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Engineering Report

REMEDIAL INVESTIGATION REPORT FOR THE COLUMBUS McKINNON SITE

VOLUME 1: TEXT

Columbus McKinnon Corporation
Tonawanda Facility
Tonawanda, New York

June 1991
Project No. 1332-01-1

MALCOLM PIRNIE

ENVIRONMENTAL ENGINEERS, SCIENTISTS & PLANNERS

COLUMBUS McKINNON CORPORATION
TONAWANDA, NEW YORK

REMEDIAL INVESTIGATION/FEASIBILITY STUDY

JUNE 1991

MALCOLM PIRNIE, INC.
S-3515 Abbott Road
P. O. Box 1938
Buffalo, New York 14219

1332-01-1

MALCOLM PIRNIE

COLUMBUS McKINNON CORP.

REMEDIAL INVESTIGATION/FEASIBILITY STUDY

TABLE OF CONTENTS

MALCOLM PIRNIE

TABLE OF CONTENTS (Continued)

MALCOLM PIRNIE

TABLE OF CONTENTS (Continued)

MALCOLM PIRNIE

TABLE OF CONTENTS (Continued)

LIST OF FIGURES

MALCOLM PIRNIE

TABLE OF CONTENTS (Continued)

LIST OF TABLES

MALCOLM PIRNIE

TABLE OF CONTENTS (Continued)

LIST OF TABLES (Continued)

TABLE OF CONTENTS (Continued)

LIST OF PLATES

MALCOLM PIRNIE

TABLE OF CONTENTS (Continued)

LIST OF APPENDICES

1.0 EXECUTIVE SUMMARY

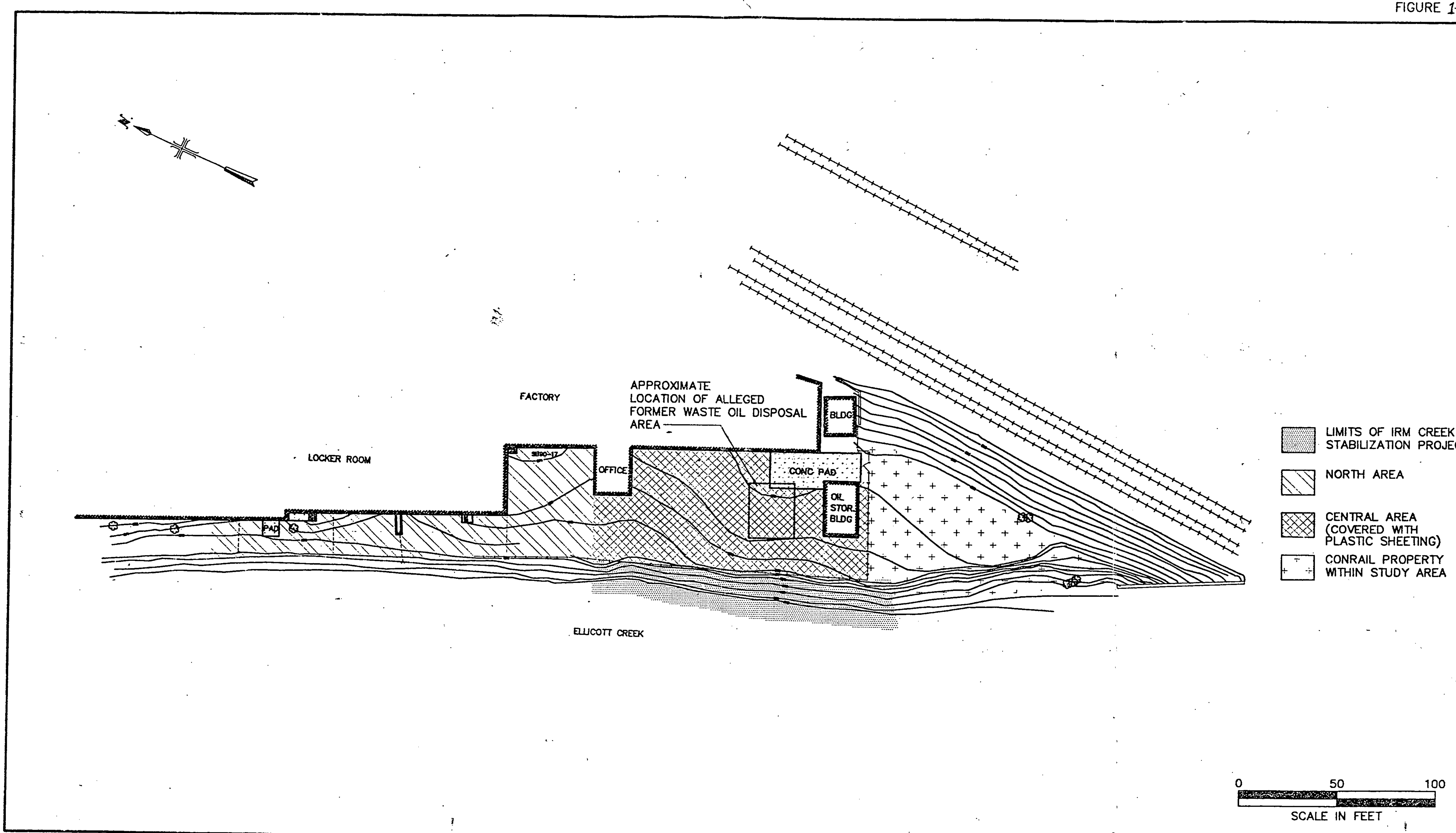
1.1 GENERAL

A site located along Ellicott Creek which encompasses an alleged former waste oil disposal area at the Columbus McKinnon Corporation (CM), Tonawanda, New York facility, has been listed by the New York State Department of Environmental Conservation (NYSDEC) on the New York State Registry of Inactive Hazardous Waste Disposal Sites (Site Number 915016). The NYSDEC has classified the site as "2", having found that the site presents a significant threat to the public health or the environment. Subsequently, CM Corporation entered into an Order-on-Consent dated October 2, 1989 (Index No. B9-0240-88-10) with NYSDEC to develop and implement a Work Plan for the completion of a Remedial Investigation/ Feasibility Study for the alleged former waste oil disposal area.

Malcolm Pirnie conducted the field investigation activities required by the Remedial Investigation Work Plan, prepared in accordance with the Order-On-Consent, during the months of April to August 1990. The project study area is shown on Figure 1-1. The purpose of this document is to present the findings of the Remedial Investigation (RI). Elements of the Remedial Investigation addressed herein include:

- physiography and climate data associated with the study area;
- geology and hydrogeology of the study area;
- hydrologic relationship of the ground water and Ellicott Creek at the study area;
- site contaminant characterization;
- assessment of off-site contaminant migration; and
- public health and environmental concerns.

An Interim Remedial Measure (IRM) has been completed at the site on the basis of a site contamination assessment that was derived from historic sampling data. This IRM included installation of plastic sheeting over an area exhibiting the most highly elevated contamination,



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PROJECT STUDY AREA

COLUMBUS McKINNON CORPORATION

DEC.1990

and installation of erosion control measures on the creek bank adjacent to the same area. The location of these remedial measures is shown on Figure 1-1.

1.2 PHYSIOGRAPHY AND CLIMATE

Surface run-off associated with the study area is received by Ellicott Creek, which discharges to Tonawanda Creek approximately 3000 to 3400 feet downstream of the CM facility. Historical climatic data indicates that the average annual precipitation is 36 inches and is fairly evenly divided throughout the year.

1.3 PHYSICAL GEOLOGY AND HYDROGEOLOGY

1.3.1 Investigative Methodology

The field investigations involved the following tasks:

- detailed survey of the study area;
- sampling and analysis of soils from 38 test borings on the Columbus McKinnon property and 10 test borings on the adjacent Conrail property;
- installation of seven ground water monitoring wells;
- development and in-situ hydraulic conductivity testing of each of the seven new ground water monitoring wells;
- measurement of ground water and creek water levels;
- collection of creek bed sediment samples; and
- collection of ground water samples.

1.3.2 Site Geology

The study area is characterized by four principal geologic units as follows: fill, lacustrine deposits, till, and bedrock. Only the three uppermost units were investigated during the course of the RI. The fill consists of gravel, sand, silt, and clay as well as various waste materials, including black slag, bricks, glass, plastic, concrete rubble, metal filings, and other metallic material such as pieces of chain. Fill thickness varies from 1-9 feet across the site. Lacustrine silt and sand underlies the fill layer in the study area. The thickness ranges from 18 to 20 feet near Ellicott Creek to approximately 29 feet thick near the buildings. Based on previous borings completed to bedrock, underlying the glaciolacustrine deposits is a sequence of tills approximately 25-30 feet in thickness. The five (5) uppermost feet of this sequence was encountered during the course of this investigation and consists of a brown to reddish-brown clayey silt with small rounded gravel. The underlying bedrock was not investigated during the Spring 1990 drilling activities.

1.3.3 Site Hydrogeology

The major hydrostratigraphic units present in the overburden at the Columbus McKinnon Facility are an unconfined, shallow water-bearing zone consisting of the lowermost fill material and the lacustrine silt and sand; and a confining unit (aquitard) characterized by a dense, poorly permeable sequence of glacial tills and interbedded sediment. Ground water flows upward through the confining unit and discharges to the shallow aquifer.

Shallow ground water flows directly to Ellicott Creek. The water table rises and falls in response to seasonal changes in infiltration rates. As a result, ground water flow and discharge to Ellicott Creek varies substantially between high water periods and low water periods. The estimated yearly average ground water outflow from the study area to Ellicott Creek is 404 ft^3/day.

1.4 HYDROLOGY

1.4.1 Water Shed Characteristics

The average discharge of Ellicott Creek for the 11-year period 1972-1984 was 130 ft^3/sec. Stream flow has a pronounced seasonal variation with 87% of total average annual flow occurring during the six-month period of December through May.

1.4.2 Flood Plain

The Columbus McKinnon facility lies approximately 3000 to 3400 feet above the confluence with Tonawanda Creek. A portion of the study area near the creek bank, with surface elevations below 571.5, may be subject to flooding. Elevations of the remainder of the site exceed 571.5 and should not be subject to flooding. Hydrologic studies indicate that flood stage elevations for downgradient Niagara River are controlled primarily by wind effects on Lake Erie. The resulting backwater effects extend upstream along Ellicott Creek and may raise creek levels in the vicinity of the Columbus McKinnon site.

1.4.3 Relationship between Creek and Ground Water Elevations

Water level monitoring results show that the wells within the study area are directly connected to the creek and flood crest elevations will directly influence ground water levels on-site.

1.5 SITE CONTAMINANT CHARACTERIZATION

The characterization of the nature and extent of contamination within the Columbus McKinnon site study area was accomplished by the collection and analysis of soil, ground water, and creek sediment samples. In accordance with the RI Work Plan, historic analytical data has been used to characterize the nature of soil/ground water contamination and to identify the general area of contamination within the study area. Additional sampling was conducted during the present RI to, in conjunction with the historic data, more precisely define the horizontal and vertical extent of soil/fill contamination and to verify the presence/absence of ground water contamination. In accordance with the Work Plan, all samples were analyzed for PCBs and metals of concern (cadmium, chromium, nickel, and lead) as identified by NYSDEC. Also in accordance with the Work Plan, selected samples were analyzed for halogenated volatile organic compounds.

1.5.1 Soil

For the purpose of the soil results discussion, the site has been segregated as shown on Figure 1-1 into the following areas:

- North Area - north of the office;
- Central Area - the area now covered by plastic sheeting and which includes the alleged former waste oil disposal area;
- South Area - Conrail property, between the railroad embankment and Ellicott Creek.

1.5.1.1 North Area

Halogenated Volatile Organics - No HVOCs were detected in any of these samples.

PCBs - PCB contamination in the North Area occurs principally in surficial soil/fill (i.e., 0-2 feet). The concentration of PCBs (i.e., Arochlor 1254) in surficial soil/fill in this area ranged from 0.36-125 ppm, with an average of 20 ppm.

Metals - The concentrations of cadmium and lead in the fill material are elevated above naturally occurring background concentrations. Metal concentrations in the native soils underlying the fill were not elevated above naturally occurring levels.

1.5.1.2 Central Area

Halogenated Volatile Organics - No volatile organic compounds were detected in the surficial soil samples collected in this area. However, trace concentrations of HVOCs (most notably dichlorobenzenes) were detected at depth at five (5) sample locations.

PCBs - PCB contamination in the Central Area occurs both in surficial soil/fill and at depth. The concentration of PCB in the surficial soil/fill was greater than 50 ppm at 29 of 46 sampling locations within the Central Area. The average concentration was 249 ppm. The PCB contamination at depth occurs predominantly within the area of the alleged former waste oil disposal area (see Figure 1-1). With the exception of three sample locations from an area of thin fill, only trace PCBs were detected in the native soil underlying the fill in the Central Area.

Metals - High concentration of metals in the Central Area also occurred within the surficial soil/fill. The concentrations of metals (Cd, Cr, Ni, Pb) diminish with increasing depth through the fill and into the underlying native soil.

1.5.1.3 South Area (Conrail Property)

Halogenated Volatile Organics - Essentially no HVOC contamination was detected.

PCBs - Similar to the North Area, the PCB contamination in the South Area occurs principally within the surficial soil/fill. The concentration of PCBs in the surficial soil/fill range from 0.63-427 ppm and average 51 ppm. Only one (1) of 21 samples collected at depth in the South Area exhibited a PCB concentration greater than 10 ppm.

Metals - The concentrations of the four metals of interest within the fill are elevated above naturally occurring background concentrations. Concentrations of the four metals in the native soil underlying the fill were not elevated above naturally-occurring background concentrations.

1.5.2 Ground Water

Shallow ground water in the well nearest to the alleged former waste oil disposal area exhibits a concentration of nickel substantially above background, and trace levels of volatile organics. Ground water collected from wells physically removed from the alleged former waste oil disposal area (vertically and horizontally) exhibit contaminant concentrations that were substantially lower or were below analytical detection limits.

1.5.3 Creek Sediments

During the present RI, Arochlor 1254 was detected at 41 ppm just offshore of the alleged former waste oil disposal area. PCB was detected at concentrations less than 10 ppm at all other sediment sampling stations. Concentrations of metals and PCB (Arochlor 1254) offshore from the alleged former waste oil disposal area were elevated with respect to upstream sampling locations and downstream locations. The magnitude of PCB concentrations determined from previous sampling was higher than the present RI sampling results. However, the spatial distribution of PCB in Ellicott Creek sediment observed during previous investigations was very similar to that determined during the present RI.

1.6 CONTAMINANT MIGRATION

The following potential pathways for off-site migration of contaminants have been identified:

- overland runoff and mechanical transport of contaminated soil/fill material into Ellicott Creek;
- mechanical erosion of the stream bank along the periphery of the study area resulting in the release of contaminated fill material to Ellicott Creek;
- release of solubilized waste constituents to ground water within the shallow overburden; and
- migration of nonaqueous phase liquid along the water table and/or confining unit interfaces.

A comparison of yearly contaminant loading to Ellicott Creek via ground water and soil erosion under existing conditions (e.g. includes all remedial measures implemented to date) indicates that soil erosion is the predominant contaminant migration pathway. Other potential pathways are of little importance. Based on the available data the yearly contaminant load to Ellicott Creek via soil erosion from the study area is approximately 13.4 Kg/yr for the four metals of interest, and approximately 0.19 Kg/yr for PCBs. Based upon the May 1991 ground water sampling results, estimated contaminant loadings to Ellicott Creek from the study area via the ground water pathway are approximately 0.3 Kg/yr for the four metals of interest, and approximately 0.06 Kg/yr for the organics of interest.

Total yearly loading via soil erosion from all subareas under existing and prior unremediated conditions is summarized as follows:

TOTAL YEARLY LOADING (Kg/yr) VIA SOIL EROSION TO ELLICOTT CREEK

	PCBs	CADMIUM	CHROMIUM	NICKEL	LEAD
Existing Conditions	0.19	0.11	1.7	2.0	9.6
Prior Un-Remediated Conditions	2.2	0.34	4.2	10.0	21.4

As indicated, the remedial measures completed at the study area to date have resulted in more than a 90% reduction in PCB loading and an approximate 55% to 80% decrease in the metal loading.

1.7 PUBLIC HEALTH AND ENVIRONMENTAL CONCERNS

In the health risk assessment, exposures to site contaminants were evaluated. Several exposure scenarios were considered:

- maintenance personnel may contact contaminated soils, resulting in absorption of contaminants through the skin;
- maintenance personnel may inadvertently ingest contaminated soils during yard work;
- residents and recreational users of Ellicott Creek may periodically consume fish caught in the Creek; and
- recreational users of Ellicott Creek may periodically use the creek for swimming.

Additionally, continued viability of freshwater aquatic life in Ellicott Creek in light of site contamination, was assessed.

Contaminants which were evaluated consisted of PCBs, cadmium, chromium, lead and nickel. These compounds were selected due to their inherent toxicity and their frequency of detection in on-site soils.

The results of the human health risk assessment are summarized below. Although the approach taken to perform this risk assessment is very conservative and probably overstates the actual risks associated with the site, it is the approach recommended by USEPA to allow for uncertainties in the risk assessment process. In addition, the risk assessment has been performed on the basis of the former unremediated conditions at the site. Actual cancer risk estimates summarized below are much lower when the degree of risk reduction achieved by the interim remedial measures now in place are considered.

