samples, the pH ranged from 7.10 to 7.39, specific conductivity ranged from 167 to 5,140 micromhos/centimeter, and the temperature ranged from 22.8 to 25.4 degrees Centigrade. The turbidity values ranged from 74 to greater than 200 NTUs.

One VOC, toluene, was detected at a concentration of 10 μg/L in one surface water sample (SW-1) collected from the on-site drainage ditch (Table 16). There is no New York State Class D surface water quality standard and the concentration was below the federal AWQC standard of 14,300 μg/L.

Three SVOCs were detected in the samples (SW-1, SW-2, and the duplicate sample obtained at the SW-1 location) above the CRQL (Table 17). No SVOCs were detected in SW-3. The SVOCs detected were: phenol, 4-methylphenol, and diethylphthalate. Diethylphthalate was the only SVOC detected in SW-2, at a concentration of 16 μg/L. It was also detected in SW-1 and the duplicate sample collected at the SW-1 location, at concentrations of 41 and 120 μg/L, respectively. All these concentrations are below the federal AWQC standard of 350,000 μg/L. 4-Methylphenol was detected in the sample from SW-1 and the duplicate sample obtained from the SW-1 location at 110 and 130 μg/L, respectively, both of which exceed the federal AWQC standard and the published standard for New York State Class D surface water standard of 1 μg/L. Phenol was detected in SW-1 and the SW-1 duplicate, at concentrations of 38 and 53 μg/L, respectively. These concentrations are above the New York State Class D surface water quality standard of 1 μg/L, but below the federal AWQC criteria of 3,500 μg/L.

No pesticides or PCBs were detected above the CRQL in the surface water samples.

Fifteen inorganic compounds were detected above the CRQL in the surface water samples (Table 18). These compounds are: aluminum, antimony, arsenic, barium, calcium, chromium, iron, lead, magnesium, mercury, nickel, sodium, vanadium, zinc, and cyanide. There are no standards for aluminum, calcium, magnesium, or sodium. Aluminum and calcium were detected in all the samples with concentrations ranging from 4,590 to 77,300 μg/L and 30,500 to 63,200 μg/L, respectively. Magnesium and sodium were detected in all the samples as well with concentrations ranging from 6,670 to 23,500 μg/L and 94,600 to 944,000 μg/L, respectively. For the compounds chromium, lead, nickel, and zinc, the hardness had to be calculated, for each sample using the equation:

$$Hardness\ (ppm) = (2.497\ x\ Ca\ (ppm)) + (4.118\ x\ Mg\ (ppm))$$

(from Clesceri, et al., 1992)

Once the hardness was calculated, the standard for each compound was calculated (see Table 4-14) using the following equations (6 NCYRR, 703):

$$\textbf{chromium} = \exp\ (0.819\ [\ln\ (\text{ppm hardness})] + 3.688)$$

lead = exp (1.266 [ln (ppm hardness)] - 1.416)

nickel = exp (0.76 [ln (ppm hardness)] +4.02)

zinc = exp (0.83 [ln (ppm hardness)] + 1.95)

These equations were obtained from the New York State Groundwater Quality Standards - 6 NYCRR 703 (September 1, 1991) and Division of Water Technical and Operational Guidance Series (1.1.1) Ambient Water Quality Standards and Guidance Values (November 15, 1992).

The corresponding values for each compound for each surface water sample are listed in Table 19. Chromium was detected in all the samples at concentrations ranging from 22.2 to 304 μg/L. All chromium concentrations are below the New York State Class D calculated surface water standards for each sample (see Table 18). A federal AWQC standard has not been developed. Lead was detected in all the samples with concentrations ranging from 56.9 to 1,530 μg/L, which for all samples exceeds both the calculated New York State Class D surface water standards (which range from 87 to 268 μg/L) and the federal AWQC standard of 50 μg/L. Nickel was detected in all the samples except SW-3. The concentrations ranged from 59.6 to 177 μg/L, which do not exceed any of the calculated New York State Class D surface water standards for each sample (which range from 1,900 to 3,752 μg/L). All the samples have concentrations exceeding the federal AWQC standard of 13.4 μg/L. Zinc was detected in all the samples with concentrations that range from 1,760 to 4,200 μg/L, all of which exceed the calculated New York State Class D surface water standards, which range from 330 to 699 μg/L. None of the samples had concentrations above the federal AWQC standard of 5,000 μg/L.

The compounds that did not require calculation of hardness and the corresponding standard are discussed below. Antimony was detected in all the samples except for SW-3. In SW-1, antimony was detected at a concentration of 133 μg/L, which is below the federal AWQC standard of 146 μg/L. The concentrations detected in both the SW-1 duplicate and SW-2 exceed the federal AWQC standard. A standard has not been developed for New York State Class D surface water.

Arsenic was detected in all the samples, except for SW-3, with concentrations that range from 18.9 to 49.2 μg/L, which do not exceed the New York State Class D standard of 360 μg/L for surface water. All concentrations exceed the federal AWQC standard of 0.0022 μg/L.

Barium was detected in the SW-1 duplicate and SW-2 at 262 and 301 μg/L, respectively, both of which are below the federal AWQC standard of 1,000 μg/L. A New York State Class D surface water standard has not been developed. Iron was detected in all the samples with concentrations that range from 4,030 to 139,000 μg/L, all of which are above both the New York State Class D surface water standard and the federal AWQC standard of 300 μg/L. Mercury was detected in all the samples except for SW-3 with concentrations that range from 0.22 to 0.92 μg/L. These concentrations exceed the New York State Class D surface water guidance value of 0.2 μg/L and the federal AWQC standard of 0.144 μg/L.

Vanadium was detected in all the samples except for SW-3. The concentration detected in SW-1 (67.2 μg/L) is below the New York State Class D surface water standard of 190 μg/L. The concentrations detected in the SW-1 duplicate and SW-2 were 211 and 336 μg/L, respectively, both of which exceed the New York State Class D surface water standard of 190 μg/L. A federal AWQC standard has not been developed. Cyanide was detected in all the samples except SW-3. The concentrations detected in SW-1 and the SW-1 duplicate (20 μg/L) are below both the New York State Class D surface water standard of 22 μg/L and the federal AWQC standard of 200 μg/L. Cyanide was detected in SW-2 at a concentration of 30 μg/L, which exceeds the New York State Class D standard of 22 μg/L but not the federal AWQC standard of 200 μg/L.

Sediment

Five sediment samples (SD-1 through SD-5) were collected from catch basins on site. The sediment sampled from the catch basins at locations SD-1 and SD-2 was black organic silt. In the catch basin at SD-3, the sediment was a mixture of very fine sand, clay, and organic material; in addition, there was an odorless, soft, tan, and white substance on top of the sediment at this location. The sediment sampled from the drainage ditch at SD-4 was orange coarse sand and organic material, while the sediment sampled in the drainage ditch from SD-5 was gray-brown, organic sand and clay. No odor was noticed at any of the surface water/sediment locations. None of the sediment samples are considered representative of background conditions. There are no federal or state standards with which to compare the concentrations of the compounds detected in the samples. The sediments were analyzed to aid in evaluating whether compounds detected in other site media are contaminants of concern at the site. The sediment samples all contained more than 50 percent to more than 90 percent moisture, which resulted in the data being qualified because of the NYSDEC ASP requirement that the sample must consist of more than 90 percent solids. Laboratory analytical results are summarized in Tables 20 through 23.

Three VOCs were detected in the sediment samples above the CRQL (see Table 20): acetone, 2-butanone, and toluene. No VOCs were detected in SD-3, SD-4, or SD-5. Acetone was detected only in SD-2 at a concentration of 1,700 μg/kg. 2-Butanone was detected in SD-1, the SD-1 duplicate, and SD-2 at 49, 71, and 340 μg/kg, respectively. Toluene was detected in SD-1 and the SD-1 duplicate at 31 and 140 μg/kg, respectively.

Four SVOCs were detected in the sediment samples above the CRQL (see Table 21): 4-methylphenol, phenanthrene, fluoranthene, and chrysene. No SVOCs were detected in the SD-1 duplicate, SD-3, SD-4, or SD-5. 4-Methylphenol was detected only in SD-1, at a concentration of 2,700 μg/kg. The remaining SVOCs were detected in SD-2: phenanthrene at a concentration of 2,500 μg/kg, fluoranthene at 2,700 μg/kg, and chrysene at 2,200 μg/kg.

The samples were not analyzed for inorganic compounds.

Five pesticides and no PCBs were detected in the sediment samples above the CRQL (see Table 22): 4,4'-DDE, endrin, 4,4'-dichlorodiphenyldichlorethane (DDD), 4,4'-DDT, and alpha-chlordane. No pesticides were detected in SD-3. 4,4'-DDE was detected in all sediment samples except SD-3 and SD-5. The concentrations ranged from 9.4 to 29 μg/kg. Endrin was detected in SD-4 and SD-5 at concentrations of 14 and 6.2 μg/kg, respectively. 4,4'-DDD was detected only in the SD-1 duplicate at a concentration of 8.8 μg/kg. 4,4'-DDT was detected in all samples except SD-2 and SD-3 at concentrations ranging from 5 to 33 μg/kg. Alpha-chlordane was detected in SD-2 and SD-4 at 4.7 and 9.1 μg/kg, respectively.

The sediment samples were also analyzed for RCRA hazardous waste characteristics and EP Toxicity for metals. The results are tabulated in Table 23. None of the samples exceeded the published regulatory limits.

5.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the findings of the field investigation activities and results of sampling and laboratory analysis, the following general conclusions and recommendations can be drawn.

5.1 SUBSURFACE SOILS

Crossgradient (west).

- No TCL VOCs, TCL pesticides, or TCL PCBs were detected above the CRQL.
- Two TCL SVOCs, di-n-butylphthalate and bis(2-ethylhexyl)phthalate, were detected above the CRQL. These compounds are derivatives of plastics. They are common artifacts of laboratory and/or sampling procedures and are not considered to be site-derived.
- One TCL inorganic compound, calcium, was detected at a concentration greater than the ranges for the Eastern United States and New York State. This is likely the result of proximity to the dolomitic bedrock underlying the site.

In the Canal.

- Three TCL VOCs: acetone, TCE, and PCE, were detected above the CRQL in one soil sample (TB-9 at 2 to 4 feet) at 18 and 30 μg/kg, respectively.
- Seventeen TCL SVOCs were detected above the CRQL. Thirteen of the TCL SVOCs are PAHs, of which possible sources are fuel, coal tar, and asphalt. The total PAHs ranged from 0 to 113,800 μg/kg in TB-14 in the 5 to 7 foot sample. Three are plasticizers and one is formed by organic synthesis, one is used in fire extinguishers or used as a rubber accelerator. These compounds are believed to represent site conditions.

- Eleven TCL pesticides and two TCL PCBs were detected above the CRQL. The two pesticides, Aroclor-1248 and Aroclor-1260 were detected in one boring (TB-9 at 2 to 4 feet) at 14,000 and 12,000 μg/kg, respectively.

- Nine TCL inorganic compounds were detected at concentrations exceeding the range for the Eastern United States, the range for New York State, or both. Aluminum, copper, lead (11.6 to 786 mg/kg), magnesium, mercury (0.14 to 132 mg/kg), and zinc exceeded the range for the Eastern United States. Arsenic (2.8 to 28.9 mg/kg) and calcium exceeded the range for New York State, and nickel exceeded the ranges for both the Eastern United States and New York State.

- None of the soil samples exceeded the regulatory limits for EP Toxicity for metals or for the RCRA hazardous waste characteristics of ignitability, corrosivity, and reactivity.

Crossgradient (east).

- There are no soil data for the crossgradient (east) borings.

Crossgradient (north).

- No TCL VOCs, TCL SVOCs, TCL pesticides or PCBs were detected above the CRQL in boring TB-5.

- No TCL inorganic compounds were detected exceeding the published ranges for either the Eastern United States or New York State.

- None of the soil samples exceeded the regulatory limits for EP Toxicity for metals or for the RCRA hazardous waste characteristics of ignitability, corrosivity, and reactivity.

5.2 GROUNDWATER

Crossgradient (west).

- No TCL VOCs, TCL SVOCs, TCL pesticides or PCBs were detected above the CRQL.

- Of the TCL inorganic compounds detected, only three (iron, magnesium, and sodium) exceeded the New York State Class GA groundwater standards. Iron, magnesium, and sodium are regulated by Secondary Limits and are only considered objectionable because of aesthetic reasons, not health reasons.

In the Canal.

- One TCL VOC was detected above the CRQL. TCE was detected in MW-2 at a concentration of 10 μg/L, which exceeds the New York State Class GA groundwater standard, the federal MCL, and the federal MCLG of 5 μg/L.

- No TCL SVOCs, TCL pesticides or PCBs were detected above the CRQL.