<u>SOILS</u>

<u>Ingestion</u>

Non-Cancer Effects: The only contaminant which may pose concern from a non-cancer standpoint, for this exposure pathway, is lead. The other four contaminants (cadmium, chromium, nickel, and PCBs) are of minimal concern for this pathway.

Cancer Effects: The incremental cancer risk associated with ingestion of PCBs in soil is about 4 in one hundred thousand.

<u>Dermal Contact</u>

Non-Cancer Effects: As with the ingestion pathway, the only contaminant of concern due to skin contact is lead. The hazard index for lead via this exposure pathway indicates the need for greater concern than for the ingestion pathway.

Cancer Effects: The incremental cancer risk associated with dermal contact with PCBs in soil is about 5 in ten thousand, or over a factor of 10 greater than the risk posed by the ingestion pathway.

<u>SURFACE WATER</u>

<u>Ingestion</u>

Non-Cancer Effects: None of the contaminants in surface water pose a health hazard, from a non-cancer standpoint, via ingestion.

Cancer Effects: The incremental cancer risk associated with ingestion exposure during swimming was calculated to be about 2 in one billion.

Dermal Contact

Non-Cancer Effects: None of the contaminants in surface water pose a health hazard, from a non-cancer standpoint, via skin contact.

Cancer Effects: The incremental cancer risk associated with skin contact was calculated to be about 7 in one hundred trillion.

FISH

Ingestion

The PCB concentration in fish fillets based on prior unremediated conditions was calculated to be 0.4 to 1.9 mg/kg. However, for conditions which reflect the degree of risk reduction achieved with the implementation of remedial measures to-date, the calculated PCB concentration in fish fillets is 0.05 to 0.16 mg/kg. These concentrations are lower than the FDA tolerance limit for PCBs in fish as food, which is 2 mg/kg.

The results of the environmental assessment quotients suggest a potential for chronic toxicity for aquatic organisms exposed to sediments contaminated with PCB-1254 in the creek immediately adjacent to the site. However, the extent of the contaminated sediments having measurable concentrations of PCB-1254 is limited to a small area of the creek.

2.0 INTRODUCTION

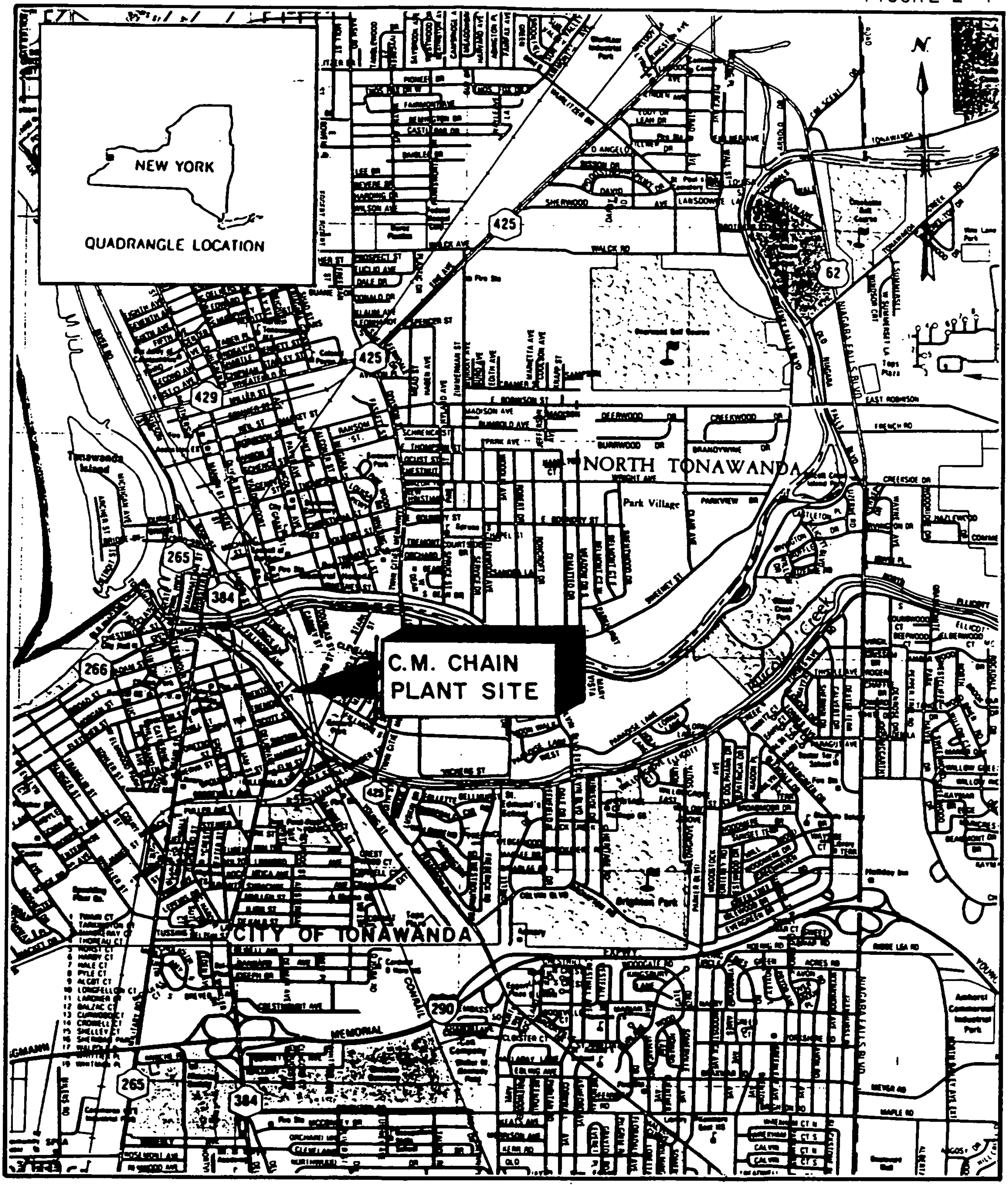
2.1 PROJECT OBJECTIVE

A site located along Ellicott Creek (Figure 2-1), which encompasses an alleged former waste oil disposal area at the Columbus McKinnon Corporation (CM), Tonawanda, New York facility, has been listed by the New York State Department of Environmental Conservation (NYSDEC) on the New York State Registry of Inactive Hazardous Waste Disposal Sites (Site Number 915016). The NYSDEC has classified the site as "2", having found that portions of the site present a significant threat to the public health or the environment. Subsequently, CM Corporation entered into an Order-on-Consent dated October 2, 1989 (Index No. B9-0240-88-10) with NYSDEC to: a) develop and implement a Work Plan for the completion of a Remedial Investigation/Feasibility Study for the alleged former waste oil disposal area; and b) design and implement an Interim Remedial measure (IRM) to mitigate erosion of Ellicott Creek bank soils. It was agreed that the Remedial Investigation would utilize data from investigative work previously performed on the site.

Columbus McKinnon Corporation contracted with Malcolm Pirnie, Inc. to implement and conduct the required Remedial Investigation/Feasibility Study. Malcolm Pirnie conducted the field investigation activities required by the Remedial Investigation scope of work during the months of April to August 1990. The project study area is shown on Figure 2-2.The purpose of this document is to present the findings of the Remedial Investigation (RI). Upon approval and acceptance of this report by the NYSDEC, these findings will provide the basis for subsequent performance of the Feasibility Study.

The objectives of the RI at the Columbus McKinnon site were as follows:

- to summarize existing site investigation data;
- to define the horizontal and vertical extent of contaminants in the site soils;



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REMEDIAL INVESTIGATION FEASIBILITY STUDY

LOCATION OF C.M. CHAIN PLANT SITE

COLUMBUS McKINNON CORP.

JANUARY 1991

- to identify the principal route(s) of contaminant migration from the site; and
- to verify the results of previous investigations that indicated contaminants maybe migrating offsite.

During this remedial investigation, subsurface data was acquired to determine whether ground water contamination is currently present beneath the site and has a potential to migrate offsite. The horizontal and vertical extent of contaminants on-site was more fully defined; and the resampling of creek sediments previously indicating contamination was conducted.

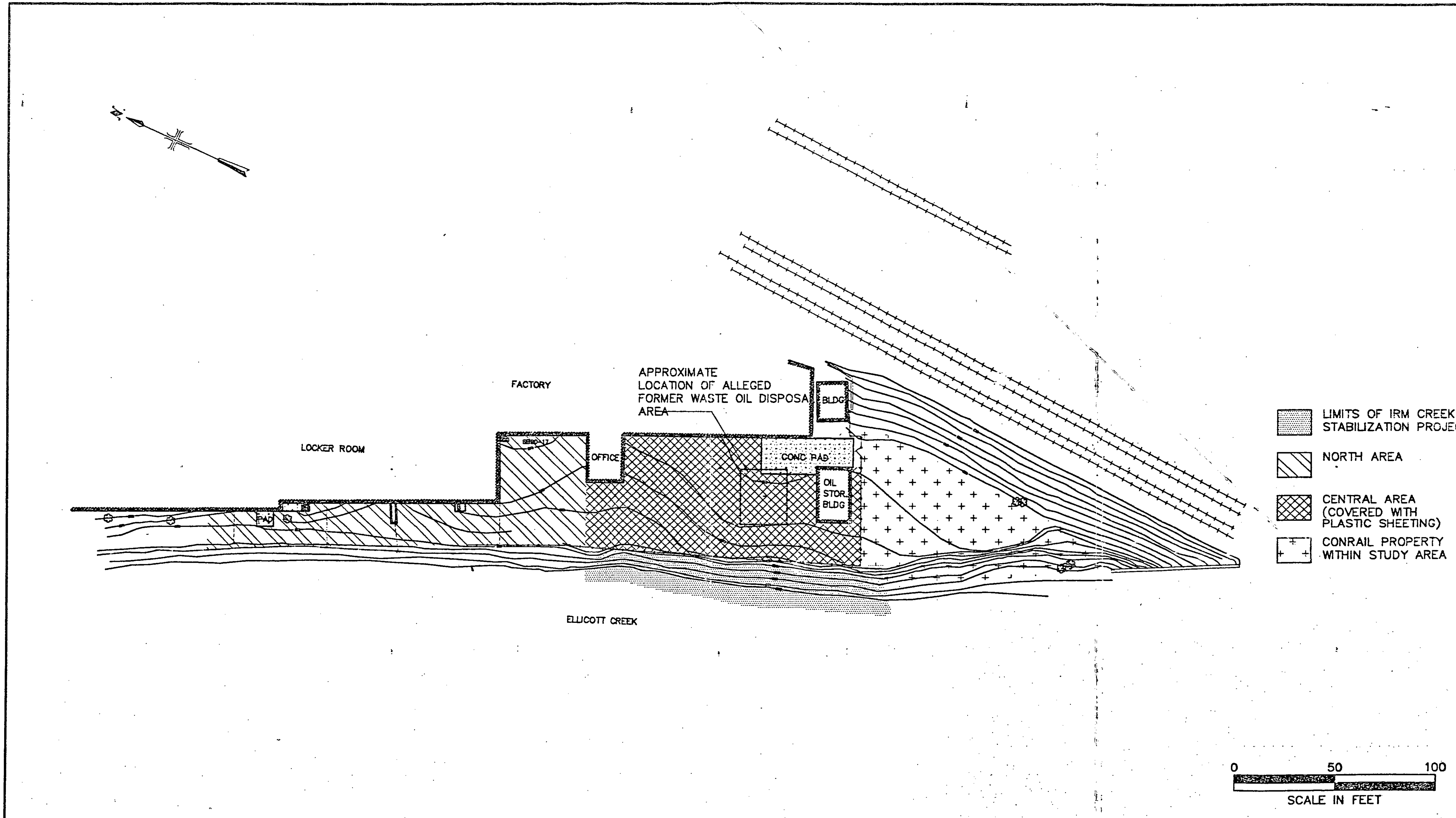
2.2 BACKGROUND

2.2.1 Study Area Location and Description

The Study Area is located along Ellicott Creek at the CM Corporation's industrial facility at One Fremont Street in the City of Tonawanda, New York (Figure 2-1 and 2-2). The Study Area, as defined in the NYSDEC-approved RI Work Plan, encompasses the area of known or suspected contamination determined by previous investigations. These investigations have documented the occurrence of contaminants within an area approximately 320 feet by 60 feet which includes a portion of the CM property located between the CM facility and Ellicott Creek and a triangular-shaped parcel owned by the Consolidated Railway Corporation (Conrail) located south of and adjacent to the CM property. The study area boundaries are defined by the foundations of CM buildings, the Conrail railroad embankment, and the near-shore areas of Ellicott Creek as shown on Figure 2-2. The entire site is fenced and the site can be accessed only through the building or the storage yard located immediately north of the main building.

2.2.2 Site History

Columbus McKinnon Corporation's facility was operated until 1984 for the manufacture of a variety of chain products. Since 1984, the facility has been used by CM to house a small forging and heat treating operation,



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PROJECT STUDY AREA

COLUMBUS McKINNON CORPORATION DEC.1990

and for the storage of CM products for sale and rental to other manufacturers.

From 1930 through 1965, a small area of the plant property was allegedly used for the disposal of spent water soluble cutting oils (see Figure 2-2). Reportedly, the alleged waste oil disposal area was a shallow depression on the order of one (1) foot deep. A total of 27,000 gallons of these oils were reportedly disposed of in the alleged waste oil disposal area through 1965, although company representatives believe this figure is substantially inflated. There has been no allegation that waste oil has been disposed of on-site since 1965. As a precautionary measure, the area of elevated PCB concentrations was covered with a durable plastic film in February 1983 to prevent soil migration to the stream.

The NYSDEC inspected the site on June 15, 1979 and issued a Hazardous Waste Disposal Site Report in April 1980. At that time the NYSDEC and the NYS Department of Health classified the inactive waste site as "F" - no further action required (AES/CRA, 1985). Subsequently, investigations voluntarily conducted by Columbus McKinnon confirmed the presence of hazardous waste on the site and, in March 1987, the NYSDEC reclassified the site as a "2". The history of investigations at the site is presented in Section 2.2.3.

Columbus McKinnon has completed IRM construction during the period of October - November 1990. The selected IRM design consisted of grading of the creek bank to uniform slopes and installation of filter fabric and riprap erosion protection. The filter fabric prevents erosion by overland flow, and channel and wave erosion caused by stream flow in Ellicott Creek. The IRM is described in the IRM Work Plan (Malcolm Pirnie, February 1990) and IRM Construction Bid Package (Malcolm Pirnie, May 1990).

2.2.3 Previous Investigations

During the period of 1979-1986, Columbus McKinnon Corporation initiated a voluntary investigation to define the existence and/or extent of contamination of soil. Samples were analyzed for priority pollutants, THO, TVO, heavy metals, pesticides and PCBs. Chemical analysis revealed the presence of PCB (Arochlor 1254) in surficial soils over the site and in the near shore stream sediment. Sampling and analysis of subsurface soil near the alleged former waste oil disposal area detected PCB contamination to a depth of seven (7) feet in the vicinity of the former pit. Surficial soil PCB contamination was also found on the Conrail property which adjoins the CM site. It was concluded by Advanced Environmental Systems (AES) that the site was not having an impact on Ellicott Creek because PCB concentrations in water samples upstream were much greater (2 orders of magnitude) than downstream (AES, 1982). In addition, based on analytical results for ground water samples collected from two monitoring wells installed on-site in 1983 AES concluded that the PCB is not mobile (AES, 1983). However, stream sediment sampling indicated that sediments offshore from the alleged former waste oil disposal area were contaminated with PCBs. A series of sampling events were conducted to define the extent of stream sediment contamination. The soil and sediment sampling history is presented in Table 2-1.

2.3 STUDY APPROACH

To implement the scope of work identified in the Order on Consent, Malcolm Pirnie prepared a Work Plan/Quality Assurance Plan (Malcolm Pirnie, 1989). In response to comments received from the NYSDEC relative to the initial Work Plan/Quality Assurance Plan, an addendum (Malcolm Pirnie, January 1990) was prepared to describe additional work tasks to be performed as part of the Remedial Investigation. Together these documents present a Remedial Investigation Plan which identifies all the field investigative activities and methodologies, including sample collection and analysis procedures, that was employed to perform the investigation. The quality assurance/quality control procedures used to insure data validity are also identified in those documents.

During the field investigation, a number of modifications to the scope of work and/or investigative procedures were recommended on the basis of conditions encountered in the field. All Work Plan modifications were implemented only after the mutual agreement and formal approval by Columbus McKinnon and NYSDEC. Documentation of all such modifications is presented in Appendix A.

TABLE 2-1

COLUMBUS McKINNON CORP.

SOIL/SEDIMENT SAMPLING HISTORY

DATE	CONSULTANT	SOIL/SEDIMENT SAMPLING	COMMENTS
7/20/79 to 9/25/79	VSSR/ED/ACTS VSSR/ED/ACTS	17 samples	• Subsurface and surface samples from 6 borings • Samples monitored for PCBs and leachable heavy metals
2/12/80	VSSR/ED/ACTS	11 samples	
9/8/81	VSSR/ED/ACTS	13 soil samples	• to depth of 5' at locaitons 10, 11, 12
11/81 - 12/81	AES/CRA	borings #1-9 4 sediment samples	• taken at surface and various depths to a maximum depth of 7'6" • from 2 locations - not mapped
5/82	AES	4 soil samples	• #10 surface, #11 0-3', #12 0-2', #13 0-2'
8/82	AES	19 soil samples	• #14-24 (except 22) at 0' and 3' • (except 0' and 2' at #20 and #24) • duplicates at #16 and @21 at surface
9/82	AES	8 soil samples	• #22, #25-31 surface only
10/82	AES	8 sediment samples	• 4 locations, 5' and 15' from shore
11/82	AES	12 soil samples 7 sediment samples	• #32-43 surface only • 4 locations, 5 and 15' from shore • far upstream locations 7, 7, 8 - PCBs < detection limit
11/82	AES	10 soil samples	• #44-53, surface only
1/83	AES	10 soil samples	• #54-63, surface only
7/83	AES	5 sediment samples	• 5 locations at 15' and 25' from shore
11/83		sediment samples	• 2 locations for total fixed residue and total volatile residue
5/85	AES	10 sediment samples	• 2 locations at different depths, max. 6'
1/86	AES	9 sediment samples	• 3 locations: 5, 15, and 25' from shore

NOTES:

VSSR = Van Wert, Snyder, Sklarsky, Rowley - Architects/Consultants
ED = Earth Dimensions, Inc.
ACTS = ACTS Testing Labs
AES = Advanced Environmental Systems, Inc.
CRA = Conestoga Rovers & Assoc.

Collectively, the Work Plan and Work Plan Addendum define the specific methodology that were employed to generate the data that is presented in this document. This methodology will only be referenced and/or summarized in the text of this document as appropriate for interpretation of results and findings. The reader is referred to the RI Plan documents for a detailed presentation of the specific investigative procedures and methods employed.

2.4 REPORT ORGANIZATION

The RI Report begins with an Executive Summary and this introductory section. The remaining sections of the report are described below:

SECTION 3.0 - Physiography and Climate - summarizes land use, topography, drainage, and climate of the Study Area vicinity;

SECTION 4.0 - Physical Geology and Hydrogeology - summarizes the investigative methodology, regional geology and hydrogeology, Study Area geology, and Study Area hydrogeology.

SECTION 5.0 - Hydrology - discusses hydrologic conditions along Ellicott Creek, and the hydraulic connection between ground water and surface water at the Study Area.

SECTION 6.0 - Environmental Sampling and Analysis - describes the sampling program and discusses the analytical results.

SECTION 7.0 - Contaminant Migration - describes contaminant migration pathways and evaluates contaminant loading to Ellicott Creek.

SECTION 8.0 - Public Health and Environmental Concerns - evaluates potential human health and environmental impacts associated with exposure to Study Area contaminants.

3.0 PHYSIOGRAPHY AND CLIMATE

3.1 LAND USE

Land use near the Columbus McKinnon (CM) Facility is illustrated by the zoning map for the City of Tonawanda included as Figure 3-1. As indicated, the facility is situated in an area zoned for manufacturing purposes. General residential, commercial, and other manufacturing areas exist adjacent to this location. The facility is situated between Ellicott Creek, which is immediately adjacent to the facility along its southwest border, and the right-of-way and elevated railroad tracks for the Consolidated Railway Corporation (Conrail), which border the facility along its eastern side.

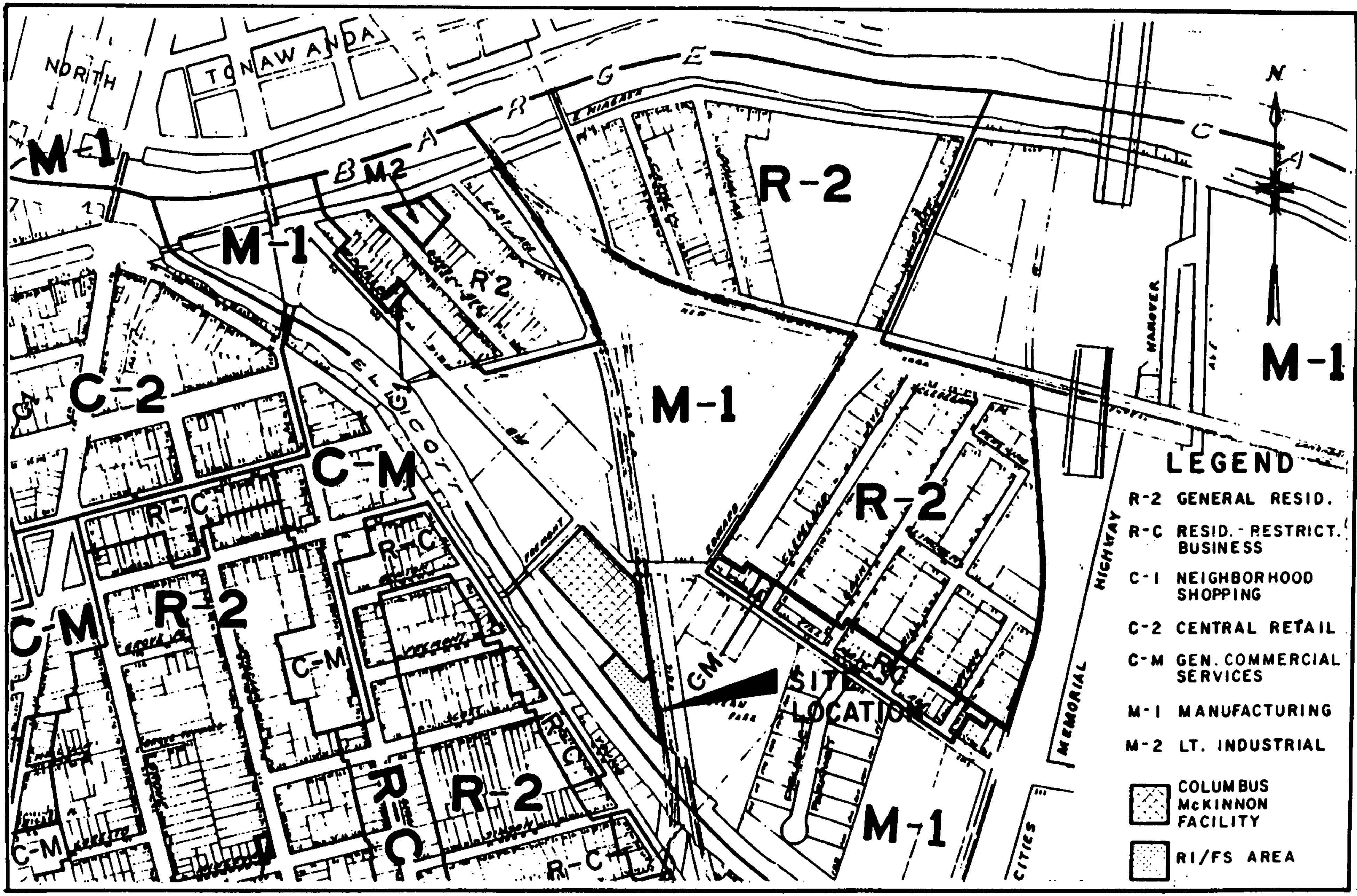
3.2 DRAINAGE AND TOPOGRAPHY

The land area of the City of Tonawanda, which is drained by Ellicott Creek for a distance of 1.5 miles, is generally flat lying with a gentle slope toward the Niagara River. Ellicott Creek flows through a meandering channel that extends from Williamsville, NY in a north-northwest direction to Tonawanda, NY, where it discharges to Tonawanda Creek approximately 3000 to 3400 feet downstream of the CM facility.

Surface run-off associated with the study area is received by Ellicott Creek. Study area topography exhibits approximately five (5) feet of relief between the structures that border the site and the edge of the embankment along Ellicott Creek. The embankment is approximately five (5) to seven (7) feet high depending on the creek stage level (see Plate 1).

3.3 CLIMATIC DATA

Meteorological data for the period 1960 through 1989 from the weather observation station at the Buffalo International Airport is summarized on Table 3-1. The data included on Table 3-1 are the mean values for the 1960-1989 time period. Also included are the maximum and



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REMEDIAL INVESTIGATION/ FEASIBILITY STUDY

ZONING MAP OF THE CITY OF TONAWANDA, NEW YORK

COLUMBUS McKINNON CORP. DECEMBER 1990

FIGURE 3-1

TABLE 3-1

SUMMARY OF CLIMATIC DATA

MEAN MONTHLY AND ANNUAL PRECIPITATION AND TEMPERATURE DATA
FOR
JANUARY 1960 THROUGH DECEMBER 1989*
BUFFALO AIRPORT WEATHER STATION

MONTH	PRECIPITATION (inches)	TEMPERATURE (°F)
January	3.07	24.8
February	2.68	24.6
March	2.77	32.5
April	2.69	43.6
May	2.93	55.0
June	2.92	64.8
July	2.91	70.5
August	3.22	68.9
September	3.08	62.5
October	3.07	51.5
November	3.33	40.0
December	3.26	29.5
Mean Annual	35.94	47.3
Maximum Annual (1977)	53.55	
Minimum Annual (1962)	28.55	

* Source: Data obtained from the National Oceanic and Atmospheric Administration, National Climatic Data Center, Asheville, NC.

minimum annual precipitation data for the same time period. The average annual precipitation of 36 inches is moderate and fairly evenly divided throughout the year.

4.0 PHYSICAL GEOLOGY AND HYDROGEOLOGY

4.1 HISTORICAL DATA

This section presents a summary of geologic and hydrogeologic data collected during previous investigations at the study area. In accordance with the October 2, 1989 Order on Consent for the Columbus McKinnon Site, the historic data presented herein was utilized in the preparation of the RI Report where such data was judged to be applicable.

Previous subsurface borings completed within the study area include the following:

a) Six (6) borings completed in July and September 1979 by Earth Dimensions for VSSR Engineers. Six (6) additional borings were completed between September 1979 and September 1981. This series of borings are designated B1 to B12. Drilling logs providing a good description of the fill material are presented in Appendix B1. Boring depths ranged from 1 foot to 11 feet below ground surface (bgs). Three (3) borings were completed by hollow-stem augers, the remainder by hand auger. Boring locations for holes B1 to B12 are shown on Plate 1.

b) Nine (9) borings designated BH1 to BH9 were completed to depths of 7 to 8 feet using hollow stem augers for Conestoga Rovers Associates in December 1981. Boring logs are presented in Appendix B-1. These data were used to map fill thickness (Plate 3).

c) Fifty-four (54) sampling locations, designated BH10 to BH63, were completed as shallow hand auger holes up to 3 feet deep or hand trowel holes 2 to 6 inches deep. These locations are collectively referred to as surficial soil sampling locations. No descriptive sample logs were prepared.

d) Two monitoring wells, OW1-83 and OW2-83, were installed by Earth Dimensions, Inc. on August 8 and 9, 1983 using 6-inch O.D. hollow stem augers. Continuous split-spoon sampling was performed to a depth of about 20.0 feet at each location. After these boreholes were sampled and logged, they were grouted to the ground surface. The holes for the monitoring wells were then drilled a few feet away. (CRA, 1983). The well screens (2 feet in length) were placed over the "wetted interval" observed from split spoon sampling and extends below the screened interval by approximately 0.5 feet and above the interval by about 6-8 feet. A 1-foot bentonite seal was placed above the sandpack and the remaining annular well space was filled with cement grout to the surface. Construction details are provided in Appendix B5. The wells were screened with 2-foot Johnson stainless steel well screens with2-inch I.D. and No. 10 slot size. The riser is made up of 2-inch diameter black steel pipe, with coupling connections, lockable caps, and locks. OW2-83 was completed with a short section of 2-inch diameter galvanized steel pipe. (Cra, 1983). Each monitoring well was abandoned during the RI field program, and due to the availability of nearby borings the subsurface data was not used for the RI report.

e) Five (5) test borings designated CM-1-89 to CM-5-89 were completed to depths of 53 to 63 feet bgs in October 1989 to provide geotechnical data for a proposed sheet piling wall between Ellicott Creek and the study area. Boring logs are presented in Appendix B-1. Each boring was sampled continuously from the surface to bedrock and provided information on geologic conditions beneath the site. Data from these borings were used to prepare Plate 2 and the discussion of site geology (Section 4.3).

Sources of information for historical subsurface data include CM file material for data generated by VSSR; and CRA/AES (1983) for sampling locations BH1 to BH63, OW-1-83 and OW-2-83. Boring logs for CM-1-89 to

CM-5-89 have not been previously reported, because the final approach to IRM creek bank stabilization did not require deep test boring data.

4.2 INVESTIGATIVE METHODOLOGY

The geologic and hydrogeologic field investigations for this Remedial Investigation (RI) were conducted at the Columbus McKinnon Tonawanda facility portion of the study area during the period of April 1990 through June 1990. The portion of the study area owned by Conrail was investigated during August 1990 after formal documentation granting permission for access to this property was received from Conrail. The field investigations involved the following tasks:

- detailed survey of the study area including the creation of a grid system for the purpose of locating soil borings, monitoring wells and creek sediment sampling locations;
- advancement, sampling, and abandonment of thirty-eight (38) test borings on the Columbus McKinnon property and ten (10) test borings on the adjacent Conrail property;
- abandonment of two (2) previously existing monitoring wells;
- installation of seven (7) ground water monitoring wells;
- development of each of the seven (7) new ground water monitoring wells;
- in-situ hydraulic conductivity testing (slug testing) of each of the newly installed wells;
- collection of weekly ground water and creek water levels during the period of May 1990 through July 1990;
- collection of continuous ground water and creek water levels for a period of 24-hours;
- collection of creek bed sediments;
- collection of ground water samples from each of the two shallow and two intermediate depth downgradient monitoring wells and single upgradient background well.

The scope of each of these investigative tasks is discussed in the sections that follow. Sampling methodology related to the collection of soil, creek sediment, and ground water sampling is addressed in Section 6.

4.2.1 Site Survey

A site survey was conducted to provide the data necessary for preparation of a topographic site base map and locational control of all site investigative activities. The map is drawn at a scale of 1-inch to 20 feet and a contour interval of 1-foot. A 20-foot square grid system was established over an area of approximately 440 feet in length by 80 feet in width for use in selection of soil borings and creek sampling locations. The long axis of the grid system follows a northwest to southeast orientation approximately parallel to Ellicott Creek. Vertical control was set by using the National Geodetic Vertical Datum of 1929 and the horizontal control was based upon an arbitrary coordinate system. Documentation of grid control points is included as Appendix B2.

The locations and elevations of monitoring wells and surface water staff gauges established during the RI were also surveyed as a part of RI activities.

4.2.2 Test Borings

A total of thirty-eight (38) soil borings were completed on the Columbus McKinnon property to collect soil samples required to provide additional information relative to the vertical and horizontal distribution of site related contaminants. Ten (10) additional borings were completed on the adjacent Conrail property. The locations of all boreholes are shown on Plate 1. A detailed discussion of sampling procedures and the rationale for collecting analytical samples is presented in Section 6.0 Environmental Sampling.

Each of the borings was advanced to at least the top of the zone of saturation by continuous split spoon sampling. Samples were described with respect to sample recovery and soil/sediment color, grain size, moisture, and any evidence of contamination based upon visual observation and/or total organic vapor readings recorded using an Hnu equipped with a 10.2 eV probe. The boring logs provide detailed descriptions of the fill material and, at some locations, the upper portion of the native soil. Detailed soil boring logs are provided in Appendix B.3.

Upon completion of sampling and borehole logging each borehole was abandoned using the procedure specified outlined in the Work Plan.