- Nine TCL inorganic compounds were detected above the New York State Class GA groundwater quality standards and/or the federal MCL and MCLGs. Four of the inorganic compounds: iron, magnesium, sodium, and zinc, are regulated by Secondary Drinking Water Standards for aesthetic reasons, not health reasons. The other five inorganic compounds: antimony, barium, lead, nickel, and chromium, were detected at concentrations exceeding the promulgated regulatory standards.

Crossgradient (east).

- No TCL VOCs, TCL SVOCs, TCL pesticides or PCBs were detected above the CRQL.

- Four TCL inorganic compounds were detected above the standards. Three of the inorganic compounds: iron, magnesium, and sodium, are regulated by Secondary Drinking Water Standards for aesthetic reasons, not health reasons. The fourth inorganic compound, antimony, exceeds only the New York State Class GA groundwater guidance value and therefore cannot be considered to be a contravention of a promulgated standard.

5.3 SURFACE WATER

- No TCL VOCs were detected at concentrations above the standards.
- No TCL pesticides and PCBs were detected in the samples above the CRQL.
- Two TCL SVOCs, 4-methylphenol and phenol, were detected at concentrations that exceed the standards of 1 μg/L.
- Nine TCL inorganic compounds exceed either the New York State Class D surface water quality standard, the federal AWQC standard, or both standards. Zinc, vanadium, and cyanide exceed the New York State Class D surface water quality standard; nickel, antimony, and arsenic exceed the federal AWQC standards; and lead, iron, and mercury exceed both standards.

5.4 SEDIMENT

- Three TCL VOCs: acetone, 2-butanone, and toluene, were detected above the CRQL.
- Four TCL SVOCs: 4-methylphenol, phenanthrene, fluoranthene, and chrysene, were detected above the CRQL.
- Five TCL pesticides: 4,4'-DDE, endrin, 4,4'DDD, 4,4'-DDT, and alpha-chlordane were detected above the CRQL.
- The sediment samples were within the regulatory limits for EP Toxicity for metals and RCRA hazardous waste characteristics.

5.5 RECOMMENDATIONS

As a result of the combined Tasks 3 and 4 field investigation at the Stauffer Chemical-Whittaker Subdivision site, it is recommended, based on a strict interpretation of Article 27, Title 13 of the *Environmental Conservation Law* (ECL) and 6 NYCRR Part 375, that the site be reclassified to a delist. This recommended classification is based on the site data: (1) no hazardous waste deposition can be documented; (2) one groundwater sample exceeded the New York State Class GA standard of 10 μg/L for TCE; (3) three monitoring wells have inorganic compounds that exceeded promulgated standards for one or all of the following inorganic compounds: antimony, barium, chromium and lead; (4) one surface water sample exceeded the New York State Class D surface water and the federal AWQC standards of 1 μg/L for phenol and 4-methylphenol; and (5) three surface water samples have inorganic compounds that exceed promulgated standards for one or all of the following inorganic compounds: zinc, cyanide, nickel, antimony, arsenic, barium, lead, iron, mercury, and vanadium. Based on these data and a strict interpretation of Article 27, Title 13, of the ECL and 6 NYCRR Part 375, because the presence of hazardous waste has not been documented, and although the exceedance of promulgated state and federal standards for groundwater and surface water has been confirmed, this site does not meet the definition of hazardous waste sites. Therefore, this site will be delisted and referred to the Division of Water for further necessary action for the contravention of groundwater and surface water standards.

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

ASP	Analytical Services Protocol
AWQC	Ambient Water Quality Criteria
bgs	below ground surface
cm/sec	centimeters per second
CRQL	Contract Required Quantitation Limit
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethane
DOT	U.S. Department of Transportation
ECL	Environmental Conservation Law
E&EE	Ecology and Environment Engineering
EP	Extraction Procedure
GPR	ground-penetrating radar
HASP	Health and Safety Plan
HSA	hollow-stem auger
HSL	Hazardous Substance List
ID	inside diameter
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
mg/kg	milligrams per kilogram
MSL	mean sea level
NCHD	Niagara County Health Department
NTU	nephelometric turbidity unit
NUS	NUS Corporation
NYCRR	New York State Codes, Rules, and Regulations
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYTEST	NYTEST Environmental, Inc.
O_2/LEL	oxygen/lower explosive limit

PAH	polycyclic aromatic hydrocarbon
PARCC	precision, accuracy, reproducibility, completeness, and comparability
PCB	polychlorinated biphenyl
PCE	tetrachloroethylene
PID	photoionization detector
ppm	parts per million
PSA	Preliminary Site Assessment
PVC	polyvinyl chloride
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
SVOC	semivolatile organic compound
TCE	trichloroethylene
TCL	Target Compound List
USEPA	U.S. Environmental Protection Agency
VOC	volatile organic compound
YSI	Yellow Spring Instrument
μg/kg	micrograms per kilogram
μg/L	micrograms per liter

Adams, Mark, 1990. Resident at 1140 Escarpment Drive, Lewiston, New York, Personal Communication with Catherine C. Lanois, E.C. Jordan Co., Wakefield, Massachusetts, July 30, 1990.

Aro Corporation (ARO), 1980. Analytical Results of Crop Samples from Escarpment and Elliot Drives, Lewiston, New York, from Aro Corporation, Buffalo, New York, January 18, 1980.

Bidell, Gene H., 1980. Town of Lewiston Water Pollution Control Center, Lewiston, New York, Written Memorandum to Lewiston Town Board and Town Clerk, January 18, 1980.

Clesceri, Lenore S., Arnold E. Greenberg and Andrew D. Eaton, 1992. Standard Methods For The Examination of Water and Wastewater, 18th edition, 1992.

Dicky, Paul, 1988. Niagara County Health Department, Niagara Falls, New York, Written Correspondence with Mr. Steve Reiter, Water Superintendent, Town of Lewiston, New York, June 21, 1988.

Dominion Soil Investigation (Dominion), 1979. "Report of Lewiston Escarpment Project Analysis of Subsoil Conditions, Whittaker Subdivision, Lewiston, New York," Scarborough, Ontario, prepared for Town of Lewiston, New York, March 1979.

E.C. Jordan Co., 1990. Preliminary Site Assessment at Stauffer Chemical-North Love Canal in the Town of Lewiston; prepared for New York State Department of Environmental Conservation, November 1990.

E.C. Jordan Co., 1992a. Program Quality Assurance Project Plan; prepared for New York State Department of Environmental Conservation, June 1992.

E.C. Jordan Co., 1992b. Preliminary Site Assessment Tasks 3-6 Site Work Plan for the Stauffer Chemical-Whittaker Subdivision Site; prepared for New York State Department of Environmental Conservation, July 1992.

Ecology and Environment Engineering, P.C. (E&EE), 1989. "Phase I Investigation, Stauffer Chemical, North Love Canal, Town of Lewiston, Niagara County, New York," prepared for New York State Department of Environmental Conservation, Division of Hazardous Waste Remediation, Albany, New York, September 1989.

Hem, J.D., 1970. Study and Interpretation of the Chemical Characteristics of Natural Water, Second Edition. U.S. Geological Survey Water Supply Paper 1473, U.S. Department of the Interior, Washington, D.C., 363 p.

Henry, Chief Leo R., 1987. Clerk, Tuscarora Indian Reservation, 2006 Mt. Hope Road - via: Lewiston, New York, Written Communication to Mr. Dennis Sutton, Ecology and Environment, Inc., Buffalo, New York, November 25, 1987.

Hettrick, Dawn, May 8, 1991. New York State Department of Health, Written Communication and Analytical Results to Mr. Julio Muscatello, 1176 Jarrett Drive, Lewiston, New York, May 8, 1991.

Hopkins, Mike, 1988. Niagara County Health Department, Niagara Falls, New York, Written Memorandum to Jack Tygert, New York State Department of Environmental Conservation, Region 9, Buffalo, New York, June 15, 1988.

Kenney, Maureen, 1990. Town of Lewiston Water Department, Lewiston, New York, Personal Communication with Catherine C. Lanois, E.C. Jordan Co., Wakefield, Massachusetts, August 2, 1990.

May, Glenn, May 6, 1991. New York State Department of Environmental Conservation, Region 9, Buffalo, New York, Written Memorandum and Analytical Results to Sri Maddineni, NYSDEC, Albany, NY, May 6, 1991.

May, Glenn, May, 1992. New York State Department of Environmental Conservation, Region 9, Buffalo, New York, Verbal Communication, 1992.

McGovern, E.C., 1988. Background Concentrations of 20 Elements in Soils with Special Regard for New York State; New York State Department of Environmental Conservation Wildlife Coordination Center.

Niagara County Health Department (NCHD), 1989. Analytical results of basement sump samples and site sketch of ditch sampling, Niagara County Health Department File, Niagara Falls, New York, January 1989.

Niagara Gazette, 1979. Newspaper articles "Lewiston canal probed," "Lewiston testing results unsettling," dated April 7 and 8, 1979.

New York State Department of Environmental Conservation (NYSDEC), 1980. Freshwater Wetlands Maps and Classification Regulations, 6 NYCRR Part 664, Lewiston and Ransomville Quadrangles, 1980.

New York State Department of Environmental Conservation (NYSDEC), 1986. Water Quality Regulations, Surface Water and Groundwater Classifications and Standards, 6 NYCRR Chapter X, Parts 700-705, March 31, 1986.

New York State Department of Environmental Conservation (NYSDEC), 1990. Natural Heritage Program, Albany, New York.

New York State Department of Environmental Conservation (NYSDEC), 1991. Analytical Services Protocol, September 1991.

New York State Department of Transportation (NYSDOT), 1976a. Topographic Map, Lewiston Quadrangle, Second Edition, 1976.

New York State Department of Transportation (NYSDOT), 1976b. Topographic Map, Ransomville Quadrangle, Second Edition, 1976.

NUS Corporation (NUS), 1987. "Potential Hazardous Waste Site Preliminary Assessment, USEPA Form 2070-12, Upper Mountain Road Dump, Lewiston, Niagara County, New York," prepared for USEPA, June 2, 1987.

NUS Corporation (NUS), 1990. "Final Draft Site Inspection Report Upper Mountain Road Dump, Lewiston, Niagara County, New York," prepared for USEPA, February 23, 1990.

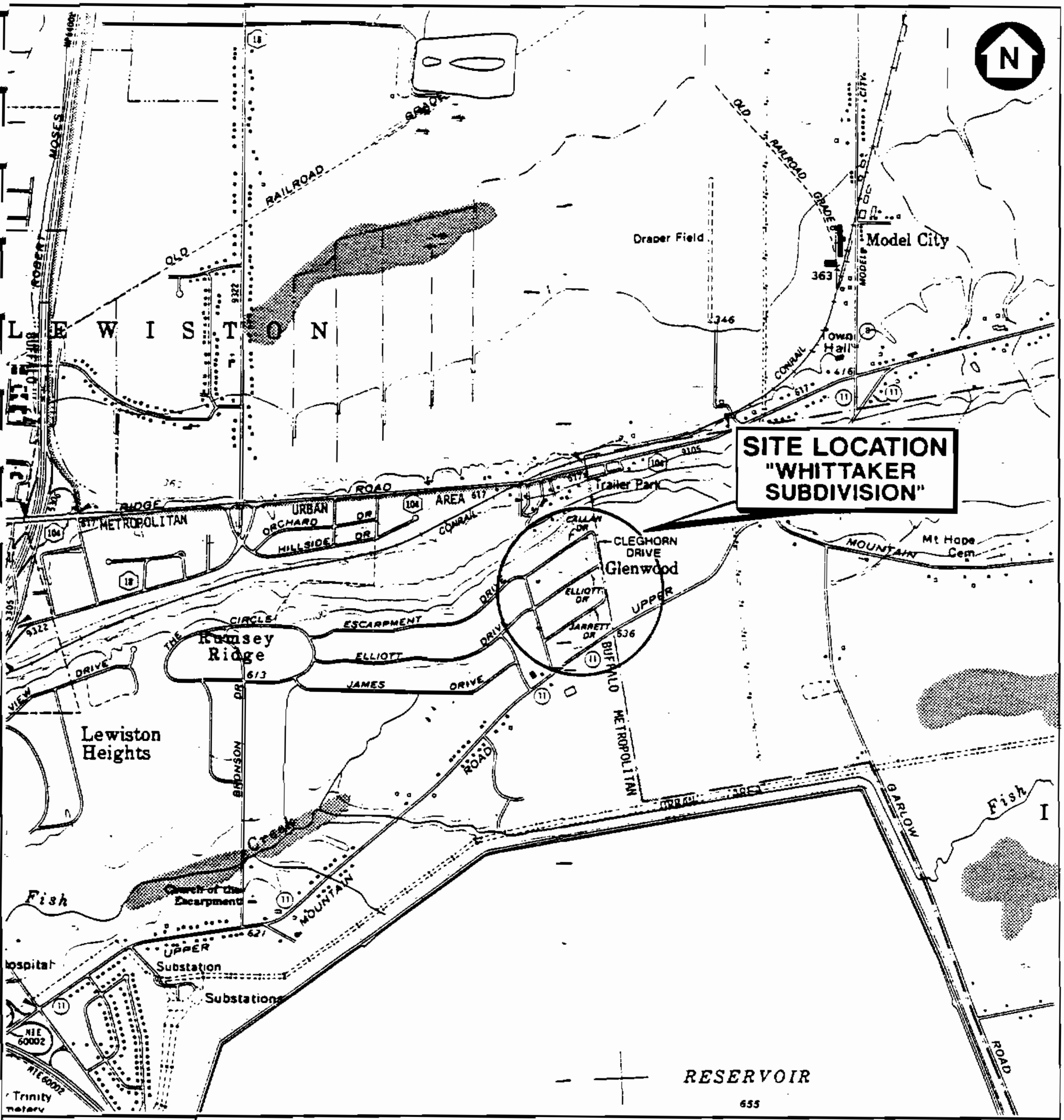
U.S. Department of Agriculture (USDA), Soil and Water Conservation Service, Niagara County, Lockport, New York, 1951. Aerial Photograph ARE-5H-182, 1" = 660', October 14, 1951.