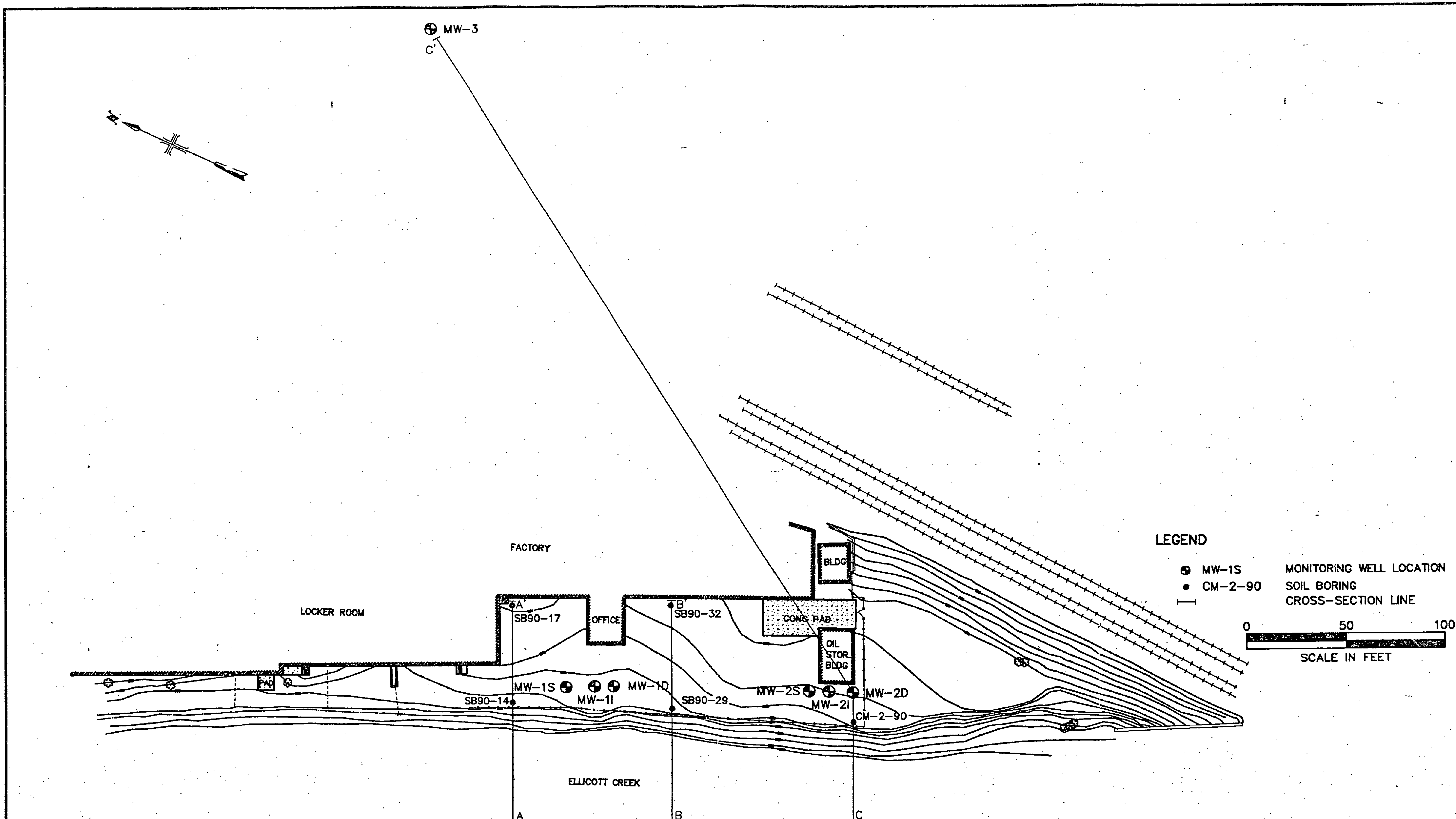
4.2.3 Existing Well Abandonment

In accordance with Addendum I of the approved Work Plan, each of the two previously existing monitoring wells (OW1-83 and OW2-83) were abandoned. Abandonment of OW1-83 was accomplished by using the cinch and hydraulics of the drill rig to directly pull the steel casing from the borehole and then backfilling the borehole to the ground surface with cement. Efforts to pull the steel casing of OW2-83 failed and abandonment was attempted by augering around the casing. Upon destroying the cement collar at the ground surface, the well casing and screen sank below ground level. Efforts to retrieve the well casing failed and the remaining borehole was grouted to ground surface.

4.2.4 Monitoring Well Installation

Following the completion of the soil borings, seven (7) ground water monitoring wells were installed. In accordance with the Addendum I of the approved Work Plan, these wells included a single upgradient well (MW-3) and well nests at each of two downgradient locations (MW-1 and MW-2) . Space limitations and the risk associated with drilling on the edge of the creek bank necessitated the placement of the nested wells approximately ten (10) feet north of the originally proposed locations. Well locations are shown on Figure 4-1. Each well nest consists of a shallow well screened across the water table; an intermediate well screened immediately at the base of the shallow water bearing zone; and a deep well screened in the till (aquitard) below the shallow water bearing zone. A single background well was installed upgradient of the site in the company parking lot. This well was screened across the water table.

The upgradient, shallow and intermediate wells were constructed of 2-inch diameter stainless steel with 0.006 inch slot screens. Screen lengths varied from 5 to 15 feet. Each well was installed with a #1 sand pack, 3-feet of bentonite pellets, and cement bentonite backfill to the



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MONITORING WELL LOCATIONS AND CROSS SECTION LINES

COLUMBUS McKINNON CORPORATION NOV. 1990

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TABLE 4-1

MONITORING WELL AND STAFF GAUGE SUMMARY

Location No.	Ground Elevation (ft amsl)	Top of Riser Elevation (ft amsl)	Sand Pack Interval (ft bgs)	Screened Interval (ft bgs)	Screened Materials/ Location
Monitoring Wells					
MW-1S	571.71	573.49	4.0-15.5	5.2-15.2	Fill and Lacustrine Deposits
MW-1I	572.15	574.07	19.7-27.0	21.7-26.7	Lacustrine Deposits
MW-1D	572.23	574.80	Not Used	29.7-31.7	Glacial Till
MW-2S	574.35	576.13	3.7-16.0	4.7-14.7	Fill and Lacustrine Deposits
MW-2I	574.57	576.45	20.7-28.0	22.7-27.7	Lacustrine Deposits
MW-2D	574.57	575.69	Not Used	33.0-35.0	Glacial Till
MW-3	576.72	578.56	3.7-30.0	5.7-20.7	Lacustrine Deposits
Staff Gauge					
SG-1	NA	567.05	NA	NA	Downstream
SG-2	NA	567.23	NA	NA	Upstream

NOTES: AMSL = Above Mean Sea Level
BGS = Below Ground Surface
NA = Not Applicable

surface. Deep wells in the two downgradient nests were installed solely for the purpose of water level monitoring and hydraulic conductivity testing. Each deep well was installed into a 3-inch hole advanced with a Shelby Tube. The well intake consists of a 2 foot length of 0.010 inch slot PVC screen wrapped in a geotextile sock, which is attached to the screen by polyethylene clips. A 2-inch I.D. PVC riser extends from the screen to the surface. A 4-inch PVC disk and 4-inch rubber stopper are positioned at the top of the screen to close off the 3-inch hole. The remaining borehole is backfilled with bentonite pellets (3-feet) and cement bentonite grout. In accordance with the Work Plan, sand was not installed around the screen in order to eliminate the potential for air-locking within the sand pack. A summary of all monitoring well specifications and elevations are provided on Table 4-1. Monitoring well boring logs and construction specifications are included in Appendices B4 and B5, respectively.

4.2.5 Well Development

Well development was initiated approximately one week following completion of the last well installation (viz., MW-3) and prior to ground water sampling. Well development was accomplished either by using a bailer or by slow pumping with a centrifugal pump. Development of each of the two deepest screened wells was performed using a bailer; however slow recharge in each of these wells, which are screened within till, did not allow for complete development. The complete development of these wells was not critical, since sampling was not planned and the screened interval was drilled in such a way as to minimize damage to the borehole wall (see Section 4.2.4)

Development of the two (2) intermediate depth wells, completed in glaciolacustrine deposits, and the background well was accomplished using a centrifugal pump and dedicated 3/4" 100 PSI PVC flexible pipe. Each of the wells was slowly pumped until approximately 10-15 well volumes were removed from the well and the purge water remained clear. Development of the shallow wells was accomplished using a centrifugal pump and by bailing. Several well volumes were evacuated from the wells using the pump; however, slow recharge to the wells did not allow for sustainable yields from the well. Because silty ground water was observed upon completion of pumping of the shallow wells, a bailer was used to more completely develop the well. A summary of well development data is presented on Table 4-2. The development for each log is presented in Appendix B6.

4.2.6 Hydraulic Conductivity Testing

In-situ hydraulic conductivity testing was performed on each of the seven (7) newly installed wells. Rising head tests were conducted on the shallow, intermediate, and background wells. Testing was accomplished by using a stainless steel slug, pressure transducer, and data logger. The method of Bouwer and Rice (1976) which is based upon the assumption of a partially saturated sandpack and unconfined conditions was used to analyze the slug test data collected from the shallow wells. In the wells where the screened interval was fully saturated (i.e. the intermediate wells), the data was analyzed by the method of Cooper et al (1967).

Equilibrium conditions had not been reached in the deep wells at the time of the May 29, 1990 test. Therefore, slug testing was not applicable to these wells and hydraulic conductivity was determined from long term (35 day) well recovery rates. For this purpose, water levels were periodically determined by the direct measurement of water levels. Because the deep till wells were screened in the poorly permeable till unit and exhibited slow recovery, the method of Hvorslev (1951) was used for data analysis.

The hydraulic conductivity testing data is presented in Appendix C1 and the test results are discussed in Section 4.4, Site Hydrogeology.

4.2.7 Surface Water and Ground Water Elevation Monitoring

A water level monitoring program was implemented to compare short term and long term variations of surface water elevation to ground water elevation and to assess the hydraulic relationship between Ellicott Creek and the ground water. The water level data was also used to establish hydraulic gradients and ground water flow direction.

Longer term fluctuations in ground water and surface water were evaluated by collecting weekly water levels from each of the seven (7) new

TABLE 4-2

WELL DEVELOPMENT DATA

Well No.	Date of Development	Static Water Level[1] (ft above sea level)	pH	Temp. °c	Specific Conductivity (umhos)	Field Observations	Volume Removed (gals.)	Development Method
MW-1S	5/09/90	566.65	8.0	11	700	Silty; some sheen; no obvious odor	6	Pumping & Bailing
MW-1I	5/08/90	567.69	7.1	12	1270	Clear; no odor	60	Pumping
MW-1D	5/15/90	567.52	11.7	13	1042	Clear; no odor	5	Bailing
MW-2S	5/08/90 5/09/90	567.03	7.0	11	1310	Silty; no odor	14	Pumping & Bailing
MW-2I	5/08/90	567.45	7.0	12	1300	Clear; no odor	55	Pumping
MW-2D	5/15/90	554.22	12.4	14	5150	Clear; no odor	3	Bailing
MW-3	5/08/90 5/09/90	571.54	7.2	9	1060	Clear; no odor	35	Pumping

NOTE:

(1) Static water level measured just prior to the start of well development.

wells and two (2) staff gauges installed below the north bank of Ellicott Creek adjacent to the CM facility. The weekly water level measurements summarized in Table 4-3 were made during the period of May 1990 - July 1990. Water level measurements taken prior to and following the period of weekly monitoring are also shown on Table 4-3. Creek staff gauges were removed during remedial construction activities along the creek bank in the fall of 1990.

In order to evaluate short term variations in surface water and ground water levels, continuous water level measurements were collected for a period of 24 hours in each monitoring well and at the two (2) staff gauges. These data are presented in Table 4-4. All ground water levels were measured with a water level meter within a 15 to 20 minute period each hour. Staff gauge readings could not be continued through the night hours due to poor visibility.

4.3 REGIONAL GEOLOGY AND HYDROGEOLOGY

4.3.1 Regional Geology

The surficial geology of Western New York is characterized by deposits resulting from three depositional environments. These deposits include recent alluvial sediment, lacustrine sediments, and ground moraine of glacial origin (Mueller, 1977). The bedrock geology includes a thick succession of stratified Paleozoic sedimentary rocks which form the northern flank of the Allegheny Basin (Buehler and Tesmer, 1963).

Recent Alluvium

These sediments include sand, silt, and gravel, which has been transported and subsequently deposited by modern rivers, creeks, and streams. These alluvial deposits are typically thin, of limited lateral extent, and lacustrine sediments or ground moraine.

Lacustrine Sediments

Sediment deposited in lakes impounded by retreating ice masses and/or glacial landforms is the primary surficial material occurring in the Tonawanda, NY area. As mapped by Mueller (1977), and D'Agostino

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TABLE 4-3

GROUND WATER AND SURFACE WATER ELEVATIONS
APRIL 1990 THROUGH NOVEMBER 1990
(All elevations in feet above mean sea level)

DATE	4/26/90	4/27/90	4/30/90	5/1/90	5/2/90	5/8/90	5/18/90	5/25/90	5/29/90
WELL NO.									
MW-1S	NA	566.31	566.51	566.72	566.57	566.65	566.99	566.56	566.38
MW-1I	NA	567.79	567.57	567.82	567.61	567.69	568.56	567.86	567.39
MW-1D	NA	564.29	566.35	566.52	566.82	567.7	547.41	556.29	559.34
MW-2S	567.18	567.08	566.94	567.02	566.92	567.03	567.72	567.14	566.8
MW-2I	567.49	567.5	567.22	567.52	567.29	567.45	568.4	567.68	567.2
MW-2D	549.85	550.36	551.85	552.11	552.56	554.45	541.68	545.41	547.41
MW-3	NA	NA	571.8	571.71	571.6	571.54	572.51	572.01	571.63
SG-1	NA	NA	NA	NA	NA	NA	NA	565.47	565.1
SG-2	NA	NA	NA	NA	NA	NA	NA	565.48	565.15

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TABLE 4-3 (Continued)

GROUND WATER AND SURFACE WATER ELEVATIONS
APRIL 1990 THROUGH NOVEMBER 1990
(All elevations in feet above mean sea level)

DATE	6/1/90	6/8/90	6/15/90	6/22/90	6/29/90	7/6/90	7/13/90	8/16/90	11/9/90	5/1/91
WELL NO.										
MW-1S	566.5	566.46	566.43	566.27	566.12	565.73	565.49	565.89	565.84	566.74
MW-1I	567.42	567.38	567.12	566.83	566.64	566.09	565.82	566.03	566.13	567.87
MW-1D	560.92	563.62	565.12	565.94	566.35	566.43	566.41	566.04	566.35	568.77
MW-2S	566.85	566.76	566.53	566.34	566.15	565.7	565.48	565.94	566.18	565.43
MW-2I	567.22	567.11	566.92	566.63	566.44	565.91	565.64	565.9	565.94	567.83
MW-2D	548.59	551.26	553.49	555.39	557.04	558.37	559.28	562.89	565.54	567.64
MW-3	571.37	570.91	570.19	569.46	568.78	567.62	567.23	566.82	568.19	572.16
SG-1	565.28	565.41	565.6	565.55	565.55	565.15	564.97	565.51	NA	NA
SG-2	565.3	565.4	565.61	565.57	565.57	565.23	565.28	565.56	NA	NA

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TABLE 4-4

GROUND WATER AND SURFACE WATER ELEVATIONS
FOR A 24-HOUR PERIOD BEGINNING JUNE 12, 1990
(All elevations in feet above mean sea level)

WELL NO.	HOURS									
	0	1	2	3	4	5	6	7	8	9
MW-1S	566.34	566.41	566.46	566.48	566.49	566.46	566.44	566.42	566.41	566.40
MW-1I	567.17	567.22	567.29	567.30	567.27	567.24	567.22	567.18	567.17	567.17
MW-1D	564.54	564.57	564.59	564.59	564.60	564.62	564.61	564.63	564.63	564.64
MW-2S	566.56	566.63	566.64	566.66	566.67	566.66	566.65	566.64	566.63	566.62
MW-2I	566.94	567.00	567.05	567.07	567.05	567.02	567.00	566.97	566.96	566.95
MW-2D	552.51	552.56	552.57	552.58	552.60	552.62	552.62	552.63	552.64	552.67
MW-3	570.50	570.51	570.51	570.51	570.51	570.49	570.48	570.56	570.45	570.45
SG-1	565.34	565.49	565.59	565.61	565.47	565.53	565.49	565.45	565.41	565.41
SG-2	565.38	565.48	565.58	565.61	565.56	565.52	565.48	565.44	565.40	565.40

WELL NO.	HOURS									
	10	11	12	13	14	15	16	17	18	19
MW-1S	566.40	566.38	566.38	566.34	566.31	566.25	566.21	566.19	566.19	566.20
MW-1I	567.15	567.13	567.12	567.07	567.02	566.97	566.94	566.94	566.96	566.99
MW-1D	564.64	564.66	564.65	564.65	564.66	564.67	564.69	564.70	564.70	564.70
MW-2S	566.62	566.60	566.61	566.58	566.56	566.53	566.49	566.47	566.45	566.47
MW-2I	566.95	566.91	566.90	566.89	566.81	566.75	566.70	566.70	566.71	566.72
MW-2D	552.67	552.68	552.69	552.69	552.69	552.73	552.74	552.74	552.76	552.74
MW-3	570.45	570.45	570.45	570.45	570.45	570.44	570.44	570.44	570.43	570.43
SG-1	565.41	565.36	565.38	565.22	565.18	NA	NA	NA	NA	NA
SG-2	565.40	565.36	565.31	565.23	565.20	NA	NA	NA	NA	NA

TABLE 4-4 (Continued)

GROUND WATER AND SURFACE WATER ELEVATIONS
FOR A 24-HOUR PERIOD BEGINNING JUNE 12, 1990
(All elevations in feet above mean sea level)

WELL NO.	HOURS						
	20	21	22	23	24	25	26
MW-1S	566.24	566.27	566.29	566.29	566.32	566.37	
MW-1I	567.02	567.06	567.07	567.07	567.11	567.19	
MW-1D	564.70	564.72	564.71	564.72	564.73	564.75	
MW-2S	566.48	566.49	566.50	566.51	566.52	566.55	566.58
MW-2I	566.79	566.80	566.82	566.85	566.88	566.94	566.99
MW-2D	552.79	552.79	552.80	552.82	552.83	552.85	
MW-3	570.42	570.42	570.42	570.42	570.45	570.41	
SG-1	NA	NA	NA	565.22	565.28	565.43	565.49
SG-2	NA	NA	NA	565.23	565.29	565.40	565.46

(1958), the southern shoreline of former Lake Tonawanda is situated immediately south of the CM facility. Lacustrine sediments are typically comprised of fine sand, silt, and clay with sand predominating along the shoreline.

Ground Moraine Deposits

Ground moraines characterized by deposits of silty clay till and sandy till are present throughout much of the area. Till consists of comminuted rock material, transported by and lodged beneath actively flowing ice masses. In the study area the ground moraine tends to be thin and directly overlies bedrock.

Bedrock

As mapped in Buehler and Tesmer (1963) the bedrock underlying the City of Tonawanda is the Upper Silurian Camillus Shale. The Camillus Shale consists of shale, limestone, dolostone, and interbedded gypsum. The strata dip to the southeast at a slope of approximately 40 feet per mile and bedrock exposure is controlled by erosion. The Camillus is highly susceptible to erosion due to the soft shale and the occupance of the water soluble gypsum throughout the formation.

4.3.2 Regional Hydrogeology

Ground water supplies in the Tonawanda region are derived from either the overburden deposits or from the underlying bedrock aquifers. The overburden deposits are typically low yielding formations and the water quality from the bedrock aquifers is generally poor. As a result of these conditions and the presence of abundant surface water supplies, ground water is not extensively utilized as a source of drinking water in the region. However, a large quantity of ground water is pumped from the Camillus Shale for industrial use (LaSala, 1968).

Overburden deposits are recharged mainly through infiltration of precipitation, however these deposits often contain fine grained materials and are therefore poorly permeable. The direction of ground water flow varies locally due to the influence of topography, land use, and drainage. On a regional scale, the ground moraine deposits or clayey lacustrine deposits act as aquitards, thus retarding the downward migration of ground water.

The Camillus Shale is a major source of ground water for industries in the Tonawanda area. According to LaSala (1968), the solution of gypsum by circulating ground water produces large water bearing openings in the shale, which impart a high permeability to the formation.

4.4 SITE GEOLOGY

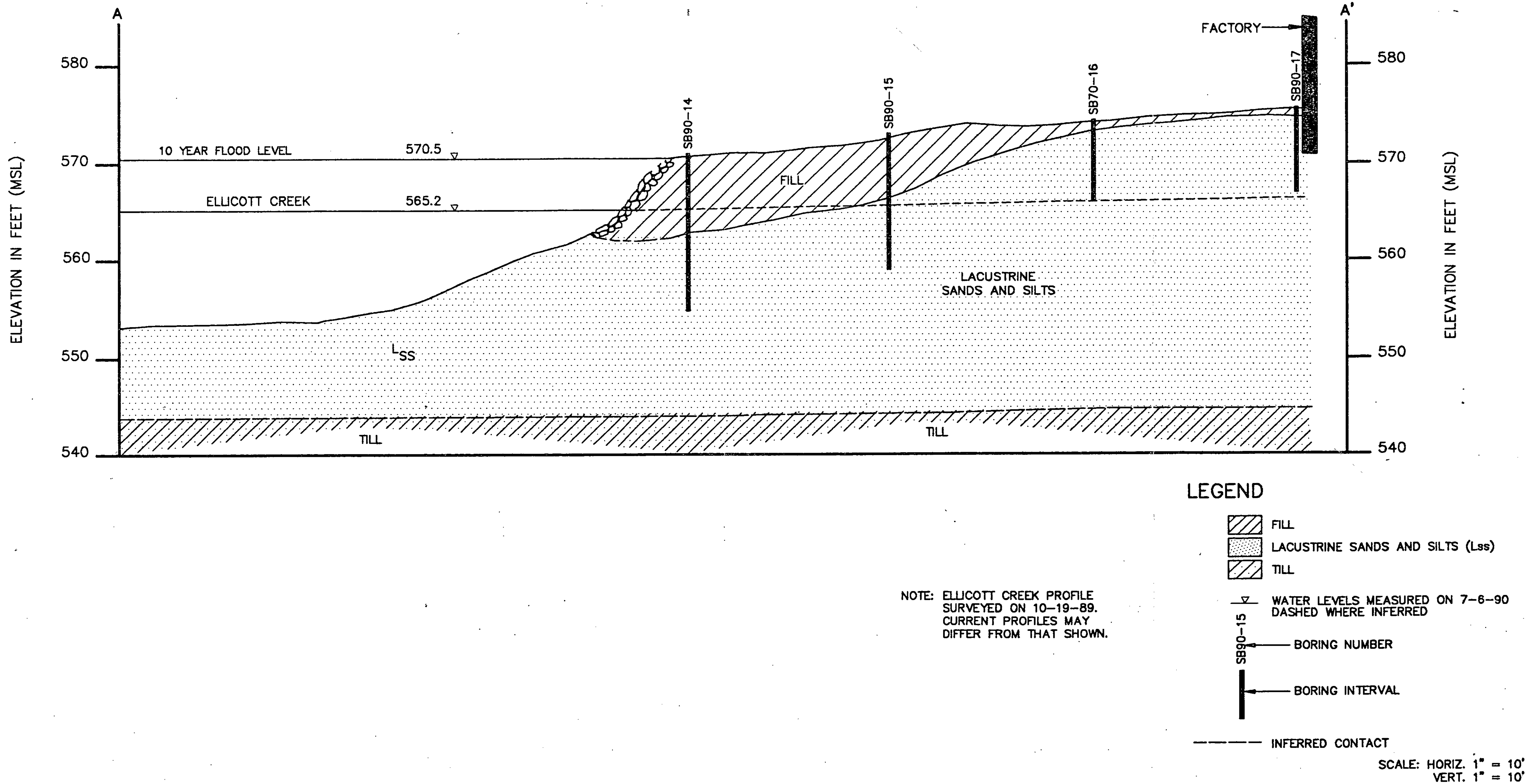
Soil boring data from previous drilling programs implemented within the study area and the data collected during the present RI provide the data base for interpretation of site geology. These include nine (9) shallow depth borings completed in 1981 and designated as BH1 to BH9, five (5) deep borings completed to bedrock in 1989 and designated as CM-1-89 to CM-5-89; three (3) intermediate depth borings completed during the RI and designated as MW-1D-90, MW-2D-90, and MW-3-90; and 48 shallow soil borings completed during the RI and designated as SB90-1 to SB90-48.

The study area is characterized by four principal units as follows: fill, lacustrine deposits, till, and bedrock. Consistent with the Work Plan, only the three uppermost units were addressed during the course of the RI. The study area stratigraphy is schematically illustrated by profiles along the cross-section locations shown on Figure 4-1. These profiles are presented in Figures 4-2 through 4-4. Plate 2 presents profiles through test borings CM-1-89 to CM-5-89. Detailed drilling logs are provided in Appendices B1, B3, and B4.

Table 4-5 summarizes the stratigraphic data base obtained from the shallow soil borings within the study area. Table 4-6 presents stratigraphic data from deep borings within the study area including survey data, depth and elevation of each stratigraphic unit encountered. Individual units are described in the following sections.

4.4.1 <u>Fill Layer</u>

The uppermost stratigraphic unit consists of fill material brought on site. The fill consists of gravel, sand, silt, and clay as well as various waste materials, including black slag, bricks, glass, plastic,



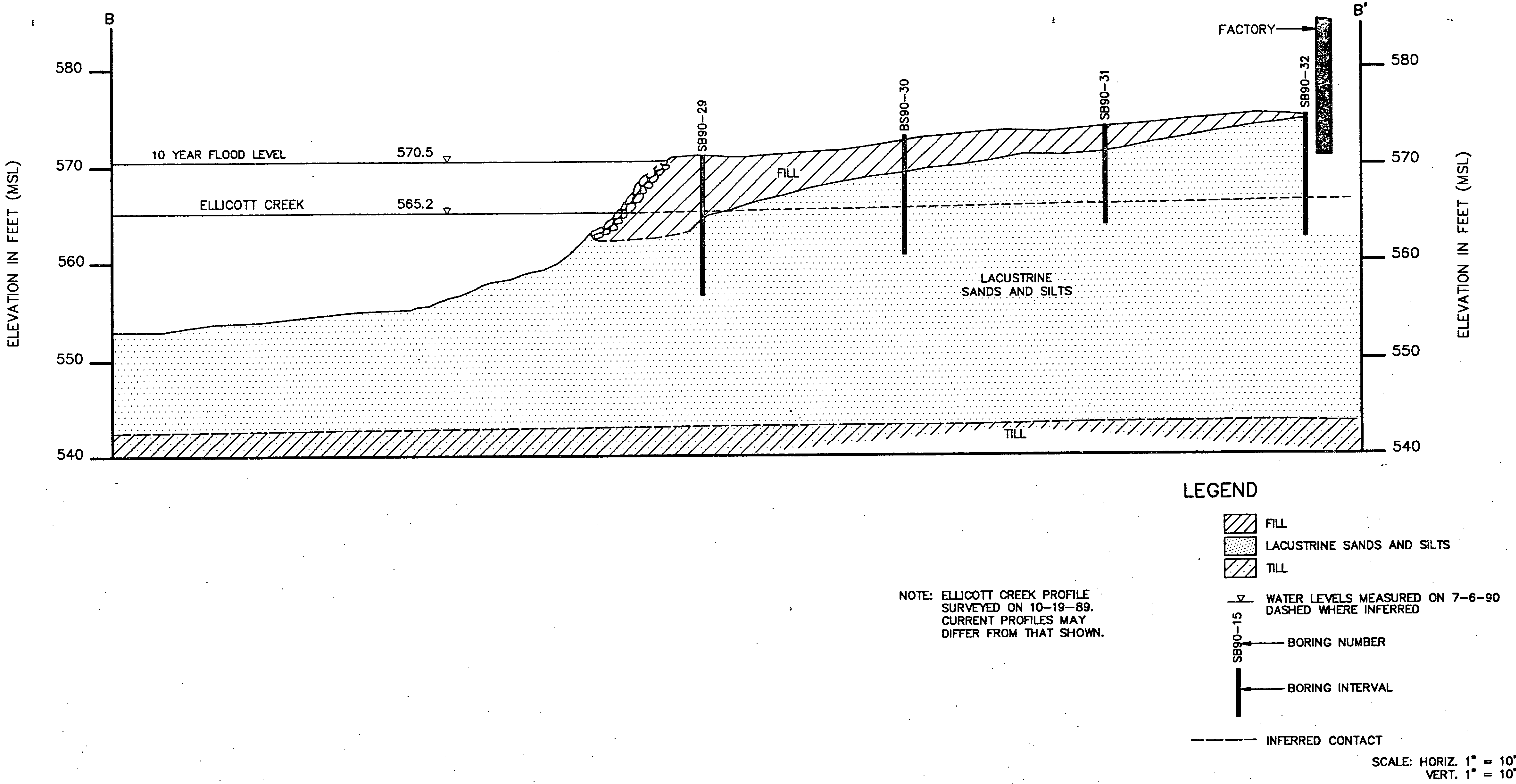
TONAWANDA FACILITY

CROSS SECTION A - A'

COLUMBUS McKINNON CORPORATION AUGUST 1990

MALCOLM PIRNIE

COL-01-CAA



NOTE: ELLICOTT CREEK PROFILE SURVEYED ON 10-19-89. CURRENT PROFILES MAY DIFFER FROM THAT SHOWN.

TONAWANDA FACILITY

CROSS SECTION B - B'

COLUMBUS McKINNON CORPORATION AUGUST 1990

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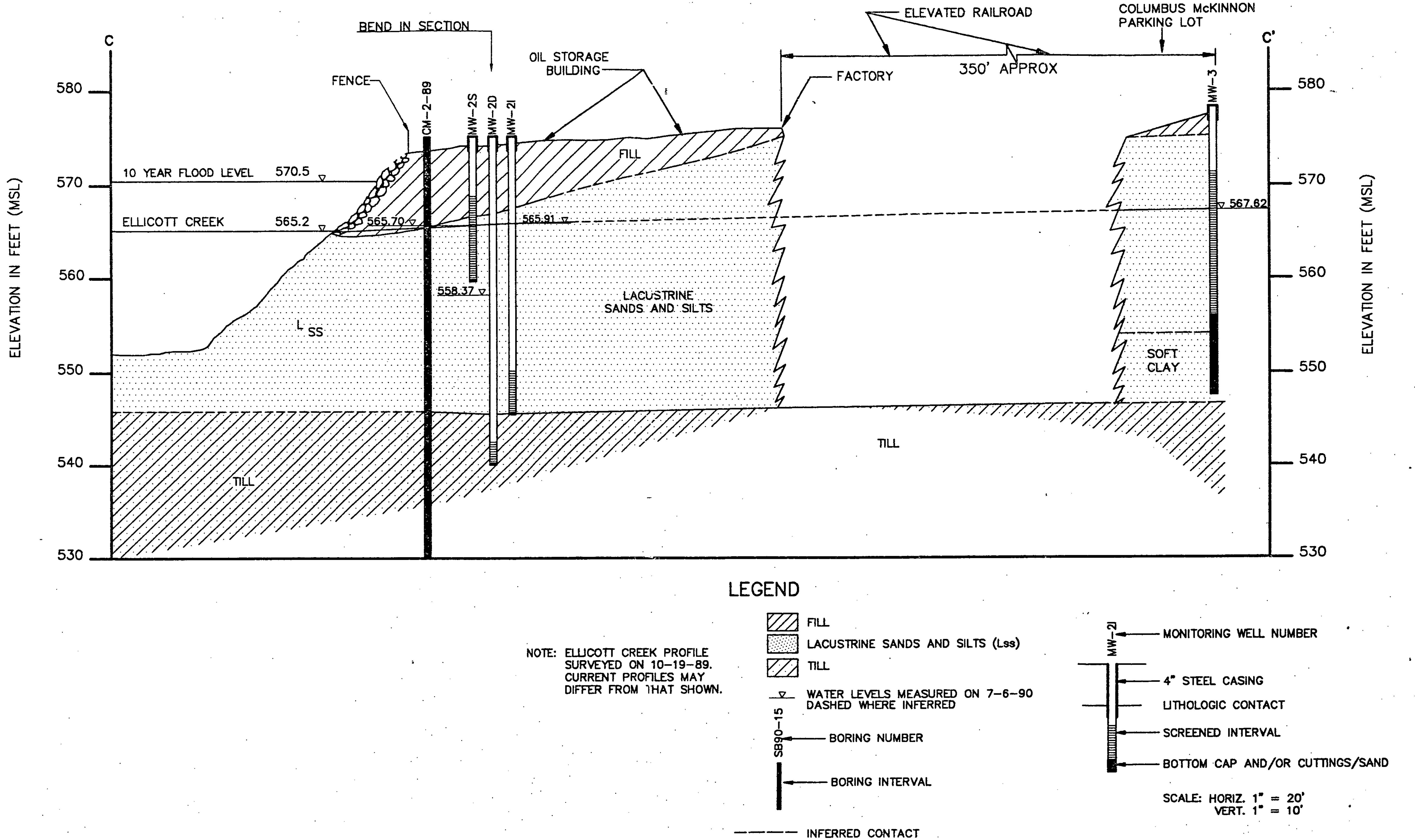
COL-01-CBB



NOTE: ELLICOTT CREEK PROFILE SURVEYED ON 10-19-89. CURRENT PROFILES MAY DIFFER FROM THAT SHOWN.