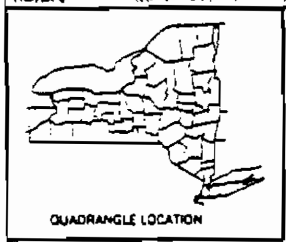
U.S. Department of Agriculture (USDA), Soil and Water Conservation Service, Niagara County, Lockport, New York, 1958. Aerial Photograph ARE-2V-9, 1" = 660', August 9, 1958.

U.S. Department of Agriculture (USDA), Soil Conservation Service, 1972. "Soil Survey of Niagara County, New York."

U.S. Environmental Protection Agency (USEPA), 1979. "Report on Love Canal Section Lewiston, New York," USEPA Rochester Program Support Branch, Surveillance and Analysis Division, Rochester, New York, September 7, 1979.

Young, William, 1990. Resident at 1153 Escarpment Drive, Lewiston, New York, Personal Communication with Catherine C. Lanois, E.C. Jordan Co., Wakefield, Massachusetts, July 23, 1990.





SOURCE: NEW YORK STATE DEPARTMENT OF TRANSPORTATION,
RANSOMVILLE AND LEWISTON QUADRANGLES, NEW YORK
7.5-MINUTE SERIES, 1976, SECOND EDITIONS

SITE NO.: 932034
LOCATION: TOWN OF LEWISTON,
NIAGARA COUNTY, NEW YORK

▨ STATE-REGULATED WETLANDS

SCALE IN FEET
0 2000 4000

FIGURE 1
SITE LOCATION MAP
STAUFFER CHEMICAL - WHITTAKER SUBDIVISION SITE
PRELIMINARY SITE ASSESSMENT
NEW YORK STATE DEC

ECJORDANCO

7060-20

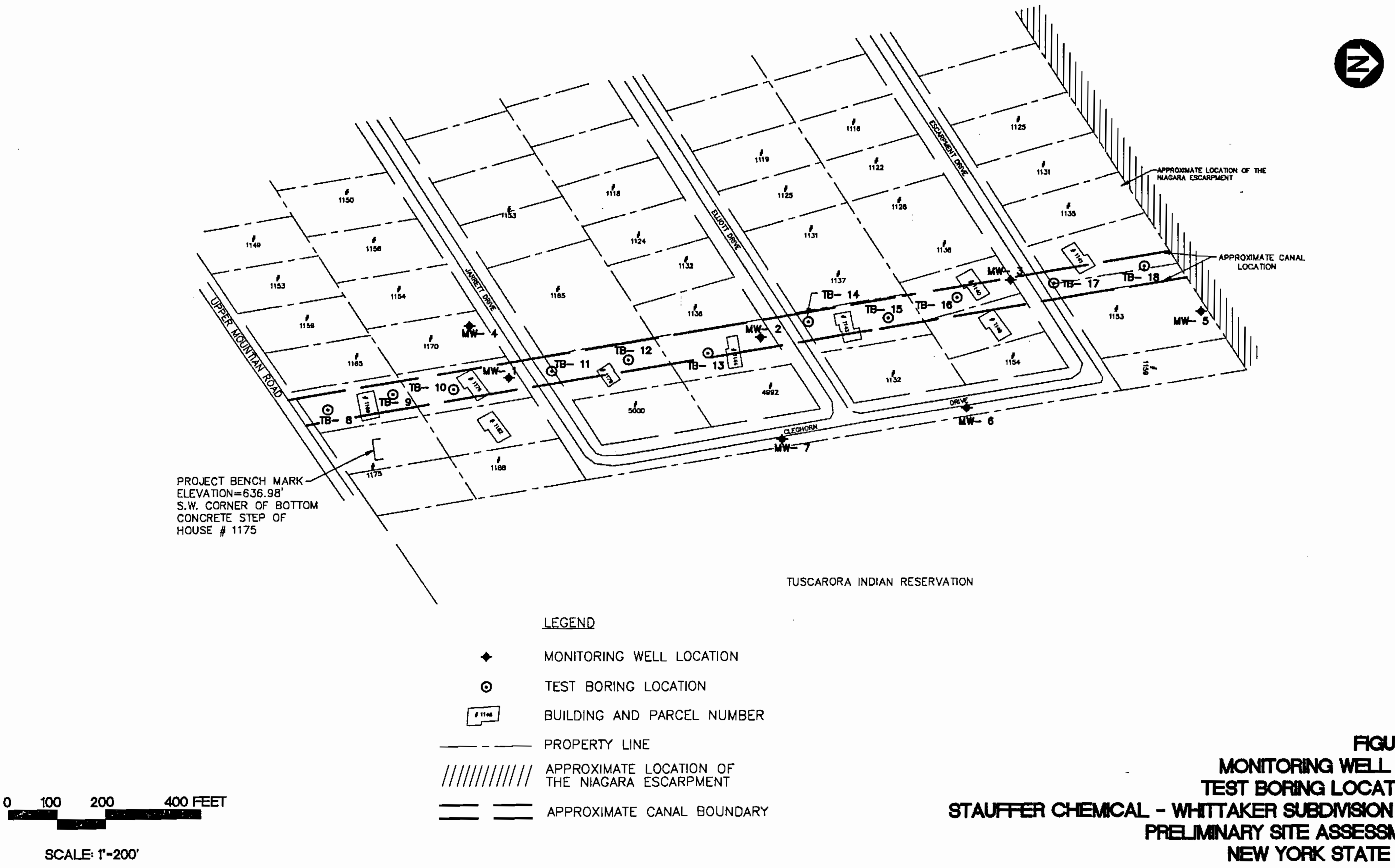


FIGURE 2
MONITORING WELL AND TEST BORING LOCATIONS
STAUFFER CHEMICAL - WHITTAKER SUBDIVISION SITE
PRELIMINARY SITE ASSESSMENT
NEW YORK STATE DEC

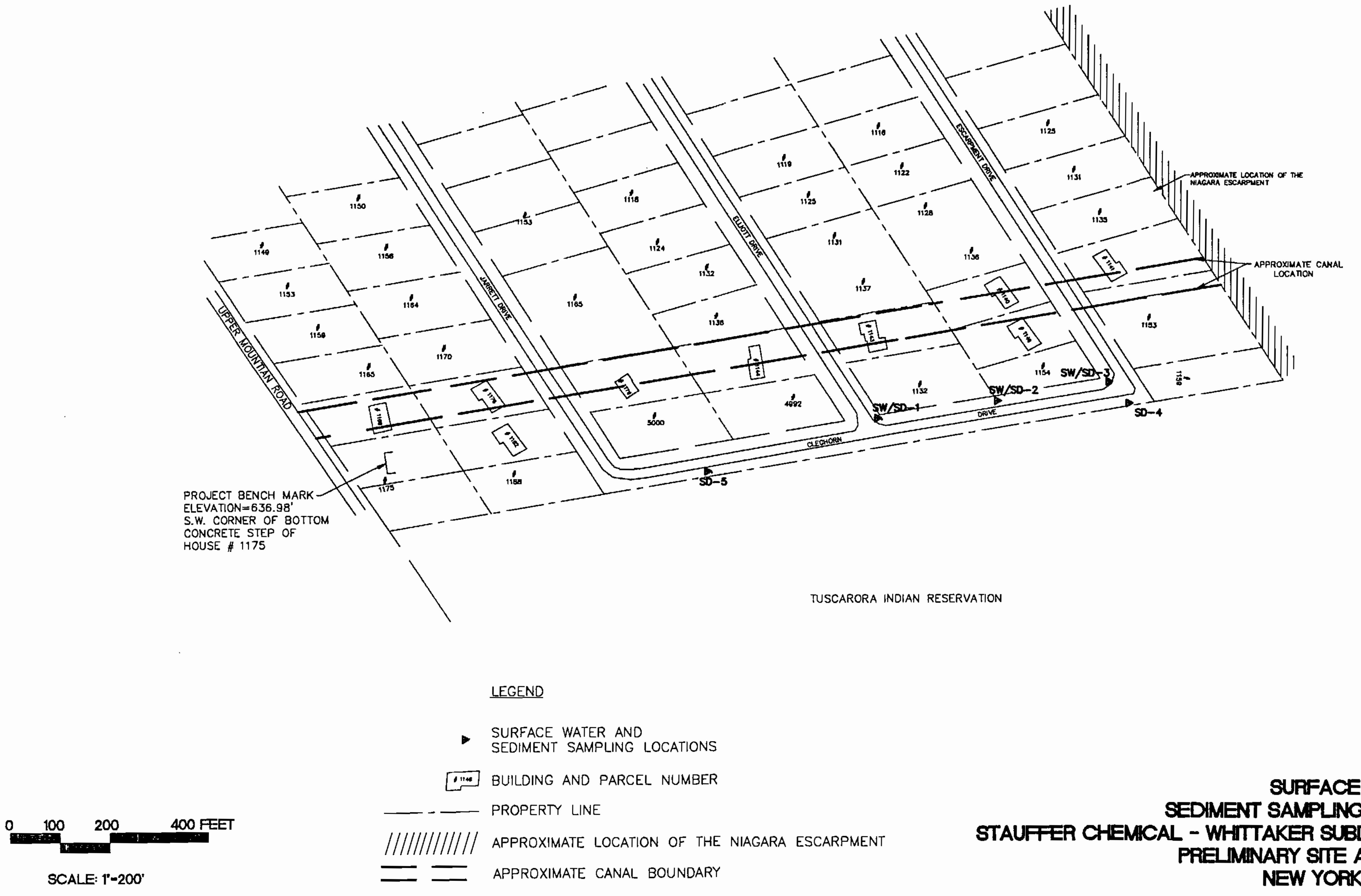
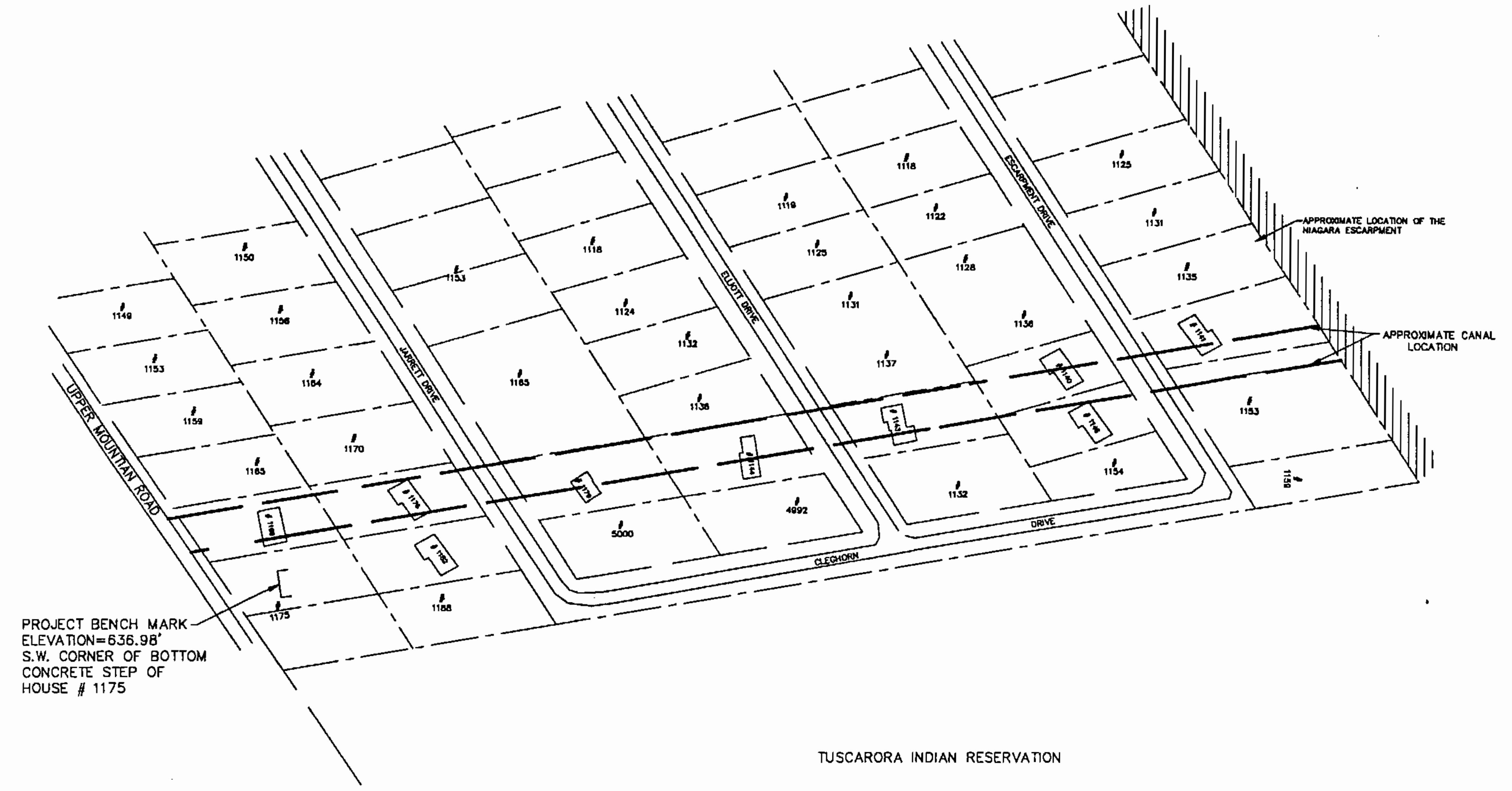


FIGURE 3
SURFACE WATER AND
SEDIMENT SAMPLING LOCATIONS
STAUFFER CHEMICAL - WHITTAKER SUBDIVISION SITE
PRELIMINARY SITE ASSESSMENT
NEW YORK STATE DEC

E.C. JORDAN CO.

Z:\7060-50\7060F102

7060-50



PROJECT BENCH MARK
ELEVATION=636.98'
S.W. CORNER OF BOTTOM
CONCRETE STEP OF
HOUSE # 1175

LEGEND

BUILDING AND PARCEL NUMBER

//////////// APPROXIMATE LOCATION OF THE NIAGARA ESCARPMENT

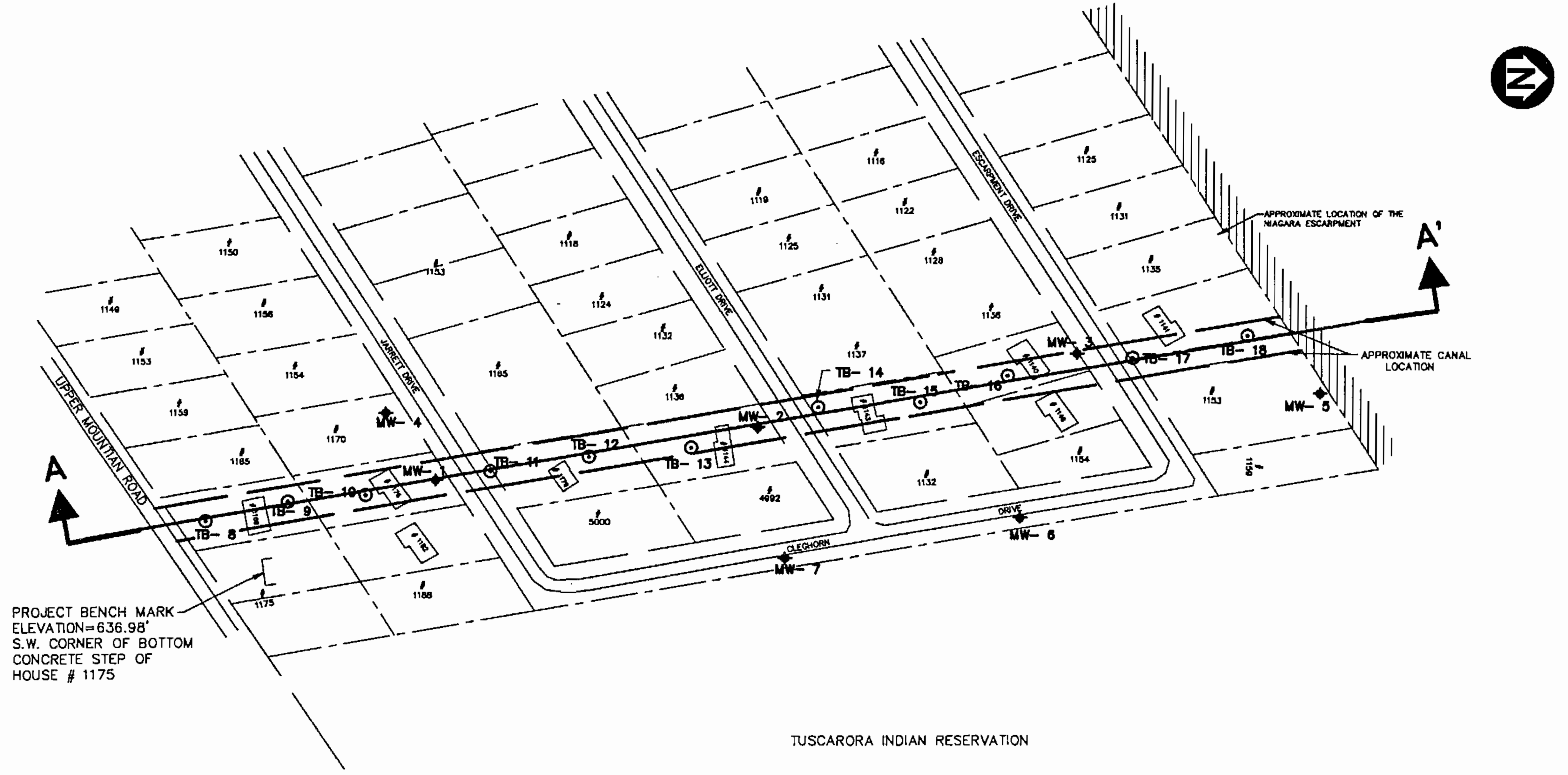
— — APPROXIMATE CANAL BOUNDARY

0 100 200 400 FEET

SCALE: 1"=200'

FIGURE 4
SITE PLAN
STAUFFER CHEMICAL - WHITTAKER SUBDIVISION SITE
PRELIMINARY SITE ASSESSMENT
NEW YORK STATE DEC

E.C. JORDAN CO.



LEGEND

- ◆ MONITORING WELL LOCATION
- ⊙ TEST BORING LOCATION
- ▭ BUILDING AND PARCEL NUMBER
- —— - —— PROPERTY LINE
- ////////////// APPROXIMATE LOCATION OF THE NIAGARA ESCARPMENT
- ═ ═ APPROXIMATE CANAL BOUNDARY

0 100 200 400 FEET

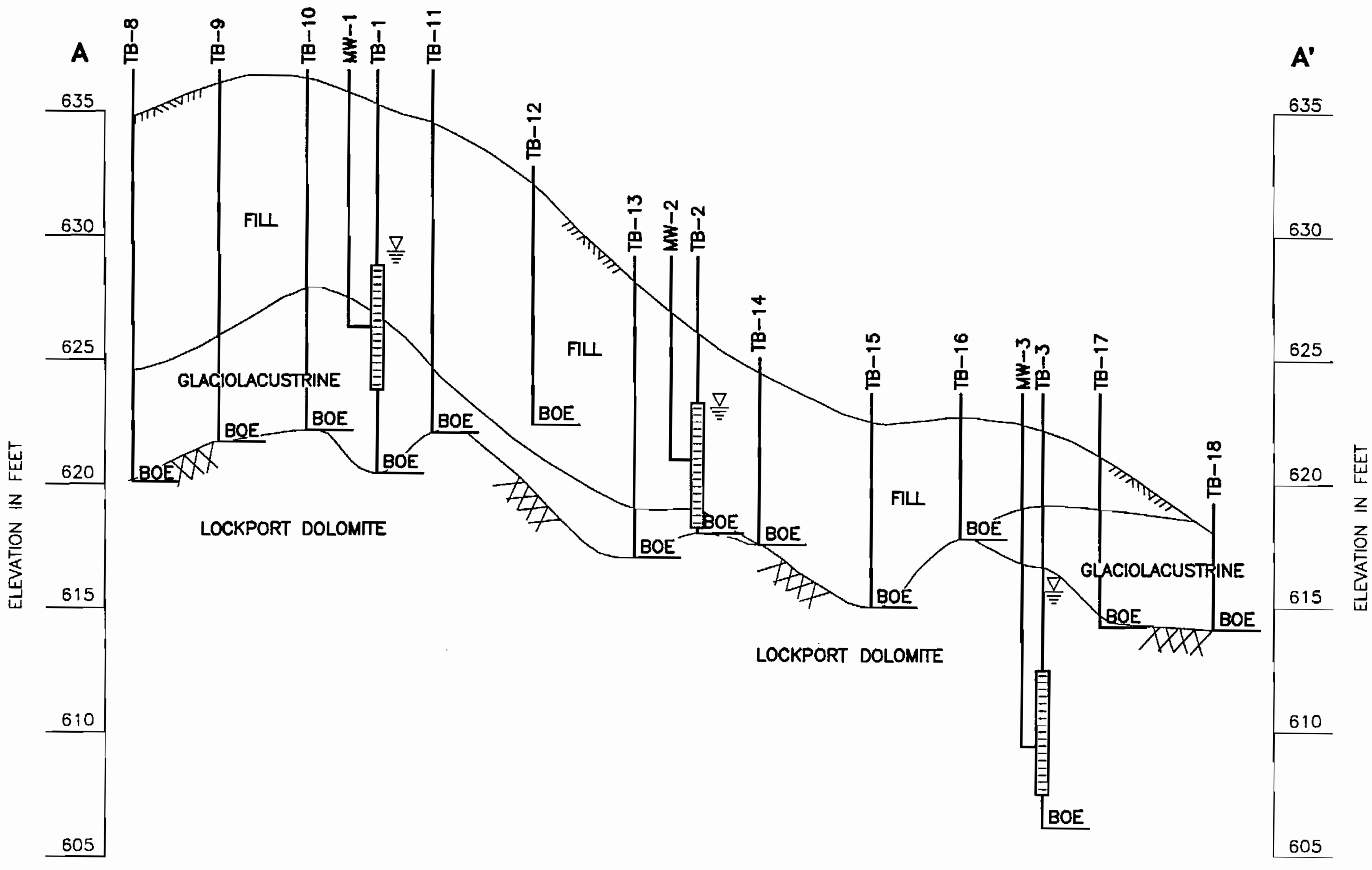
SCALE: 1"=200'

FIGURE 5
LOCATION AND ORIENTATION OF GEOLOGIC PROFILE A-A'
STAUFFER CHEMICAL - WHITTAKER SUBDIVISION SITE
PRELIMINARY SITE ASSESSMENT
NEW YORK STATE DEC

E.C. JORDAN CO.

7060-50

Z:\7060-50\7060F105



NOTES:

1. ALL GEOLOGIC BOUNDARIES WERE INTERPOLATED AND ARE BEST APPROXIMATIONS BETWEEN BORINGS. ACTUAL GEOLOGIC BOUNDARIES AND MATERIALS BETWEEN BORINGS MAY BE DIFFERENT THAN SHOWN.
2. ORIENTATION OF PROFILE IS SHOWN ON FIGURE 5.

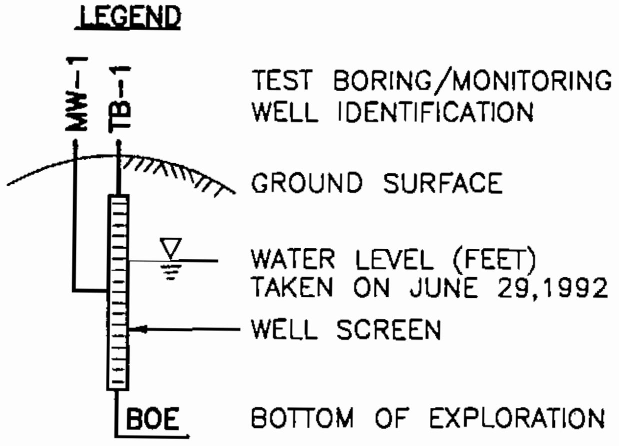
GEOLOGIC DESCRIPTION

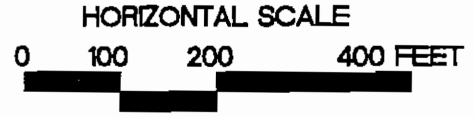
FILL:
PRIMARILY BROWN, RED-BROWN, AND GRAY SANDY SILTS AND SILTY CLAYS WITH FRAGMENTS OF BRICK, COAL, GLASS, FIBROUS MATERIAL AND ORGANIC MATERIAL; SOME BLACK CLAYEY, TARRY MATERIAL WITH LENSES OF VERY SOFT DARK GRAY SLUDGE, AND SOME YELLOW TO WHITE SANDY/ASHY MATERIAL WITH LAYERS OF SILT, SAND AND BLACK GRAVEL.