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TONAWANDA FACILITY

CROSS SECTION C – C'

COLUMBUS McKINNON CORPORATION AUGUST 1990

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TABLE 4-5

COLUMBUS McKINNON CORP.
STRATIGRAPHIC SUMMARY TABLE FOR
SHALLOW BORINGS

Boring No.	Interpolated Elevation (G.L. amsl)	Depth To Glaciolacustrine Deposit/Fill Thickness	Elevation Glaciolacustrine Deposit
SB-90-1	569.2	2.5	567.7
SB-90-2	569.0	>2.1 <4.0	566.9
SB-90-3	569.3	>2.5 <4.0	566.8
SB-90-4	569.3	4.3	565.0
SB-90-5	572.3	2.4	569.9
SB-90-6	569.5	4.5	565.0
SB-90-7	571.1	>1.0 <2.0	570.1
SB-90-8	567.0	<5.0 (Boring terminated in fill unit)	
SB-90-9	569.8	2.3	567.5
SB-90-10	570.2	>4.3 <6.0	565.9
SB-90-11	571.3	>4.4 (boring terminated in fill unit)	
SB-90-12	567.0	>6.3 (boring terminated in fill unit)	
SB-90-13	572.1	>6.5 <8.0	565.6
SB-90-14	570.2	8.3	561.9
SB-90-15	572.0	6.2	565.8
SB-90-16	573.5	2.3	571.2
SB-90-17	574.3	.3	574.0
SB-90-18	574.1	.7	573.4
SB-90-19	573.2	>.6 <2.0	572.6
SB-90-20	571.8	No recovery at fill/native soil interface	
SB-90-21	570.2	>6.5 <8.0	563.7
SB-90-22	571.9	6.2	575.7
SB-90-23	572.7	>.3 <2.0	572.4
SB-90-24	573.6	.5	573.1

(Continued)

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TABLE 4-5

COLUMBUS McKINNON CORP.
STRATIGRAPHIC SUMMARY TABLE FOR
SHALLOW BORINGS

Boring No.	Interpolated Elevation (G.L. amsl)	Depth To Glaciolacustrine Deposit/Fill Thickness	Elevation Glaciolacustrine Deposit
SB-90-25	574.1	.2	573.9
SB-90-26	572.8	2.2	570.6
SB-90-27	571.8	6.2	565.6
SB-90-28	570.8	8.1	562.7
SB-90-29	571.1	>4.4 <6.0	566.7
SB-90-30	572.2	>2.2 <4.0	570.0
SB-90-31	573.4	2.3	571.1
SB-90-32	574.2	0.0	574.2
SB-90-33	574.6	>2.4 <4.0	572.2
SB-90-34	574.2	2.5	571.7
SB-90-35	572.7	8.3	564.4
SB-90-36	572.5	6.2	566.3
SB-90-37	574.1	6.4	567.7
SB-90-38	574.2	>6.3 <8.3	567.9
SB-90-39	575.2	>4.4 <6.0	570.8
SB-90-40	574.5	6.2	568.3
SB-90-41	573.2	>7.1 <8.0	563.4
SB-90-42	571.0	>6.8 <8.0	564.2
SB-90-43	575.1	>6.6 <8.0	568.5
SB-90-44	575.5	>4.4 <6.0	571.1
SB-90-45	575.8	6.6	569.2
SB-90-46	575.3	>4.7 <8.0	570.6
SB-90-47	575.3	6.9	568.4
SB-90-48	574.0	3.8	570.2

(Continued)

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TABLE 4-5

COLUMBUS McKINNON CORP.
STRATIGRAPHIC SUMMARY TABLE FOR
SHALLOW BORINGS

Boring No.	Interpolated Elevation (G.L. amsl)	Depth To Glaciolacustrine Deposit/Fill Thickness	Elevation Glaciolacustrine Deposit
BH-2-81	573.6	7.0+ Boring terminated in fill unit	
BH-3-81	574.9	7.0	567.9
BH-4-81	574.3	7.0+ Boring terminated in fill unit	
BH-5-81	573.4	7.0+ Boring terminated in fill unit	
BH-6-81	574.5	7.6+ Boring terminated in fill unit	
BH-7-81	573.7	7.0+ Boring terminated in fill unit	
BH-8-81	575.4	3.3+	572.1
BH-9-81	574.0	5.5	568.5

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TABLE 4-6

COLUMBUS McKINNON CORP.
STRATIGRAPHIC SUMMARY TABLE FOR
DEEP BORINGS

Well No.	Elevation (G.L. amsl)	Depth to Glaciolacustrine Deposit/Fill Thickness	Elevation Glacio-Lacustrine Deposit	Depth to Till	Elevation of Till	Depth to Bedrock	Elevation of Bedrock
MW-1S-90	571.71	>5.1 <7.0	566.6	NA	NA	-	-
MW-1D-90	572.13	6.2	565.9	27.6	544.53	-	-
MW-2S-90	574.35	>6.4 <7.0	567.9	NA	NA	-	-
MW-2D-90	574.57	6.7	567.9	29.4	545.17	-	-
MW-3-90	576.72	2.5	574.2	NA	NA	-	-
CM-1-89	572.4	8.2	564.2	28.6	543.8	51.2	520.8
CM-2-89	573.5	8.3	565.2	27.6	545.9	54.8	518.2
CM-3-89	571.0	8.1	562.9	27.4	543.6	52.3	518.7
CM-4-89	575.2	2.6	572.6	31.4	543.8	54.9	520.1
CM-5-89	573.6	0.0	573.6	29.1	544.5	53.0	520.0

concrete rubble, metal filings, and miscellaneous materials such as chains. Fill thickness varies as a function of the distance from the creek bank; approximating nine (9) feet in borings located closest to the bank, and one foot in borings adjacent to the building. Fill thicknesses across the study area are illustrated in Plate 3. Moisture conditions observed within the fill varied from dry to saturated where the fill intersects the watertable.

4.4.2 Lacustrine Deposits

Lacustrine silt and sand underlies the fill layer in the study area. These are described as a very low density, gray fine to very fine sand with abundant silt or clayey silt lamina 5 to 10 mm thick. Occasional layers of fine to medium sand occur near the base of the lacustrine deposit. The thickness ranges from 18 to 20 feet near Ellicott Creek, to approximately 29 feet thick near the buildings. The occurrence of similar lacustrine silt and sand at the upgradient well location (MW-3) indicates that the unit is laterally extensive in the site vicinity.

4.4.3 Glacial Till

Underlying the glaciolacustrine deposits is a sequence of tills approximately 25-30 feet in thickness. The five (5) uppermost feet of this sequence was encountered during the course of this investigation and consists of a brown to reddish-brown clayey silt with small rounded gravel.

Based on historic borings CM-1-89 to CM-5-89 (see Plate 1), the uppermost till varies in thickness from 5 to 14 feet and is underlain by a discontinuous red-gray, plastic clay up to 3.5 feet in thickness. Locally the clay grades into a sand and gravel. Beneath the clay is a lower till which varies from the upper till in terms of color and texture. The lower till is described as a gray-brown sandy till with occasional interbedded sand and gravel lenses. This till varies in thickness from 6 to 15 feet. Due to its occurrence between two tills and its absence in three of five deep test borings (CM-1-89, CM-2-89, and CM-4-89), the sand and gravel is probably lenticular and not laterally extensive.

4.4.4 Bedrock

Although the underlying bedrock was not addressed during the Spring 1990 drilling activities, previous test borings (CM-1-89 and CM-4-89) completed in October 1989 included sampling of the upper 10 feet of bedrock by NX rock coring methods. The underlying bedrock occurs at a depth of 51 to 55 feet and consists of a brown shaley dolostone, with abundant vertical to horizontal fractures infilled with gypsum. This is consistent with descriptions of the Camillus Shale given by LaSala (1968).

4.5 SITE HYDROGEOLOGY

4.5.1 Hydrostratigraphic Units and Hydrogeologic Properties

Hydrostratigraphic units are sequences of geologic materials which exhibit similar hydrogeologic properties relative to hydraulic conductivity, storage, and porosity. Based upon the findings of this investigation, the major hydrostratigraphic units present in the overburden at the Columbus McKinnon Facility are the following:

1) An unconfined, shallow water-bearing zone consisting of the lowermost fill material and the lacustrine silt and sand.

2) A confining unit (aquitard) characterized by a dense, poorly permeable sequence of glacial tills and interbedded sediment.

Based on regional information (Section 4.3.2) the bedrock underlying the site has the potential to be a significant aquifer where interbedded gypsum or gypsum in fractures has been dissolved. Descriptions of the rock cores from the Columbus McKinnon site (provided in Appendix B1) indicate that at least locally the fractures remain closed. The occurrence of fractures infilled with water soluble gypsum suggests that the upper bedrock is not a significant aquifer beneath the site.

4.5.1.1 Shallow Water Bearing Zone

The shallow water bearing zone consists of the saturated portion of the fill material and the lacustrine silt and sand. Saturated silt and sand underlies the entire study area and appears to extend, at a minimum, from Ellicott Creek to well location MW-3, a distance of 370 feet in a north-northeastern direction (see Figures 4-1 through 4-4). Surficial mapping by Mueller (1977) showing the extent of former Lake Tonawanda suggests that similar saturated sediments are laterally extensive in north-northeast direction.

Based on the water level elevation at MW-3 (5/25/90) creek stage levels, and the elevation of the top of the till sequence along the creek, the average saturated thickness of the shallow water bearing zone is 21.5 feet. Hydraulic conductivities of five (5) wells (MW-1S, MW-1I, MW-2S, MW-2I, and MW-3) screened in the shallow water bearing zone range from 6.3×10^{-5} cm/s to 3.0×10^{-3} cm/s with a geometric mean of 4.3×10^{-4} cm/s (see Table 4-7). Estimated porosity of the silt and sand is 0.30 based on values given in Freeze and Cherry (1979).

4.5.1.2 Confining Unit

The till sequence and the intercalated sediments comprise an aquitard that defines the base of the shallow water bearing zone. The substantial thickness (24.4 ft) suggests that the unit is laterally extensive. As shown in Table 4-7, hydraulic conductivities for the upper till underlying the lacustrine silt and sand range from 1.2×10^{-6} cm/sec in MW-1D to 2.9×10^{-7} cm/sec in MW-2D (mean value: 5.9×10^{-7} cm/s). Sediments within the till sequence include a plastic silty clay and a silty sand and gravel. The clay and till probably have similar hydraulic conductivities. Sand and gravel units in the till sequence are probably not laterally extensive.

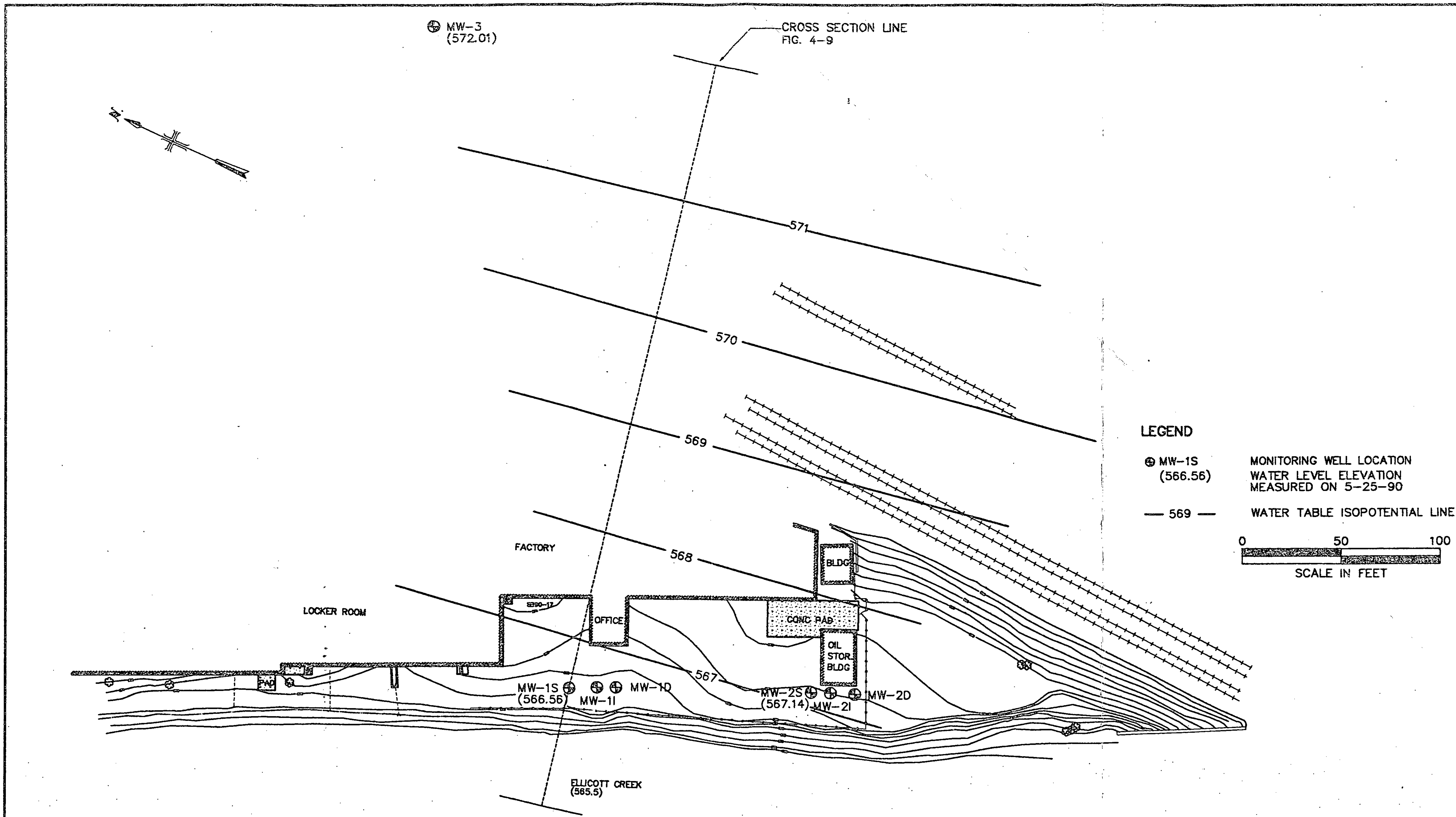
4.5.2 Ground Water Flow

4.5.2.1 Shallow Water-Bearing Zone

Shallow ground water flow conditions for May 25, 1990 and August 16, 1990 are presented on Figure 4-5 and Figure 4-6, respectively. These two maps represent periods of high and low ground water levels during field activities at the site and illustrate that the shallow ground water flows in a south-southwest direction and discharges to Ellicott Creek.

Water level elevation data collected from each of the monitoring wells and the creek staff gauges throughout the course of this investiga-

FIGURE 4-5



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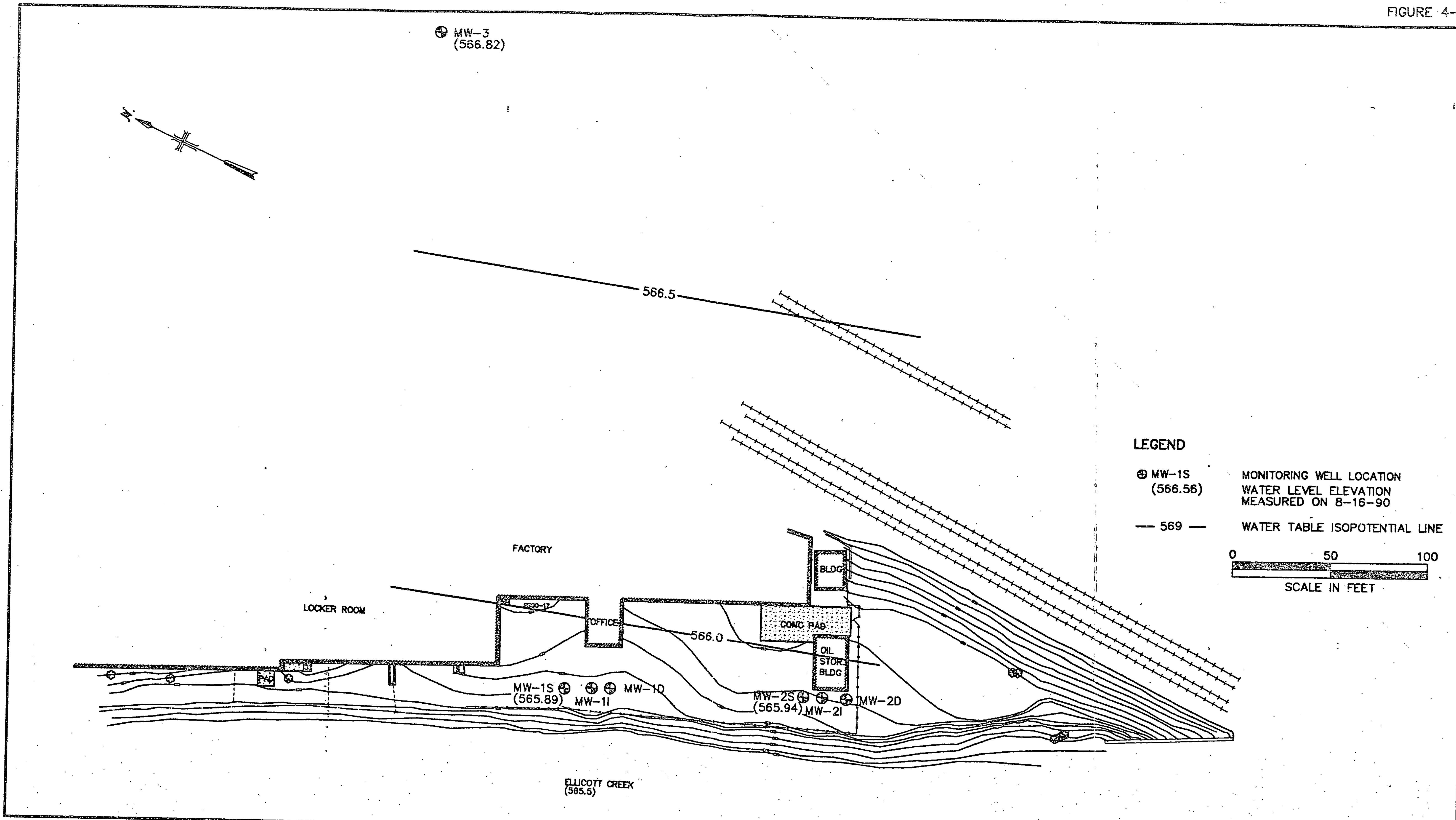
COL-01-ISO