GLACIOLACUSTRINE DEPOSITS:
LIGHT BROWN TO REDDISH BROWN SOFT TO DENSE CLAYEY SILT WITH TRACES OF FINE TO COARSE SAND AND FINE GRAVEL.

LOCKPORT DOLOMITE:
UPPER FRACTURED FAIRLY PERMEABLE UNIT.

LEGEND





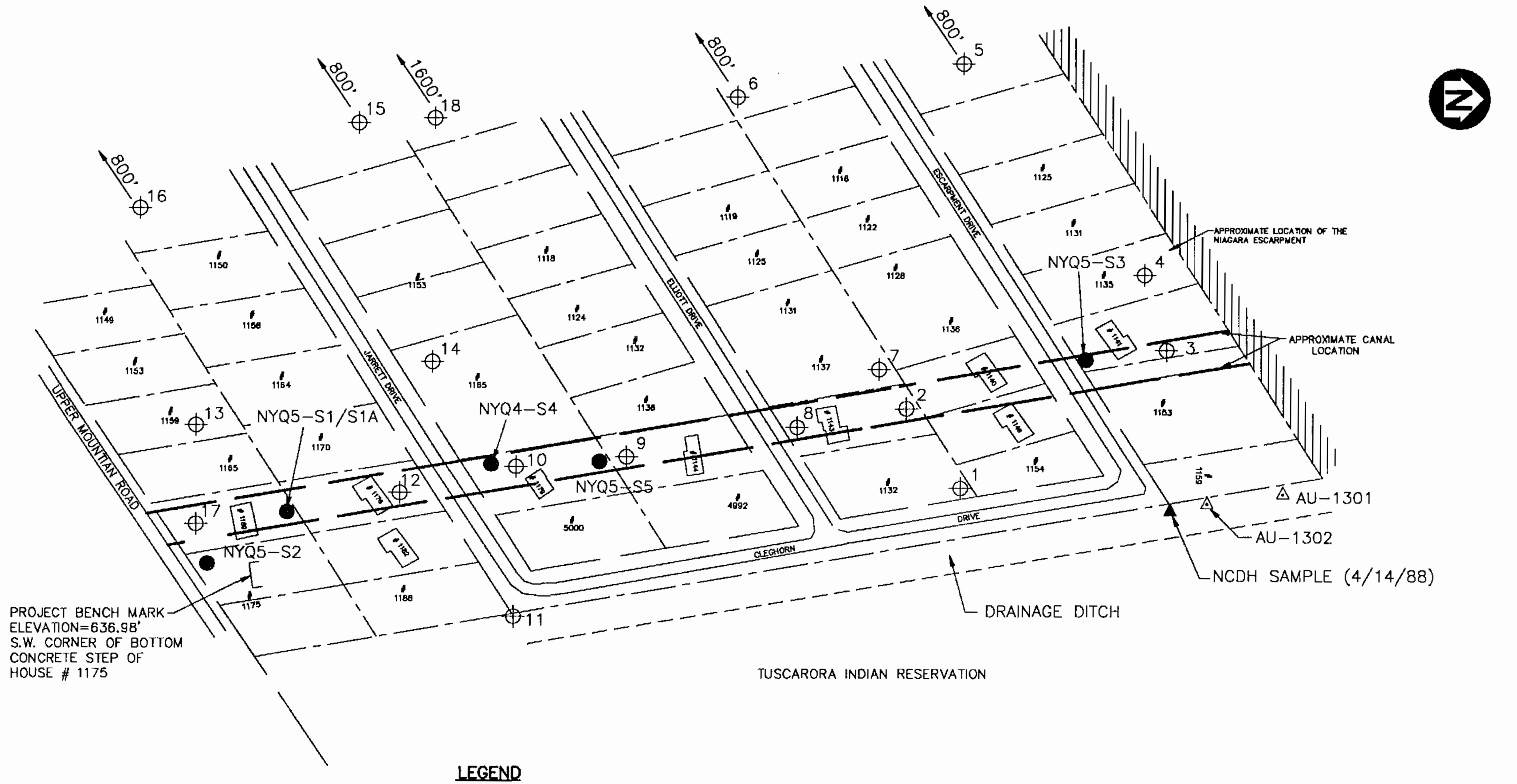
VERTICAL EXAGGERATION 40 : 1

FIGURE 6
GEOLOGIC PROFILE A-A'
STAUFFER CHEMICAL - WHITTAKER SUBDIVISION SITE
PRELIMINARY SITE ASSESSMENT
NEW YORK STATE DEC

E.C. JORDAN CO.

7060-50

Z:\7060-50\7060F106



LEGEND

BUILDING AND PARCEL NUMBER

PROPERTY LINE

APPROXIMATE LOCATION OF THE NIAGARA ESCARPMENT

APPROXIMATE CANAL BOUNDARY

△ AU-1301 APPROXIMATE LOCATION OF DITCH SAMPLE; NYSDEC 1991.

⊕ 4 APPROXIMATE LOCATION OF SOIL BORINGS; DOMINION, 1979.

● NYQ5 -S1 APPROXIMATE LOCATION OF SHALLOW SOIL SAMPLES: NUS REPORT, FEBRUARY, 1990.

0 100 200 400 FEET

SCALE: 1"=200'

FIGURE 7
PREVIOUS EXPLORATION LOCATIONS
STAUFFER CHEMICAL - WHITTAKER SUBDIVISION SITE
PRELIMINARY SITE ASSESSMENT
NEW YORK STATE DEC

E.C. JORDAN CO.

Z:\7060-50\7060F107\12-14-92

TABLE 1
SUBSURFACE EXPLORATION PROGRAM SUMMARY
STAUFFER CHEMICAL - WHITTAKER SUBDIVISION SITE

LOCATION		PURPOSE	TOTAL DEPTH (ft. bgs)	SCREEN DEPTH (ft. bgs)
TB/MW-1	In canal (south end of site)	To provide soil/waste and groundwater samples to confirm or deny on-site hazardous waste disposal in the canal and to assess whether ambient water quality standards are exceeded.	15.3	6.5-11.5
TB/MW-2	In canal (center of site)	To provide soil/waste and groundwater samples to confirm or deny on-site hazardous waste disposal in the canal and to assess whether ambient water quality standards are exceeded.	8	2.8-7.8
TB/MW-3	In canal (north end of site)	To provide soil/waste and groundwater samples to confirm or deny on-site hazardous waste disposal in the canal and to assess whether ambient water quality standards are exceeded.	15.9	9.8-14.8
TB/MW-4	Upgradient of canal	To provide background soil and groundwater data.	14.6	9.3-14.3
TB/MW-5	Downgradient of canal	To provide downgradient soil and groundwater data (outside canal boundaries).	15.2	9.0-14.0
TB/MW-6	Crossgradient of canal	To provide groundwater quality data to determine the significance of a potential threat to nearby private drinking water supplies on the Tuscarora Indian Reservation	14.6	7.5-12.5
TB/MW-7	Crossgradient of canal	Same as MW-6	18.7	10.25-15.25
TB-8	In canal (south end of site)	To provide soil/waste samples to confirm the presence or absence of on-site hazardous waste disposal in the canal	14	NA
TB-9	In canal (south end of site)	To provide soil/waste samples to confirm the presence or absence of on-site hazardous waste disposal in the canal	14.5	NA
TB-10	In canal (south end of site)	To provide soil/waste samples to confirm the presence or absence of on-site hazardous waste disposal in the canal	14	NA
TB-11	In canal (south end of site)	To provide soil/waste samples to confirm the presence or absence of on-site hazardous waste disposal in the canal	12.5	NA
TB-12	In canal (south end of site)	To provide soil/waste samples to confirm the presence or absence of on-site hazardous waste disposal in the canal	9.6	NA
TB-13	In canal (center of site)	To provide soil/waste samples to confirm the presence or absence of on-site hazardous waste disposal in the canal	11	NA
TB-14	In canal (center of site)	To provide soil/waste samples to confirm the presence or absence of on-site hazardous waste disposal in the canal	7	NA
TB-15	In canal (center of site)	To provide soil/waste samples to confirm the presence or absence of on-site hazardous waste disposal in the canal	7.8	NA
TB-16	In canal (north end of site)	To provide soil/waste samples to confirm the presence or absence of on-site hazardous waste disposal in the canal	4.9	NA
TB-17	In canal (north end of site)	To provide soil/waste samples to confirm the presence or absence of on-site hazardous waste disposal in the canal	6.9	NA
TB-18	In canal (north end of site)	To provide soil/waste samples to confirm the presence or absence of on-site hazardous waste disposal in the canal	3.9	NA

NOTES:
ft bgs = feet below ground surface
NA = not applicable
KRN/TAB-1/S2

TABLE 2
SUMMARY OF ENVIRONMENTAL SAMPLES COLLECTED DURING COMBINED TASKS 3 & 4 FIELD INVESTIGATION
STAUFFER CHEMICAL – WHITTAKER SUBDIVISION SITE

MEDIA	LOCATION	DEPTH(a)	SAMPLE ID	PARAMETER	METHOD
GROUND–WATER	MW–1	6.5 – 11.5	SCMW001XXX92XX	TCL VOC	91–1
	MW–2	2.8 – 7.8	SCMW002XXX92XX	TCL SVOC	91–2
	MW–2 DUP	2.8 – 7.8	SCMW002XXX92XD	TCL PEST/PCB	91–3
	MW–3	9.8 – 14.8	SCMW003XXX92XX	TCL INORGANICS	SERIES 200 CLP–M
	MW–4	9.3 – 14.3	SCMW004XXX92XX	CYANIDE	
	MW–6	7.5 – 12.5	SCMW006XXX92XX		
	MW–7	10.25–15.25	SCMW007XXX92XX		
SURFACE WATER	SW/SD–1	SURFACE	SCSW001XXX92XX	TCL VOC	91–1
	SW/SD–1DUP	SURFACE	SCSW001XXX92XD	TCL SVOC	91–2
	SW/SD–2	SURFACE	SCSW002XXX92XX	TCL PEST/PCB	91–3
	SW/SD–3	SURFACE	SCSW003XXX92XX	TCL INORGANICS	SERIES 200 CLP–M
				CYANIDE	
SEDIMENT	SW/SD–1	SURFACE	SCSD001XXX92XX	TCL VOC	91–1
	SW/SD–1DUP	SURFACE	SCSD001XXX92XD	TCL SVOC	91–2
	SW/SD–2	SURFACE	SCSD002XXX92XX	TCL PEST/PCB	91–3
	SW/SD–3	SURFACE	SCSD003XXX92XX	TCL INORGANICS	SERIES 200 CLP–M
	SW/SD–4	SURFACE	SCSD004XXX92XX	EP TOXICITY METALS/	1310
	SW/SD–5	SURFACE	SCSD005XXX92XX	IGNITABLITY	1010 OR 1020
				CORROSIVITY	9045
				REACTIVITY	ASP VOL.3, PART XV
SOIL	MW–1	2–4	SCBS001X0492XX	TCL VOC	91–1
	MW–1	6–8	SCBS001X0892XX	TCL SVOC	91–2
	MW–2	0–2	SCBS002X0292XX	TCL PEST/PCB	91–3
	MW–2	2–4	SCBS002X0492XX	TCL INORGANICS	SERIES 200 CLP–M
	MW–3	2–4	SCBS003X0492XX	EP TOXICITY METALS/	1310
	MW–4	5–7	SCBS004X0792XX	IGNITABLITY	1010 OR 1020
	MW–5	0–2	SCBS005X0292XX	CORROSIVITY	9045
	TB–8	8–10	SCBS008X1092XX	REACTIVITY	ASP VOL.3, PART XV
	TB–8DUP	8–10	SCBS008X1092XD		
	TB–9	2–4	SCBS009X0492XX		
	TB–10	2–4	SCBS010X0492XX		
	TB–11	8–10	SCBS011X1092XX		
	TB–12	4–6	SCBS012X0692XX		
	TB–13	4–6	SCBS013X0692XX		
	TB–14	2–4	SCBS014X0492XX		
	TB–14	6–7	SCBS014X0792XX		
	TB–15	4–6	SCBS015X0692XX		
	TB–15	6–8	SCBS015X0892XX		
	TB–16	2–4	SCBS016X0492XX		
	TB–16DUP	2–4	SCBS016X0492XD		
	TB–17	0–2	SCBS017X0292XX		
	TB–17DUP	0–2	SCBS017X0292XD		
	TB–18	1–3	SCBS018X0392XX		
QUALITY CONTROL	SOIL SAMPLER BLANK		SCQS001XXX92SB		
	SEDIMENT SAMPLER BLANK		SCQS001XXX92XX		
	SEDIMENT SAMPLER BLANK		SCQS002XXX92XX		
	TRIP BLANK		SCQT001XXX92XX		

NOTES:
* – Extra volume collected for laboratory quality control procedures
(a) – Depths given for groundwater samples are well screen intervals.
All depths are in feet below ground surface.
DUP – Duplicate sample
EP – Extraction Procedure
TCL – Target Compound List
VOC– Volatile Organic Compound
PCB – Polychlorinated Biphenyls
SVOC – Semivolatile Organic Compound
PEST – Pesticides

TABLE 3
WATER LEVEL DATA
STAUFFER CHEMICAL - WHITTAKER SUBDIVISION SITE

LOCATION	GROUND SURFACE (ft. MSL)	RISER ELEVATION (ft. MSL)	GROUNDWATER ELEVATION (ft. MSL)
MW-1	635.2	635.08	629.38
MW-2	626.1	625.69	623.14
MW-3	622.2	622.12	615.38
MW-4	636.4	636.22	625.88
MW-5	616.8	616.51	DRY
MW-6	621.1	620.92	615.00
MW-7	624.4	624.13	619.70

NOTES:
ft. MSL = feet mean sea level
MW = monitoring well

TABLE 4
CONTRACT LABORATORY QUALITY CONTROL REQUIREMENTS
STAUFFER CHEMICAL - WHITTAKER SUBDIVISION

ORGANICS	INORGANICS
- monitoring of hold times	- monitoring of hold times
- gas chromatograph/mass spectrometry tuning	- instrument calibration
- instrument calibration	- laboratory method blank analysis
- laboratory method blank analysis	- interference check sample analysis
- surrogate spike analysis	- inductively coupled serial dilution analysis
- matrix spike/matrix spike duplicate analysis	- matrix spike analysis
- internal standard performance review	- duplicate sample analysis
- compound identification/quantitation	- furnace atomic absorption quality control review
	- laboratory control sample analysis

TABLE 5
DEFINITION OF DATA QUALIFIERS
STAUFFER CHEMICAL - WHITTAKER SUBDIVISION

ORGANIC DATA QUALIFIERS	
J	Indicates an estimated concentration because results are either below the Contract Required Quantitation Level (CRQL) or quality control (QC) criteria were not met.
JJ	Validation qualifier for concentrations below the Sample Quantitation Limit (SQL) but greater than the CRQL.
U	Indicates that compound was analyzed for but not detected.
UJ	Indicates that quantitation level was estimated because QC criteria were not met, the compound was analyzed for but not detected.
B	Indicates analyte was detected in both the sample and the associated laboratory method blank.
E	Indicates that the analyte concentration exceeded the calibration range of the gas chromatograph and mass spectrometer (GC/MS) and that a reanalysis of a diluted sample was required.
D	Indicates that sample concentration was obtained by dilution to bring the result within calibration range.
R	Indicates that data is unusable (rejected) because QC acceptance criteria were not met.
N	Indicates presumptive evidence of a compound. This flag is used for tentatively identified compounds (TICs) where the identification is based on a library search and is applied to all TIC results. For general classes of compounds (hydrocarbons, etc.) this flag is not used.
P	This flag is used for pesticides/polychlorinated biphenyls (PCBs) when there is greater than 25% difference between the concentrations on the two columns used for analysis.
C	This flag applies to pesticides/PCBs results when the identification has been confirmed by GC/MS.
A	Indicates that a TIC is a suspected aldol-condensation product.
X	Laboratory-defined qualifier used to provide additional information not covered by the other qualifiers.

(continued)

TABLE 5
DEFINITION OF DATA QUALIFIERS
STAUFFER CHEMICAL - WHITTAKER SUBDIVISION

INORGANIC DATA QUALIFIERS	
E	The reported concentration is estimated because of the presence of an interference.
J	Indicates an estimated concentration because (rejected) QC acceptance criteria were not met.
R	Indicates that data is unusable because QC criteria were not met.
M	Duplicate injection precision criteria were not met.
N	Spiked sample recovery not within control limits.
s	The reported concentration was determined by the method of standard additions.
W	Postdigestion spike for furnace atomic adsorption analysis is outside control limits.
[ ]	Concentration reported is below CRQL.
*	Duplicate analysis not within control limits.
+	Correlation coefficient for the method of standard additions was less than 0.995.
OTHER NOTATIONS	
NR	Analysis not requested.
NA	Analysis requested but not performed.
-	Compound analyzed but is less than the CRQL.

TABLE 6
SUMMARY OF SURFACE SOIL DATA FROM THE NUS CORPORATION 1990 INVESTIGATION
STAUFFER CHEMICAL – WHITTAKER SUBDIVISION

	LOCATION					
COMPOUND (µg/kg)	NYQ5 S1	NYQ5 S1A	NYQ5 S2	NYQ5 S3	NYQ5 S4	NYQ5 S5
Volatile Organic Compounds						
Chloroform	–	–	–	–	–	22
Carbon Tetrachloride	–	–	–	–	–	34
Tetrachloroethene	16	18	–	–	–	35
Toluene	–	–	–	–	–	J
Semivolatile Organic Compounds						
Hexachloroethane	–	J	–	–	–	J
Hexachlorobutodiène	–	–	–	–	–	J
Hexachlorobenzene	–	–	–	–	–	J
Phenanthrene	1800	1300	–	–	–	J
Anthracene	J	J	–	–	–	–
Di-n-butylphthalate	–	–	–	–	–	J
Fluoranthene	2300	1600	–	J	J	970 E
Pyrene	2400 E	1700 E	–	–	J	930 E
Benzo(a)anthracene	1400	980	–	–	J	J
Chrysene	1500	1000	–	–	J	J
Benzo(b)fluornathene	1300	1110	–	–	–	J
Benzo(k)fluoranthene	1000	J	–	–	–	J
Benzo(a)pyrene	1200	890	–	–	J	J
Indeno(1,2,3–cd)pyrene	870	J	–	–	–	J
Benzo(g,h,i)perylene	J	J	–	–	–	J
Pesticides						
Aldrin	J	J	–	–	–	–
Inorganics						
Aluminum	17,100	16,400	12,700	13,100	14,400	9,080
Antimony	29.9	12.6	–	–	–	34.8
Arsenic	R	R	3.7 E	3.6 E	2.7 E	9.3 E
Beryllium	J	J	J	–	–	–
Cadmium	2.4	2	–	–	–	–
Calcium	18,900	20,600	32.800	29,300	6,900	33,200
Chromium	55.1	45.5	24.8	22.3	18.4	40.8
Cobalt	13	11.9	–	10.2	J	J
Copper	234	277	38.6	26.5	16.9	63.8
Iron	41,700	35,600	23,500	23,200	20,800	24,200
Lead	249	257	40.8	46.5	39.9	280
Magnesium	6,600	6,490	6,200	10,300	4,510	10,300
Manganese	847 E	846 E	640 E	654 E	850 E	658 E
Mercury	R	R	–	–	–	0.87
Nickel	50.4	54.3	26.7	21	19.5	35.5
Potassium	1940 E	1750 E	2020 E	1370 E	769 E	1750 E
Silver	–	–	–	–	4.7 E	2.5 E
Vanadium	33.6	32.9	23.6	23.1	25.5	20.5
Zinc	288 E	267 E	65.5 E	112 E	52.3 E	184 E

NOTES:
– = Compound analyzed for but not detected.
E = Estimated value.
J = Estimated value, compound present but below Contract Required Quantitation Limit but above Sample Quantitation Limit.
R = Analysis did not pass U.S. Environmental Protection Agency Quality Assurance/Quality Control.

TABLE 7
SUMMARY OF VOLATILE ORGANIC COMPOUND DATA FOR SOIL BORINGS
STAUFFER CHEMICAL – WHITTAKER SUBDIVISION SITE

LOCATION	PARAMETER (ug/kg) ACETONE CRQL 10 ug/kg	TRICHLOROETHENE CRQL 10 ug/kg	TETRACHLOROETHENE CRQL 10 ug/kg
TB–1 (2–4')	–	–	–
TB–1 (6–8')	–	–	–
TB–2 (0–2')	–	–	–
TB–2 (2–4')	–	–	–
TB–3 (2–4')	17 J	–	–
TB–4 (5–7')	–	–	–
TB–5 (0–2')	–	–	–
TB–8Dup (8–10')	14	–	–
TB–8 (8–10')	16	–	–
TB–9 (2–4')	–	18	30
TB–10 (2–4')	15	–	–
TB–11 (8–10')	–	–	–
TB–12 (4–6')	–	–	–
TB–13 (4–6')	24	–	–
TB–14 (2–4')	38	–	–
TB–14 (5–7')	–	–	–
TB–15 (4–6')	28	–	–
TB–15 (6–8')	16	–	–
TB–16Dup (2–4')	120 J	–	–
TB–16 (2–4')	120 J	–	–
TB–17Dup (0–2')	–	–	–
TB–17 (0–2')	–	–	–
TB–18 (1–3')	–	–	–

NOTES:

CRQL = Contract Required Quantitation Limit
ug/kg = micrograms per kilogram
J = estimated
Dup = duplicate sample
– = not detected
(2–4') = depth below ground surface in feet

TABLE 8
SUMMARY OF
SEMIVOLATILE ORGANIC COMPOUND DATA FOR SOIL BORINGS
STAUFFER CHEMICAL – WHITTAKER SUBDIVISION SITE

COMPOUND (ug/kg)	CRQL (ug/kg)	LOCATION																						
		(2–4') TB–1	(6–8') TB–1	(0–2') TB–2	(2–4') TB–2	(2–4') TB–3	(5–7') TB–4	(0–2') TB–5	(8–10') TB–8 Dup	(8–10') TB–8	(2–4') TB–9	(2–4') TB–10	(8–10') TB–11	(4–6') TB–12	(4–6') TB–13	(2–4') TB–14	(5–7') TB–14	(4–6') TB–15	(6–8') TB–15	(2–4') TB–16 Dup	(2–4') TB–16	(0–2') TB–17 Dup	(0–2') TB–17	(1–3') TB–18
Hexachloroethane	330	–	–	–	–	–	–	–	–	–	–	440	–	–	–	–	–	–	–	–	–	–	–	–
Naphthalene[a]	330	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1,000	–	–	–
Fluorene[a]	330	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2,000	–	–	–	–	1,200	–	–	–
Phenanthrene[a]	330	–	–	–	1,700	–	–	–	–	560 J	–	800	440	480	540	14,000	24,000	–	–	1,800	5,600	–	380 J	–
Anthracene[a]	330	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2,900	6,200	–	–	–	1,300	–	–	–
Di–n–butylphthalate	330	1,700	1,700	–	–	1,700	2,000	–	–	–	–	–	–	–	–	–	–	430	460	1,500	1,400	–	1,500 J	1,100
Fluoranthene[a]	330	–	–	–	2,300	–	–	–	–	970 J	–	540	520	–	690 J	6,800	18,000	–	–	1,300	3,900	–	470 J	–
Pyrene[a]	330	–	–	–	2,300 J	–	–	–	–	1,500 J	–	420	–	–	630 J	5,200	18,000	–	–	1,100	2,700	–	–	–
Butylbenzylphthalate	330	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	660 J	–
Benzo(a)Anthracene	330	–	–	–	710	–	–	–	–	530 J	–	–	–	–	–	5,600	8,600	–	–	–	–	–	–	–
Chrysene[a]	330	–	–	–	910	–	–	–	–	760 J	–	480	–	640	–	6,900	11,000	–	–	–	1,900	–	– –	–
bis(2–Ethylhexyl)–phthalate	330	–	–	–	–	–	2,800 J	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2,100 J	–
Benzo(b)Fluoranthene[a]	330	–	–	–	840	–	–	–	–	–	–	–	–	–	–	3,000	5,200	–	–	–	–	–	–	–
Benzo(k)Fluoranthene[a]	330	–	–	–	490	–	–	–	–	–	–	–	–	–	–	2,900	4,900	–	–	–	1,200	–	–	–
Benzo(a)Pyrene[a]	330	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3,600	7,200	–	–	–	1,200	–	–	–
Indeno(1,2,3–c,d)–Pyrene[a]	330	–	–	–	490	–	–	–	–	–	–	–	–	–	–	1,900	5,800	–	–	–	–	–	–	–
Benzo(g,h,i)perylene[a]	330	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	4,900	–	–	–	–	–	–	–
Total PAHs	NA	0	0	0	9,740	0	0	0	0	4,320	0	2,240	960	1,120	1,860	54,800	113,800	0	0	4,200	20,000	0	850	0