WATER TABLE ISOPOTENTIAL MAP
FOR 5-25-90

COLUMBUS McKINNON CORPORATION

NOV. 1990



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COL-01IS1

WATER TABLE ISOPOTENTIAL MAP FOR 8-16-90

COLUMBUS McKINNON CORPORATION COL-01-IS1

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TABLE 4-7

HYDRAULIC CONDUCTIVITY TEST RESULTS

WELL NO.	DEPTH OF SCREENED INTERVAL (ft)	MATERIAL SCREENED	HYDRAULIC CONDUCTIVITY (cm/sec)	METHOD OF ANALYSIS
MW-1S	5.2 - 15.2	Fill and Lacustrine Deposits	6.3×10^{-5}	Bouwer & Rice (1976)
MW-1I	21.7 - 26.7	Lacustrine Deposits	3.0×10^{-3}	Cooper et al. (1967)
MW-1D	29.7 - 31.7	Glacial Till	1.2×10^{-6}	Hvorslev (1951)
MW-2S	4.7 - 14.7	Fill and Lacustrine Deposits	1.4×10^{-4}	Bouwer & Rice (1976)
MW-2I	22.7 - 27.7	Lacustrine Deposits	1.4×10^{-3}	Cooper et al. (1967)
MW-2D	33.0 - 35.0	Glacial Till	2.9×10^{-7}	Hvorslev (1951)
MW-3	5.7 - 20.7	Lacustrine Deposits	4.0×10^{-4}	Bouwer & Rice (1976)

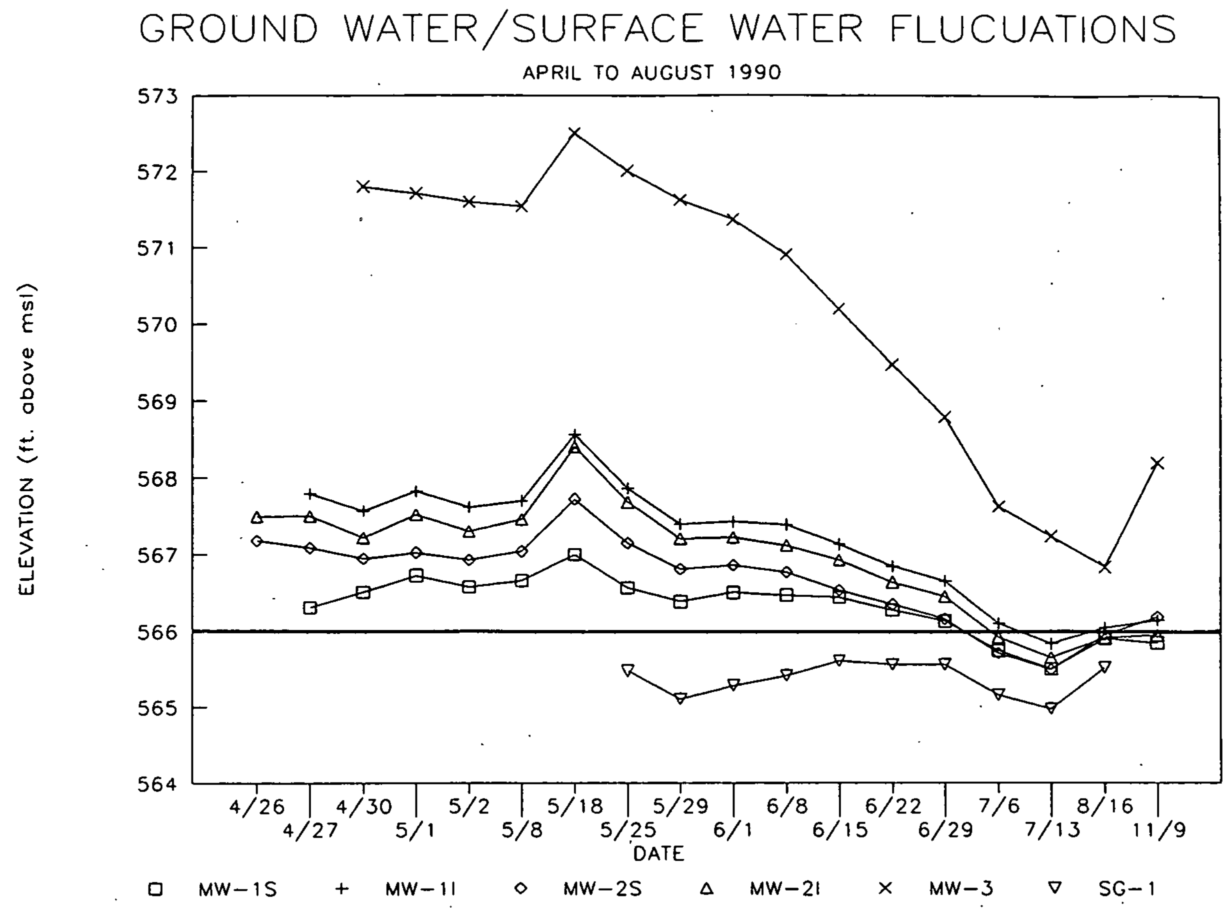
tion are shown on Figure 4-7. During the period May through June, ground water levels show a substantial decline. A high water period in May reflects the water table response to spring precipitation. A low water period appears to occur from mid-summer to November. The water level data shows that the water table aquifer at the site and the immediate surroundings (upgradient well MW-3) responds dynamically to seasonal variations in infiltration.

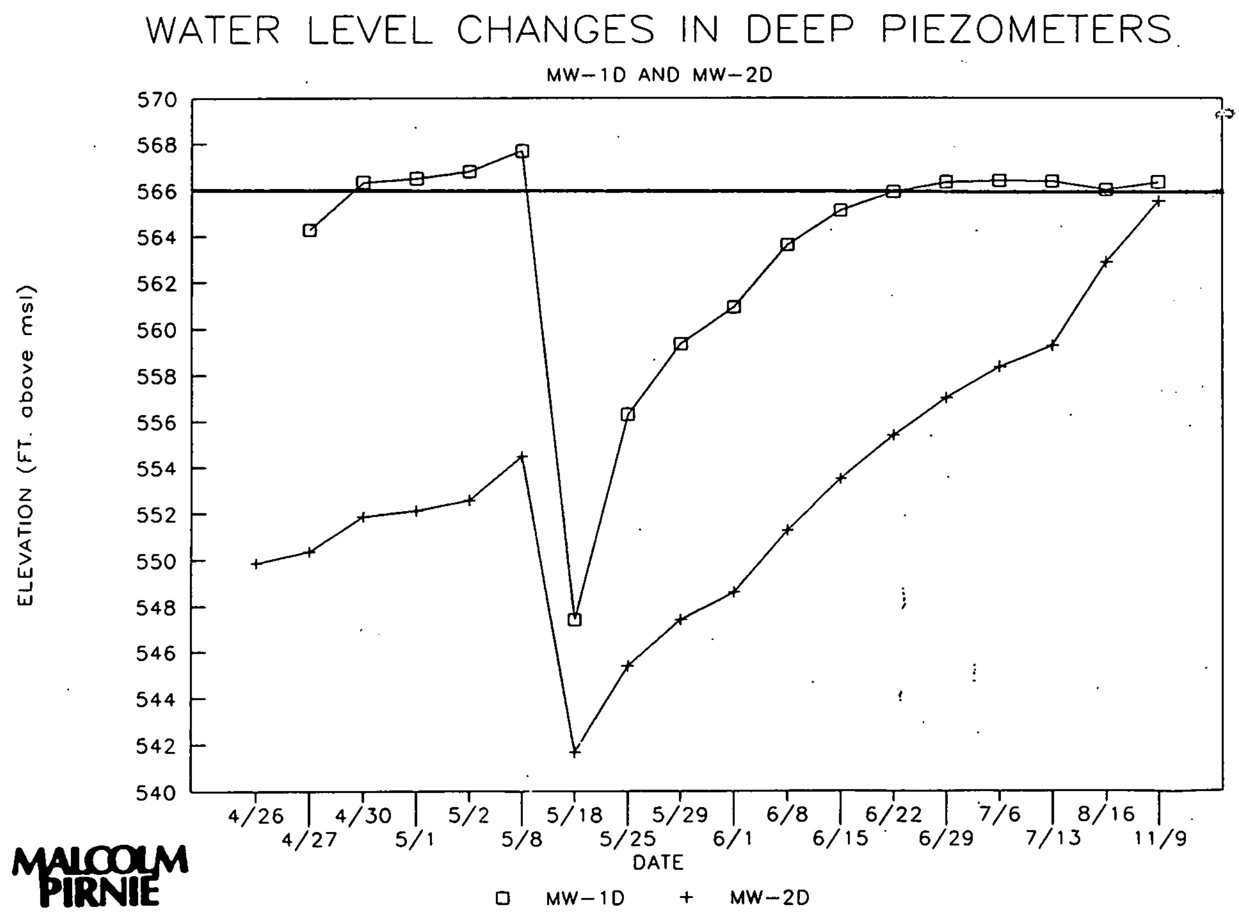
The shallow water bearing zone is directly influenced by fluctuations in water level in Ellicott Creek. This influence was confirmed during the collection of water level data over a 24-hour period beginning June 12, 1990. This hydraulic relationship is discussed in Section 5.2.

Figure 4-8 presents a cross-section through the shallow water bearing zone. The section follows a ground water flow line originating at the isopotential line passing through upgradient well MW-3 to well nest MW-1 and Ellicott Creek. A cross-section line is shown in Figure 4-5. Lines of constant hydraulic head are presented based on the horizontal hydraulic gradient along the flow line and vertical hydraulic gradient between MW-1S and MW-1I. There is an upward gradient near Ellicott Creek indicating that ground water flow, which is approximately perpendicular to the equipotential lines, has a pronounced upward component beneath the study area. The flow pattern illustrated in Figure 4-8 was similar during both high and low water periods during the period of study. However the magnitude of the hydraulic gradients are lower. Horizontal hydraulic gradients between MW-3 and Ellicott Creek range from 0.019 ft/ft on 05/25/90 to 0.003 ft/ft on 08/16/90. These are average gradients calculated across the distance between MW-3 and Ellicott Creek and can change locally, depending upon hydrogeologic conditions. Hydraulic gradients between the on-site shallow wells and the creek are slightly higher (0.050 ft/ft and 0.010 ft/ft on the same respective dates) indicating a local decrease in hydraulic conductivity near the creek.

4.5.2.2 Confining Unit

A comparison of ground water levels in the till confining unit and in the shallow water bearing zone indicates that ground water in the confining unit has an upward flow potential of 0.13 ft/ft at MW-1D. Well





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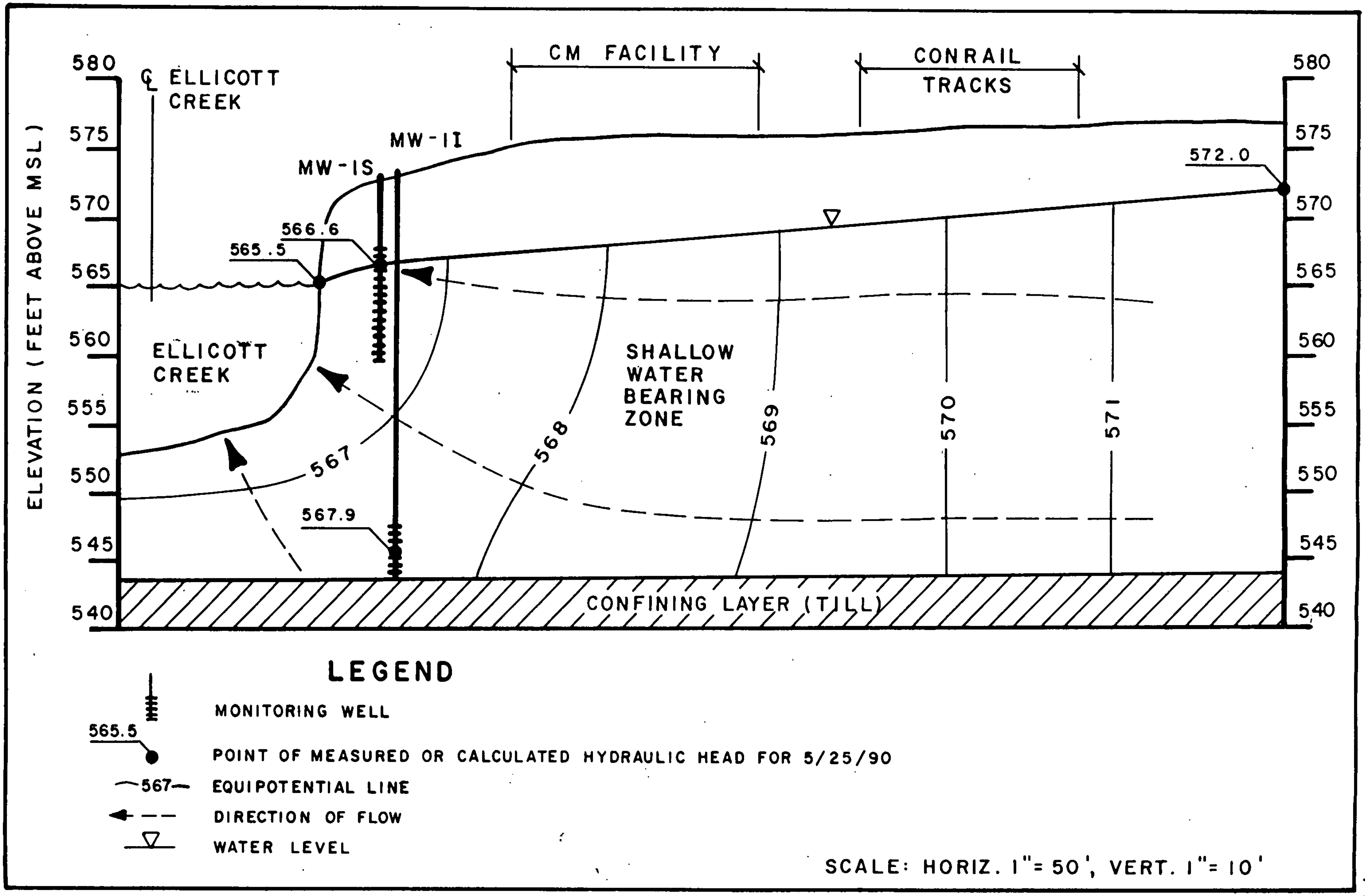

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REMEDIAL INVESTIGATION/FEASIBILITY STUDY

GROUND WATER FLOW NET

COLUMBUS McKINNON CORP.

DECEMBER 1990

FIGURE 4-8

MW-2D indicates an downward gradient; however, as shown on Figure 4-7 and in the recovery test analysis (Appendix C1) the well recovers very slowly and even the latest water level reading (taken on 11/09/90) does not yet indicate a stable water level. The water level in MW-2D may continue to rise and eventually indicate an upward gradient. Based on the observed upward gradients within the confining unit, the underlying bedrock aquifer appears to be under confined conditions.

4.5.3 Summary of Hydrogeologic Properties

The physical hydrogeologic properties of the shallow water bearing zone and the confining unit are summarized in Table 4-8. Average ground water flow characteristics, including principal flow direction, hydraulic gradient, average linear velocity, and specific discharge are also included on this table. Average flow characteristics are presented for high water level (05/25/90) and low water level (08/16/90) periods. Average specific discharge is presented in cubic feet per day per unit cross-sectional area (ft^2).

In summary, shallow ground water flows directly to Ellicott Creek. The water table rises and falls in response to seasonal changes in infiltration rates. As a result, ground water flow and discharge to Ellicott Creek was approximately six (6) times greater at high water periods than at low water periods during the period of the RI field activities (average specific discharge varied from 0.004 to 0.023 ft^3/day-ft^2). The shallow aquifer is underlain by a confining unit, which is comprised primarily of a dense, low permeability till. Ground water flows upward through the confining unit and discharges to the shallow aquifer.

4.5.4 Ground Water Discharge to Ellicott Creek

Ground water discharge from the Columbus McKinnon site to Ellicott Creek was estimated by Darcy's Law which is expressed as :

$$Q = KiA$$

TABLE 4-8

COLUMBUS McKINNON CORP.

HYDROGEOLOGIC PROPERTIES

HYDROGEOLOGIC UNIT	GEOLOGIC UNIT	AVERAGE PHYSICAL PROPERTIES: SATURATED THICKNESS (ft)	AVERAGE PHYSICAL PROPERTIES: HYDRAULIC CONDUCTIVITY (FT/DAY)	AVERAGE PHYSICAL PROPERTIES: POROSITY[1] (%)	AVERAGE FLOW PROPERTIES[4]: FLOW DIRECTION	HYDRAULIC GRADIENT (ft/ft) 5/25	HYDRAULIC GRADIENT (ft/ft) 8/16	AVERAGE LINEAR VELOCITY (ft/day) 5/25	AVERAGE LINEAR VELOCITY (ft/day) 8/16	SPECIFIC DISCHARGE ($ft^3/day/ft^2$) 5/25	SPECIFIC DISCHARGE ($ft^3/day/ft^2$) 8/16
Shallow Water-Bearing Zone	Lacustrine Sand and Silt	21.5	1.219 (4.3×10^{-4} cm/s)	.30	Lateral to Upward	0.019[2]	0.003[2]	0.077	0.012	0.023	0.004
Confining Layer	Till Sequence	24.4	0.0017 (5.9×10^{-7} cm/s)	.30	Upward	.13[3]		.006		.0002	

NOTES:

(1) Based on values from Freeze & Cherry (1979).
(2) Calculated between MW-3 and Ellicott Creek.
(3) Calculated between MW-1I and MW-1D.
(4) Flow properties can vary locally from those shown.

where:

K = average hydraulic conductivity (1.219 ft/day);

i = average hydraulic gradient (0.035 ft/ft);

A_1 = cross-sectional area of flow (440 x 21.5 = 9,460 ft^2);

The hydraulic conductivity value used in the calculation is the geometric mean of slug test results for the shallow water bearing zone. The hydraulic gradient was determined between the on-site well MW-2S and Ellicott Creek. An average of the high (0.057 ft/ft) and low (0.013 ft/ft) hydraulic gradient over the period of measurement was used because these values are assumed to be representative of high and low ground water flow conditions on a yearly basis. The cross-sectional area of flow was taken as the saturated thickness of the shallow water-bearing zone (from the water table to the till confining layer) multiplied by the length of the site (from SB90-1 to SB90-48).