NOTES:

CRQL = Contract Required Quantitation Limit
ug/kg = micrograms per kilogram
J = estimated
– = not detected
NA = not applicable

(2–4') = depth in feet below ground surface
Dup = duplicate sample
PAHs = polycyclic aromatic hydrocarbons
a = PAHs

TABLE 9
SUMMARY OF PESTICIDE AND POLYCHLORINATED BIPHENYL DATA FOR SOIL BORINGS
STAUFFER CHEMICAL – WHITTAKER SUBDIVISION SITE

COMPOUND (ug/kg)	CRQL (ug/kg)	LOCATION																						
		(2–4') TB–1	(6–8') TB–1	(0–2') TB–2	(2–4') TB–2	(2–4') TB–3	(5–7') TB–4	(0–2') TB–5	(8–10') TB–8 Dup	(8–10') TB–8	(2–4') TB–9	(2–4') TB–10	(8–10') TB–11	(4–6') TB–12	(4–6') TB–13	(2–4') TB–14	(5–7') TB–14	(4–6') TB–15	(6–8') TB–15	(2–4') TB–16 Dup	(2–4') TB–16	(0–2') TB–17 Dup	(0–2') TB–17	(1–3') TB–18
beta–BHC	1.7	–	–	–	–	–	–	–	–	14 J	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Heptachlor	1.7	–	–	–	–	–	–	–	–	–	68 J	–	–	–	–	–	–	–	–	–	–	–	–	–
Aldrin	1.7	–	–	–	–	–	–	–	–	–	–	27 J	–	–	–	–	28 J	–	–	–	–	–	–	–
Heptachlor Epoxide	1.7	–	–	–	–	–	–	–	–	–	–	29 J	–	2.3 J	–	–	–	–	–	–	–	–	–	–
Endosulfan I	1.7	–	–	–	–	–	–	–	–	–	35	24 J	–	–	–	–	–	–	–	–	–	–	–	–
Dieldrin	3.3	–	–	–	–	–	–	–	–	–	–	–	–	8.9	–	–	–	–	–	–	–	–	–	–
4,4'–DDE	3.3	–	–	–	–	–	–	–	–	–	240	–	–	–	–	–	–	–	–	–	–	8 J	–	–
Endrin	3.3	–	–	–	–	–	–	–	–	16 J	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Endosulfan II	3.3	–	–	–	–	–	–	–	–	–	–	–	–	5 J	–	–	–	–	–	–	–	–	–	–
4,4'–DDT	3.3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	5.6 J	–	–
gamma–Chlordane	1.7	–	–	–	–	–	–	–	2.8 J	16 J	170	26 J	5.8 J	–	–	–	–	–	–	–	–	–	–	
Aroclor–1248	3.3	–	–	–	–	–	–	–	–	–	14,000DJ	–	–	–	–	–	–	–	–	–	–	–	–	–
Aroclor–1260	3.3	–	–	–	–	–	–	–	–	–	12,000DJ	–	–	270 J	–	–	–	–	–	–	–	–	–	–

NOTES:

CRQL =Contract Required Quantitation Limit
ug/kg =micrograms per kilogram
Dup = duplicate sample
J = estimated
D = diluted
– = not detected
(2–4') = depth in feet below ground surface

TABLE 10
SUMMARY OF INORGANIC COMPOUND DATA FOR SOIL BORINGS
STAUFFER CHEMICAL – WHITTAKER SUBDIVISION SITE

COMPOUND	CRQL mg/kg	EASTERN US mg/kg	New York State (mg/kg)	LOCATION																				
				(2–4') SB–1	(6–8') SB–1	(0–2') SB–2	(2–4') SB–2	(2–4') SB–3	(5–7') SB–4	(0–2') SB–5	(8–10') SB–8DUP	(8–10') SB–8	(2–4') SB–9	(2–4') SB–10	(8–10') SB–11	(4–6') SB–12	(4–6') SB–13	(2–4') SB–14	(5–7') SB–14	(4–6') SB–15	(6–8') SB–15	(2–4') SB–16DUP	(2–4') SB–16	(2–4') SB–17DUP	(0–2') SB–17	(1–3') SB–18
Aluminum	40	7,000–100,000	a	20,500	12,000	34,000	45,800	21,200	11,100	13,400	13,800	17,900	26,300	16,000J	10,800	16,500J	22,200J	3,220J	17,300J	8,090J	4,640J	18,100	14,700	18,400	13,100	26,500
Antimony	12	a	a	31.9J	34.2J	416J	945J	20J	14.6J	–	91.7J	156J	240J	65.4J	25.1J	25.2J	17.9J	18.7J	86.9J	–	–	–	19.6J	19J	25.2J	28.2J
Arsenic	2	<0.1 – 73	3–12	7.6	14.2	5.9	6.2	3.6	2.6	4.4	9.8	12.8	9.4	17.1J	28.9	8.7J	13.3J	6.7J	14.9J	–	–	–	2.8	4.5	4	5.6
Barium	40	10 – 1,500	15–600	97.4J	104J	69.7	72.8	152J	97.8J	84.4	182J	194J	101J	159J	89.2	115J	241J	–	163J	64.5J	–	139J	135J	113J	90	128J
Calcium	1000	100 – 280,000	130–35,000	13,300J	53,500J	15,700J	13,600J	8,980J	53,600J	4,060	41,300J	45,200J	89,800J	45,300J	39,800J	39,400J	4,000J	25,9000J	43,600J	86,400J	15,9000J	43,600J	43,000J	50,600J	52,600J	14,400J
Chromium	2	1– 1,000	1.5–35,000	26J	19.3J	73.7J	78.5J	25.8J	13.7J	17.8J	30.1J	64.9J	46.3J	28.8J	20.7J	127J	55.1J	10.4J	44.3J	13.1J	12.6J	27.2J	21.4J	23.6J	17.4J	57.3J
Cobalt	10	<0.3 – 70	2.5–60	13.9	–	12.3	20.8	14.8	–	–	13.5	14.4	–	13.2	–	–	14.3	–	33	–	–	–	–	12.3	–	13.9
Copper	5	<1 – 700	a	319J	242J	9,640J	20,200J	14J	29.1J	9.4J	617J	1,880J	2,910J	158J	1,050J	756J	923J	48.4J	911J	86.1J	41.9J	50.5J	38.3J	17.4J	16.8J	16.8J
Iron	20	100–100,000	a	27,600	19,000	23,000	16,800	29,600	19,400	22,400	27,200	26,500	39,700	35,400J	21,300	27,600J	39,900J	8,610J	25,300J	14,000J	12,700J	24,700	22,900	25,000	21,400	32,400
Lead	0.6	<10–300	a	94J	120J	439J	396J	11.6J	4.1J	14J	107J	188J	246J	84.9J	140J	139J	786J	59J	577J	29J	14J	25.4J	17.4J	24.7J	18J	33.6J
Magnesium	1000	50–50,000	a	5970	12,800	4,370	3,030	5,660	6,580	4,390	9,810	9,180	11,900	7,920J	6,760	9,020J	4,990J	11,900J	6,870J	19,400J	80,800J	15,900	14,500	19,400	18,300	9,820
Manganese	3	<2–7,000	50–5,000	10,50J	797J	492J	483J	1,390J	913J	2,280J	714J	756J	287J	778J	527J	483J	185J	107J	436J	493J	2,320J	752J	799J	757J	690J	780J
Mercury	0.04	0.01–3.4	a	–	–	–	0.25J	–	–	–	0.15J	0.58J	132J	0.45	0.49J	1.5	0.99	0.47	0.51	0.14	–	–	–	–	–	–
Nickel	8	<5–700	0.5–25	89J	21.2J	655J	1,070J	24.1J	12.7J	14.1J	42J	88.7J	113J	30.9	34.9J	72.4	92.8	127	79.3	40.9	48.3	80.5J	83.1J	20.3J	16.1J	27J
Potassium	1000	50–37,000	8,500–43,000	2,640	2,110	1,430	–	2,280	2,400	1,390	2,590	2,580	–	3,240	1,330	2,370	2,490	–	2,820	1,920	–	2,840	1,540	3,380	2,020	4,110
Selenium	1	<0.1–3.9	a	–	–	–	–	–	–	–	–	–	–	–	3.1J	–	–	–	–	–	–	–	–	–	–	–
Silver	2	a	a	–	–	5.7J	10.6J	–	–	–	–	–	–	–	–	–	–	29.4J	4.1J	–	8J	–	–	–	–	–
Sodium	1000	500–500,000	a	–	1,220	–	–	–	–	–	2,130	1,700	–	–	–	–	–	4,040	–	–	1,720	21,400J	22,300J	–	–	–
Vanadium	10	<7–300	a	44.5	29.4	34.7	28.4	40.5	27	28.4	29.7	32	25.9	36.3J	20.5	27.6J	46.6J	–	36.7J	19.9J	14.7J	36.6	30.4	37.8	29.3	50.4
Zinc	4	<5–2,900	a	180J	63.8J	392J	709J	93.4J	35.7J	100J	207J	461J	334J	10,900J	95.2J	279J	460J	168J	364J	187J	195J	68J	59.6J	123J	124J	217J

NOTES:

CRQL = Contract Required Quantitation Limit
mg/kg = milligrams per kilogram
DUP = duplicate
J = estimated
– = not detected
a = no range has been developed
(2–4') = depth in feet below ground surface

TABLE 11
SUMMARY OF EP TOXICITY AND RCRA HAZARDOUS WASTE CHARACTERISTIC DATA FOR SOIL BORINGS
STAUFFER CHEMICAL – WHITTAKER SUBDIVISION SITE

COMPOUND	RL	METHOD DL	(2–4') TB–1	(6–8') TB–1	(0–2') TB–2	(2–4') TB–2	(2–4') TB–3	(5–7') TB–4	(0–2') TB–5	(8–10') TB–8 DUP	(8–10' TB–8	(2–4') TB–9	(2–4') TB–10	(8–10' TB–11	(4–6') TB–12	(4–6') TB–13	(2–4') TB–14	(5–7') TB–14	(4–6') TB–15	(6–8') TB–15	(2–4') TB–16 DUP	(2–4') TB–16	(2–4') TB–17 DUP	(0–2') TB–17	(1–3') TB–18
RCRA Hazardous Waste Characteristics																									
Ignitability	<140°F	212 F	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Corrosivity	12.5<pH<2	–	7.4	9.2	7.7	7.6	7.4	8.6	7.2	8.4	7.7	6.3	7.7	6.9	7.1	6.2	8.4	7.9	8.9	8.8	10.5	10.7	8.1	8.2	6.9
Reactive cyanide	250 mg/kg	1 mg/kg	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Reactive sulfide	500 mg/kg	1 mg/kg	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
EP Toxicity Metals																									
Arsenic	5 mg/L		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	.069	–	–	–
Barium	100 mg/L		.534	.458	.767	1.22	.708	1.26	.966	.445	.302	–	–	.244	–	–	–	–	–	–	.447	.476	1.15	1.22	.748
Cadmium	1 mg/L		.009J	–	.006J	.025J	–	–	–	–	.011J	.023 J	–	.012J	–	–	–	–	–	–	–	–	–	–	–
Chromium	5 mg/L		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	.010J	.022J	–	–	–
Lead	5 mg/L		–	–	–	.114J	–	–	–	–	.087J	–	–	.077J	–	–	–	–	–	–	–	.050J	–	–	.044J
Mercury	0.2 mg/L		–	–	–	–	–	–	–	–	–	.027	–	–	–	–	–	–	–	–	–	–	–	–	–
Selenium	1 mg/L		.036	–	–	.036	.044	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Silver	5 mg/L		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

NOTES:
RL = regulatory limits (reference 6 NYCRR Part 371)
DL = detection limits
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
DUP = duplicate
J = estimated
– = not detected
RCRA = Resource Conservation and Recovery Act
EP = Extraction Procedure
(2–4') = depth in feet below ground surface
°F = degrees Fahrenheit

TABLE 12
SUMMARY OF VOLATILE ORGANIC COMPOUND DATA FOR MONITORING WELLS
STAUFFER CHEMICAL – WHITTAKER SUBDIVISION SITE

					LOCATION						
COMPOUND	CRQL (ug/L)	NEW YORK STATE GROUNDWATER QUALITY CLASS GA (ug/L)	FEDERAL MCL (ug/L)	FEDERAL MCLG (ug/L)	MW–1	MW–2(Dup)	MW–2	MW–3	MW–4	MW–6	MW–7
TCE	10	5	5	0	–	–	10	–	–	–	–

NOTES:

There is no MW–5 = (it was dry when sampling occurred)
ug/L = micrograms per liter
Dup = duplicate sample
– = not detected
TCE = trichloroethene
CRQL = Contract Required Quantitation Limit
MCL = Maximum Contaminant Level
MCLG = Maximum Contaminant Level Goal

TABLE 13
SUMMARY OF INORGANIC COMPOUND DATA FOR MONITORING WELLS
STAUFFER CHEMICAL – WHITTAKER SUBDIVISION SITE

					LOCATION						
COMPOUND (ug/L)	CRQL (ug/L)	NEW YORK STATE CRQL QUALITY CLASS GA (ug/L)	FEDERAL MCL (ug/L)	FEDERAL MCLG (ug/L)	MW–1	MW–2(Dup)	MW–2	MW–3	MW–4	MW–6	MW–7
Aluminum	200	a	a	a	34,500 J	11,700 J	15,700 J	4,270 J	2,310 J	947 J	719 J
Antimony	60	3(G)	6	6	235 J	240 J	315 J	–	–	76.7 J	–
Arsenic	10	25	50	a	21.9 J	–	5.6 J	–	–	–	–
Barium	200	1,000	2	2	381	–	–	–	–	–	–
Calcium	5,000	a	a	a	645,000 J	250,000 J	324,000 J	144,000 J	149,000 J	232,000 J	321,000 J
Chromium	10	50	100	100	147 J	41.1 J	60.9 J	11.2 J	–	–	–
Iron	100	300	a	a	160,000 J	21,500 J	27,700 J	3,480 J	2,510 J	1,000 J	1,010 J
Lead	3	25	(TT) 15	0	373 J	386 J	531 J	12.9 J	3.7 J	–	–
Magnesium	5,000	35,000 (G)	a	a	186,000 J	63,500 J	82,400 J	36,900 J	48,300 J	48,000 J	83,400 J
Mercury	0.2	2	2	2	0.30 J	–	–	–	–	–	–
Nickel	40	a	100	100	120 J	181 J	232 J	–	–	–	–
Silver	10	50	50	a	–	–	–	–	25.2J	–	–
Sodium	5,000	20,000	a	a	106,000 J	26,800 J	36,100 J	25,900 J	38,500 J	487,000 J	623,000 J
Vanadium	50	a	a	a	67.6 J	–	–	–	–	–	–
Zinc	20	300	a	a	446 J	348 J	506 J	103 J	99.5 J	80.9 J	231 J

NOTES:

CRQL = Contract Required Quantitation Limit
ug/L = micrograms per liter
Dup = duplicate sample
– = not detected
J = estimated
TT = Treatment Technique Action Level

a = no standard has been developed
MCL = Maximum Contaminant Level
MCLG = Maximum Contaminant Level Goal
G = Guidance values taken from New York State Division of Water Technical and Operational Guidance Series (Ambient Water Quality Standards and Guidance Values, November 15, 1991).

TABLE 14
GROUNDWATER SAMPLE FIELD PARAMETERS
STAUFFER CHEMICAL - WHITTAKER SUBDIVISION

LOCATION	TEMPERATURE (DEG. C)	pH	TURBIDITY (NTUs)	SPECIFIC CONDUCTIVITY (μMHOS/cm)
MW-1	15.8	6.65	>200	3350
MW-2	16.8	6.40	110.0	2230
MW-3	16.0	7.71	>200	896
MW-4	12.8	7.60	>200	882
MW-6	14.6	7.60	100.0	366
MW-7	13.3	7.42	110.5	4300

NOTES:
deg. C = degrees Centigrade
NTUs = nephelometric turbidity unit
μMHOS/cm = micromhos per centimeter at 25 degrees Centigrade

TABLE 15
SURFACE WATER SAMPLE FIELD PARAMETERS
STAUFFER CHEMICAL - WHITTAKER SUBDIVISION

LOCATION	TEMPERATURE (DEG. C)	pH	TURBIDITY (NTUs)	SPECIFIC CONDUCTIVITY (μMHOS/cm)
SW-1	22.8	7.2	>200	1120
SW-2	*	7.39	96	5140
SW-3	25.4	7.10	74	167

NOTES:
deg. C = degrees Centigrade
NTUs = nephelometric turbidity unit
μMHOS = micromhos per centimeter at 25 degrees centigrade
* = temperature probe did not work

TABLE 16
SUMMARY OF VOLATILE ORGANIC COMPOUND DATA FOR SURFACE WATER SAMPLES
STAUFFER CHEMICAL – WHITTAKER SUBDIVISION SITE

COMPOUND	CRQL (ug/L)	NEW YORK STATE SURFACE WATER QUALITY CLASS D (ug/L)	FEDERAL AWQC (ug/L)	LOCATION			
				SW–1 (Dup)	SW–1	SW–2	SW–3
Toluene	10	a	14,300	–	13	–	–

Notes:

AWQC = Ambient Water Quality Criteria
CRQL = Contract Required Quantitation Limit
(ug/L) = micrograms per liter
Dup = duplicate sample
a = no standard has been developed
– = not detected

TABLE 17
SUMMARY OF SEMIVOLATILE ORGANIC COMPOUNDS FOR SURFACE WATER SAMPLES
STAUFFER CHEMICAL – WHITTAKER SUBDIVISION SITE

COMPOUND (ug/L)	CRQL (ug/L)	NEW YORK STATE SURFACE WATER QUALITY CLASS D (ug/L)	FEDERAL AWQC WATER AND ORGANISMS (ug/L)	LOCATION			
				SW–1 (Dup)	SW–1	SW–2	SW–3
Phenol	10	1	3,500	53	38	–	–
4–methylphenol	10	a	1	130 D	110 D	–	–
Diethylphthalate	10	a	350,000	120 D	41 J	16 J	–

NOTES:

AWQC = Ambient Water Quality Criteria
CRQL = Contract Required Quantitation Limit
ug/L = micrograms per liter
D = diluted
Dup = duplicate sample
– = not detected
a = no standard developed

TABLE 18
SUMMARY OF INORGANIC COMPOUND DATA FOR SURFACE WATER SAMPLES
STAUFFER CHEMICAL – WHITTAKER SUBDIVISION SITE

COMPOUND (ug/L)	CRQL (ug/L)	NEW YORK STATE SURFACE WATER QUALITY CLASS D (ug/L)	FEDERAL AWQC (ug/L)	LOCATION			
				SW–1 (Dup)	SW–1	SW–2	SW–3
Aluminum	200	a	a	41,400 J	15,500 J	77,300 J	4,590 J
Antimony	60	a	146	309 J	133 J	283 J	–
Arsenic	10	360	0.0022	48.3 J	18.9 J	49.2 J	–
Barium	200	a	1,000	262	–	301	–
Calcium	5000	a	a	63,200 J	47,000 J	40,700 J	30,500 J
Chromium	10	@@@	a	304 J	90.1 J	732 J	22.2 J
Iron	100	300	300	139,000 J	53,700 J	111,000 J	4,030 J
Lead	3	***	50	1,530 J	479 J	1,300 J	56.9 J
Magnesium	5000	a	a	23,500 J	14,600 J	15,500 J	6,670 J
Mercury	0.2	0.2 G	0.144	0.92 J	0.22 J	0.50 J	–
Nickel	40	****	13.4	177 J	59.6 J	145 J	–
Sodium	5000	a	a	105,000 J	94,600 J	944,000 J	153,000 J
Vanadium	50	190	a	211 J	67.2 J	336 J	–
Zinc	20	******	a	4,200 J	1,760 J	3,890 J	2,030 J
Cyanide	10	22	200	20	20	30	–

Notes:
AWQC = Ambient Water Quality Criteria
CRQL = Contract Required Quantitation Limit
(ug/L) = micrograms per liter
J = estimated
– = not detected
Dup = duplicate sample
a = standard not developed
@@@ = exp (0.819 [ln (ppm hardness)] + 3.688)
*** = exp (1.266 [ln (ppm hardness)] – 1.416)
**** = exp (0.76 [ln (ppm hardness)] + 4.02)
****** = exp (0.83 [ln (ppm hardness)] +1.95)
G = Guidance values taken from New York State Division of Water Technical and Operational Guidance Series (Ambient Water Quality Standards and Guidance Values, November 15, 1991)

TABLE 19
CALCULATED INORGANIC STANDARDS FOR NEW YORK STATE CLASS D SURFACE WATER
STAUFFER CHEMICAL-WHITTAKER SUBDIVISION

		COMPOUND μg/L			
LOCATION	Hardness	Chromium	Lead	Nickel	Zinc
SW-1	177	2,752	169	2,836	513
SW-1 DUP	255	3,752	268	3,752	699
SW-2	165	2,618	156	2,697	488
SW-3	104	1,790	87	1,900	330

NOTES:
μg/L = micrograms per liter

TABLE 20
SUMMARY OF VOLATILE ORGANIC COMPOUND DATA FOR SEDIMENT SAMPLES
STAUFFER CHEMICAL – WHITTAKER SUBDIVISION SITE

		LOCATION					
COMPOUND (ug/kg)	CRQL (ug/kg)	SD–1 (Dup)	SD–1	SD–2	SD–3	SD–4	SD–5
Acetone	10	–	–	1,700 DJ	–	–	–
2–Butanone	10	71 J	49 J	340 J	–	–	–
Toluene	10	140 J	31 J	–	–	–	–

NOTES:

CRQL = Contract Required Quantitation Limit
ug/kg = micrograms per kilogram
J = estimated
D = diluted
Dup = duplicate
– = not detected

TABLE 21
SUMMARY OF SEMIVOLATILE ORGANIC COMPOUND DATA FOR SEDIMENT SAMPLES
STAUFFER CHEMICAL – WHITTAKER SUBDIVISION SITE

		LOCATION					
COMPOUND (ug/kg)	**CRQL (ug/kg)**	**SD–1 (Dup)**	**SD–1**	**SD–2**	**SD–3**	**SD–4**	**SD–5**
4–Methylphenol	330	–	2,700 J	–	–	–	–
Phenanthrene	330	–	–	2,500 J	–	–	–
Fluoranthene	330	–	–	2,700 J	–	–	–
Chrysene	330	–	–	2,200 J	–	–	–

NOTES:

CRQL = Contract Required Quantitation Limit
Dup = duplicate sample
J = estimated
ug/kg = micrograms per kilogram
– = not detected

TABLE 22
SUMMARY OF PESTICIDE AND POLYCHLORINATED BIPHENYL COMPOUND DATA FOR SEDIMENT SAMPLES
STAUFFER CHEMICAL – WHITTAKER SUBDIVISION SITE

COMPOUND (ug/kg)	CRQL (ug/kg)	LOCATION					
		SD–1 (Dup)	SD–1	SD–2	SD–3	SD–4	SD–5
4,4'–DDE	3.3	18 J	29 J	14 J	–	9.4 J	–
Endrin	3.3	–	–	–	–	14 J	6.2 J
4,4'–DDD	3.3	8.8 J	–	–	–	–	–
4,4'–DDT	3.3	8.5 J	33 J	–	–	11 J	5 J
alpha–Chlordane	1.7	–	–	4.7 J	–	9.1 J	–

NOTES:

CRQL = Contract Required Quantitation Limit
ug/kg = micrograms per kilogram
J = estimated
Dup = duplicate
– = not detected

TABLE 23
SUMMARY OF EP TOXICITY AND RCRA HAZARDOUS WASTE CHARACTERISTIC DATA FOR SEDIMENT SAMPLES
STAUFFER CHEMICAL – WHITTAKER SUBDIVISION SITE

			LOCATION					
COMPOUND	RL	DL	SD–1	SD–1DUP	SD–2	SD–3	SD–4	SD–5
RCRA Hazardous Waste Characteristics								
Ignitability	<140°F	212°F	–	–	–	–	–	–
Corrosivity	12.5<pH<2	–	6.3	6.4	6.3	5.7	5.3	7.4
Reactive cyanide	250 mg/kg	1 mg/kg	–	–	–	–	–	–
Reactive sulfide	500 mg/kg	1 mg/kg	–	–	–	–	–	–
EP Toxicity Metals								
Arsenic	5 mg/L		–	–	–	–	.059J	–
Barium	100 mg/L		.269	.427	.468	.745	–	.438
Cadmium	1 mg/L		–	–	–	–	.005J	–
Chromium	5 mg/L		–	–	–	–	.007J	–
Lead	5 mg/L		–	–	–	.324J	–	–
Mercury	0.2 mg/L		–	–	–	–	.0002J	–
Selenium	1 mg/L		–	–	–	–	–	–
Silver	5 mg/L		–	–	–	–	.025J	.037J

NOTES:

RL = regulatory limit (reference 6 NYCRR Part 371)
DL = detection limit
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
– = not detected
DUP = duplicate
J = estimated
RCRA = Resource Conservation and Recovery Act
EP = Extraction Procedure
°F = degrees Fahrenheit