The total ground water outflow to Ellicott Creek is 404 ft^3/day. Backwater effects from the Niagara River and flood stage events contribute recharge and discharge to the site (see section 5.0), but the changes in ground water levels are considered negligible on a yearly basis.

5.0 HYDROLOGY

5.1 WATER SHED CHARACTERISTICS

As illustrated by Figure 5-1, Ellicott Creek originates in Genesee Co. and flows a distance of 40 miles north-northwesterly through Erie Co. to Tonawanda Creek. The confluence of Ellicott and Tonawanda Creeks is approximately one mile from the Niagara River. Tributaries to Ellicott Creek include 11-Mile, Crooked, Spring, Peck, and Durkee Creeks and are a component of the Erie-Niagara Drainage Basin. Both industrial and residential development are present along the lower reaches of Ellicott Creek. The total drainage area for Ellicott Creek is 110 square miles (Harding and Gilbert, 1968).

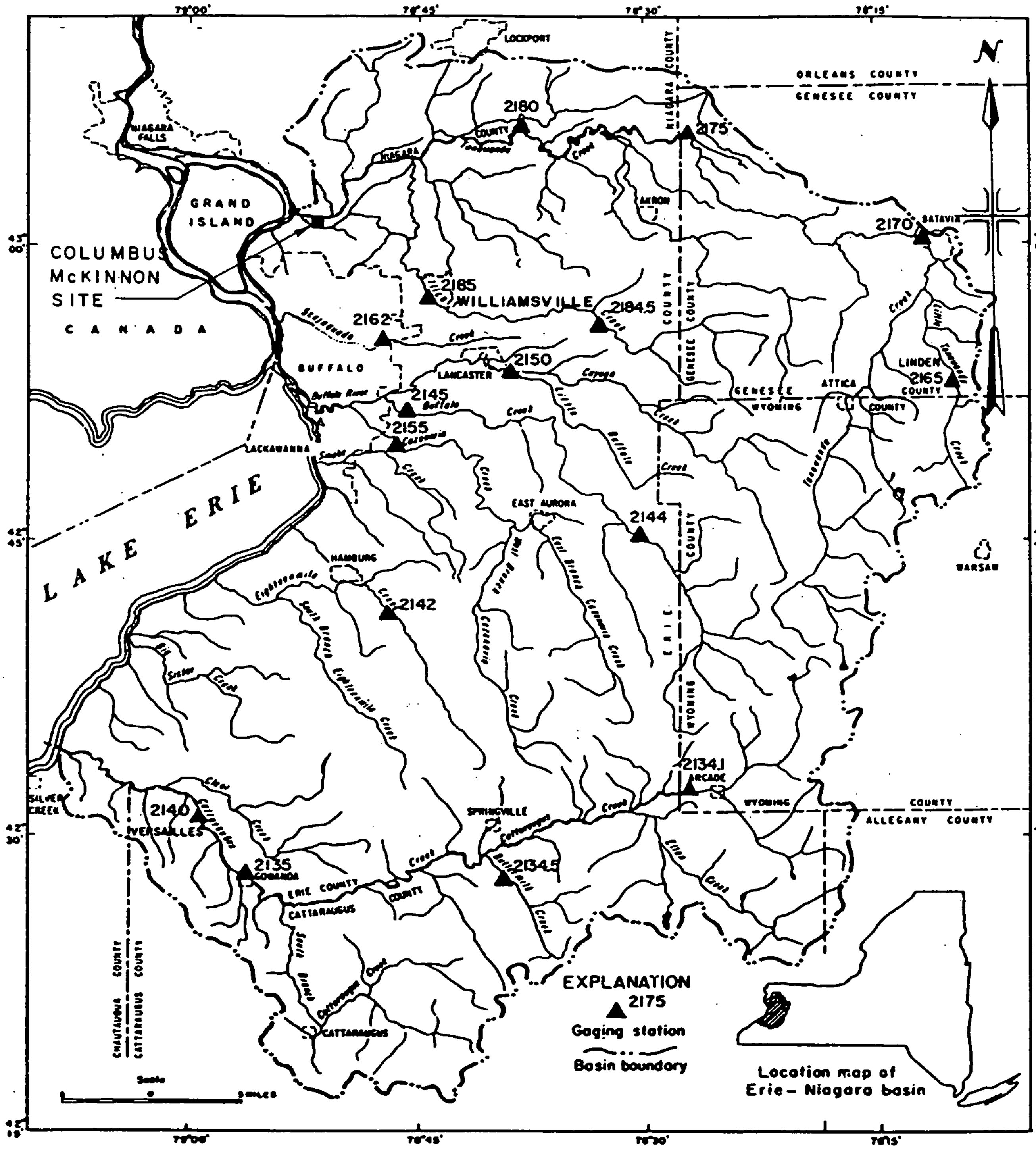
A permanent stream-gauging station is located at Williamsville, NY approximately 10.3 miles upstream of the Columbus McKinnon site. Based on stream flow records at Williamsville, the average discharge of Ellicott Creek for the 11-year period 1972-1984 is 130 ft^3/sec (USGS, 1984b). Stream flow has a pronounced seasonal variation with 87% of total average annual flow occurring during the six-month period of December through May (Harding and Gilbert, 1968).

Stream flow in Ellicott Creek is influenced by several types of stream diversion or regulation: 1) intermittent pumping from a stone quarry upstream of Williamsville augments stream flow (USGS, 1983); 2) a diversion channel in Ellicott Creek Park (three miles upstream of the site) connects Ellicott Creek with Tonawanda Creek during high flow periods (USGS, 1983); and 3) the flow of Tonawanda Creek is reversed from its mouth at the Niagara River to Pendleton (12 miles upstream) to provide water for the NYS Barge Canal System during the navigation season (April to November) (Harding and Gilbert, 1968).

5.2 FLOOD PLAIN

The floodplain of Ellicott Creek associated with the Columbus McKinnon Facility lies approximately 3000 to 3400 feet above the confluence with Tonawanda Creek. To determine the 10-, 50-, 100-, and

FIGURE 5-1



NOTE: INDEX MAP OF THE ERIE-NIAGARA BASIN.
(AFTER HARDING AND GILBERT, 1968)

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ERIE-NIAGARA BASIN

COLUMBUS McKINNON CORP. DECEMBER 1990

500-year flood discharges associated with this reach of the creek as well as upstream locations along Ellicott Creek, the Federal Emergency Management Agency (FEMA) has performed hydrologic analyses relative to peak discharge and elevation frequencies. Table 5-1 (FEMA, 1979) summarizes the peak discharge data associated with the specified flood frequencies. Flood stage elevations reached during the 10-, 50-, 100-, and 500-year discharges range from 570.3 to 571.5 ft amsl and are shown in cross-section on Figure 5-2. Location "E" (2950 ft above the confluence with Tonawanda Creek) represents the conditions on Ellicott Creek adjacent to the Columbus McKinnon Facility. A portion of the North Area near the creek bank (see Figure 1-1) with surface elevations below 571.5 may be subject to flooding at the specified flood frequencies. Elevations of the remainder of the site exceed 571.5 and should not be subject to flooding.

Hydrologic studies indicate that flood stage elevations for downgradient Niagara River are controlled primarily by wind effects on Lake Erie. The resulting backwater effects extend upstream along Ellicott Creek and may raise creek levels in the vicinity of the Columbus McKinnon site (FEMA, 1979). High discharge events on Ellicott Creek occur as a result of runoff from rainfall and snowmelt.

5.3 RELATIONSHIP BETWEEN CREEK AND GROUND WATER ELEVATIONS

Water level and stream stage measurements were collected for a 24 hour period on June 12-13, 1990. Water level elevations are presented in Table 4-5.

Observations during this 24-hour period included a marked rise in water elevation in the creek during the early morning hours and a subsequent lowering of the creek water level during the afternoon hours. Shallow and intermediate on-site monitoring wells responded rapidly to fluctuations in Ellicott Creek. The hydraulic relationship between the stream stage and on-site ground water elevations during the 24-hour period is illustrated by Figures 5-3 and 5-4. Upgradient well MW-3 showed no apparent water level change during the 24 hour period (see Figure 5-5).

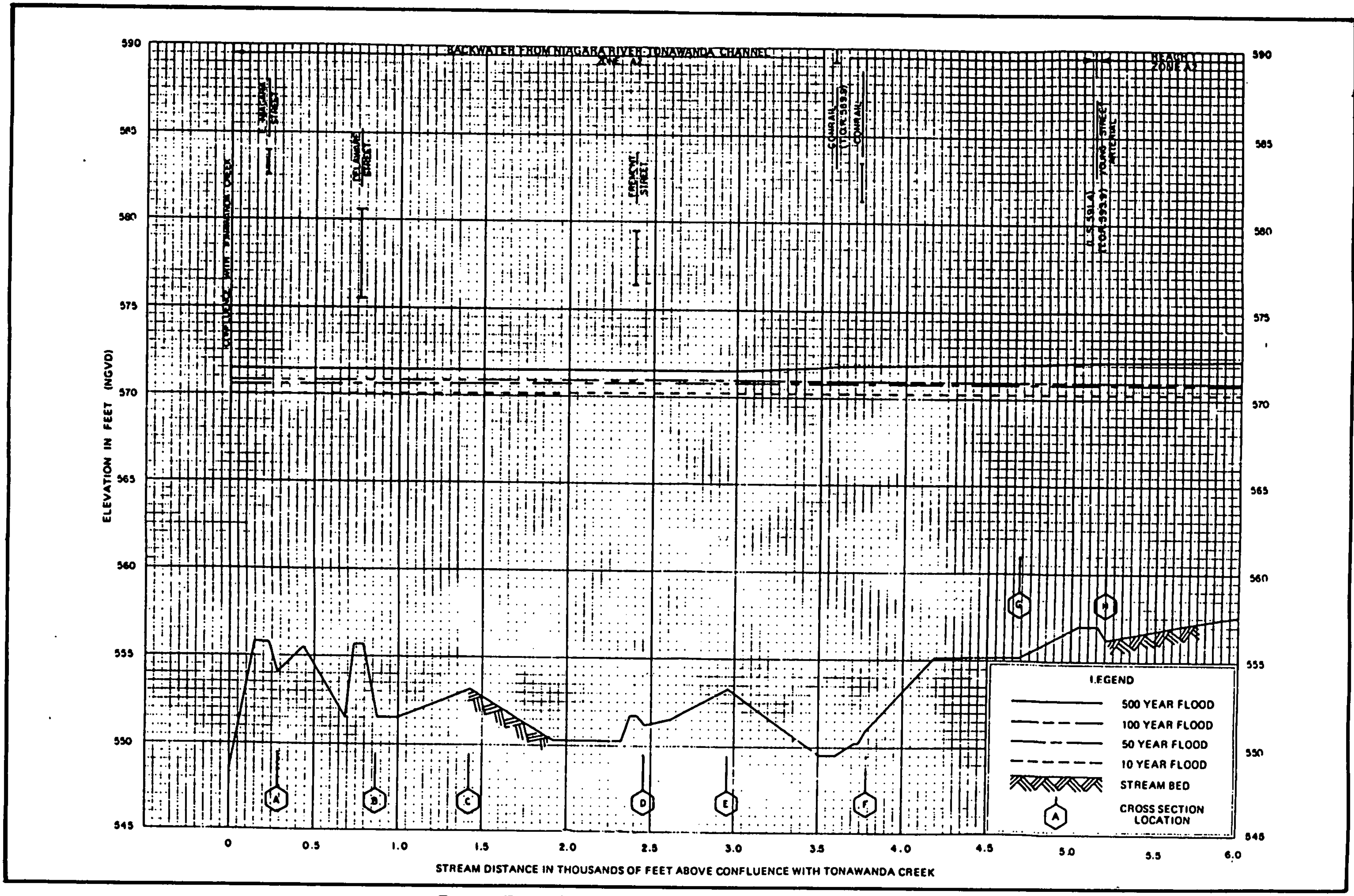
The configuration of equipotential lines discussed in Section 4.4.2 indicates that Ellicott Creek is an effluent stream continually recharged

TABLE 5-1

COLUMBUS McKINNON CORPORATION
TONAWANDA FACILITY

Location	Drainage Area (sq. mi.)	Peak Discharges (cfs)			
		10-yr	50-yr	100-yr	500-yr
Ellicott Creek at Mouth*	110	3,300	4,400	4,900	6,300

* The mouth of Ellicott Creek is approximately 3000 to 3400 feet downstream from the study area.



From FEMA, 1979

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REMEDIAL INVESTIGATION/FEASIBILITY STUDY

CROSS SECTION ALONG ELLICOTT CREEK

COLUMBUS McKINNON CORP.

DECEMBER 1990

FIGURE 5-2

ELEVATION OF GROUND WATER AND SURFACE WATER AT WELL NEST 1 DURING A 24-HOUR PERIOD (JUNE 1990)

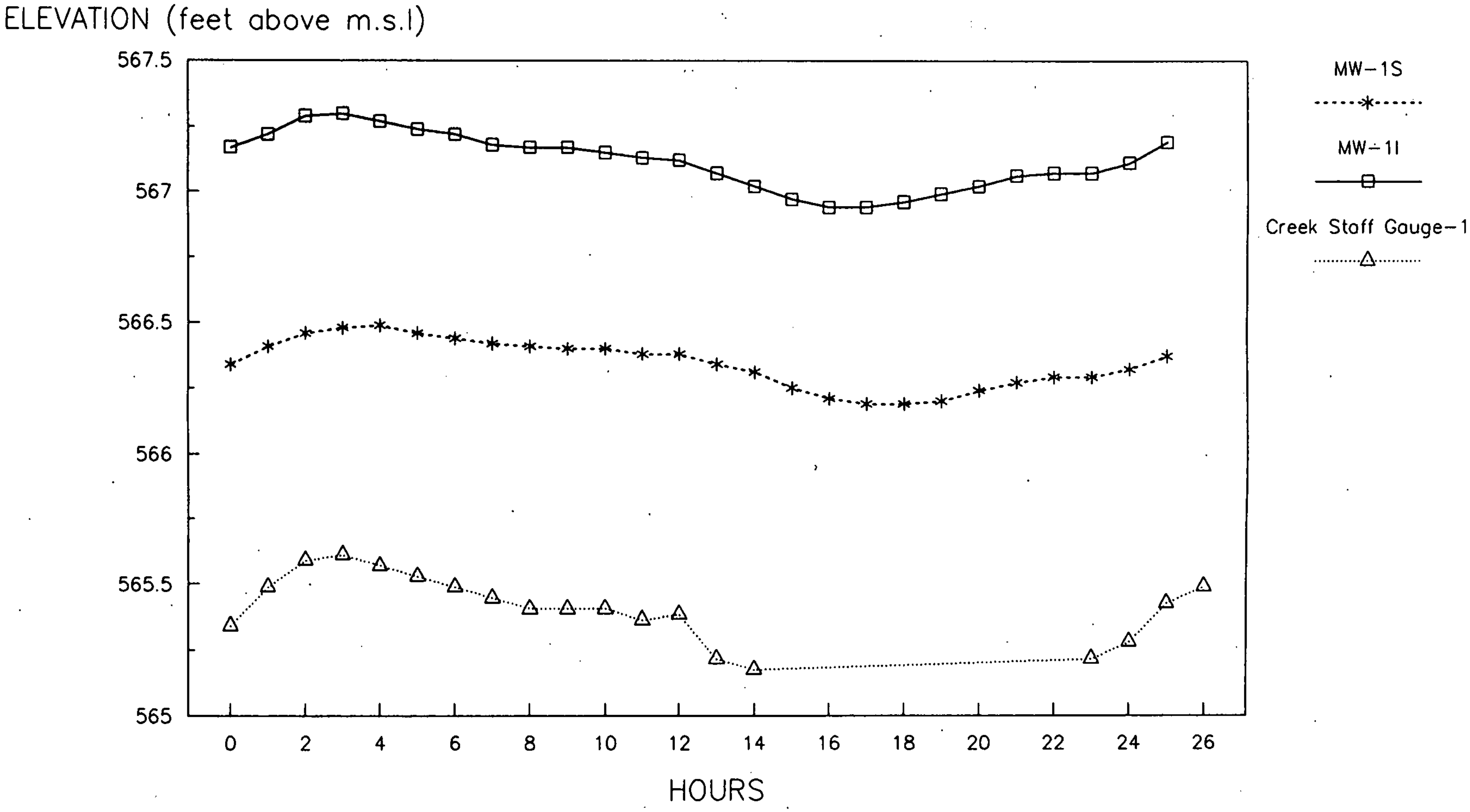

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FIGURE 5-3

ELEVATION OF GROUND WATER AND SURFACE WATER AT WELL NEST 2 DURING A 24-HOUR PERIOD (JUNE 1990)

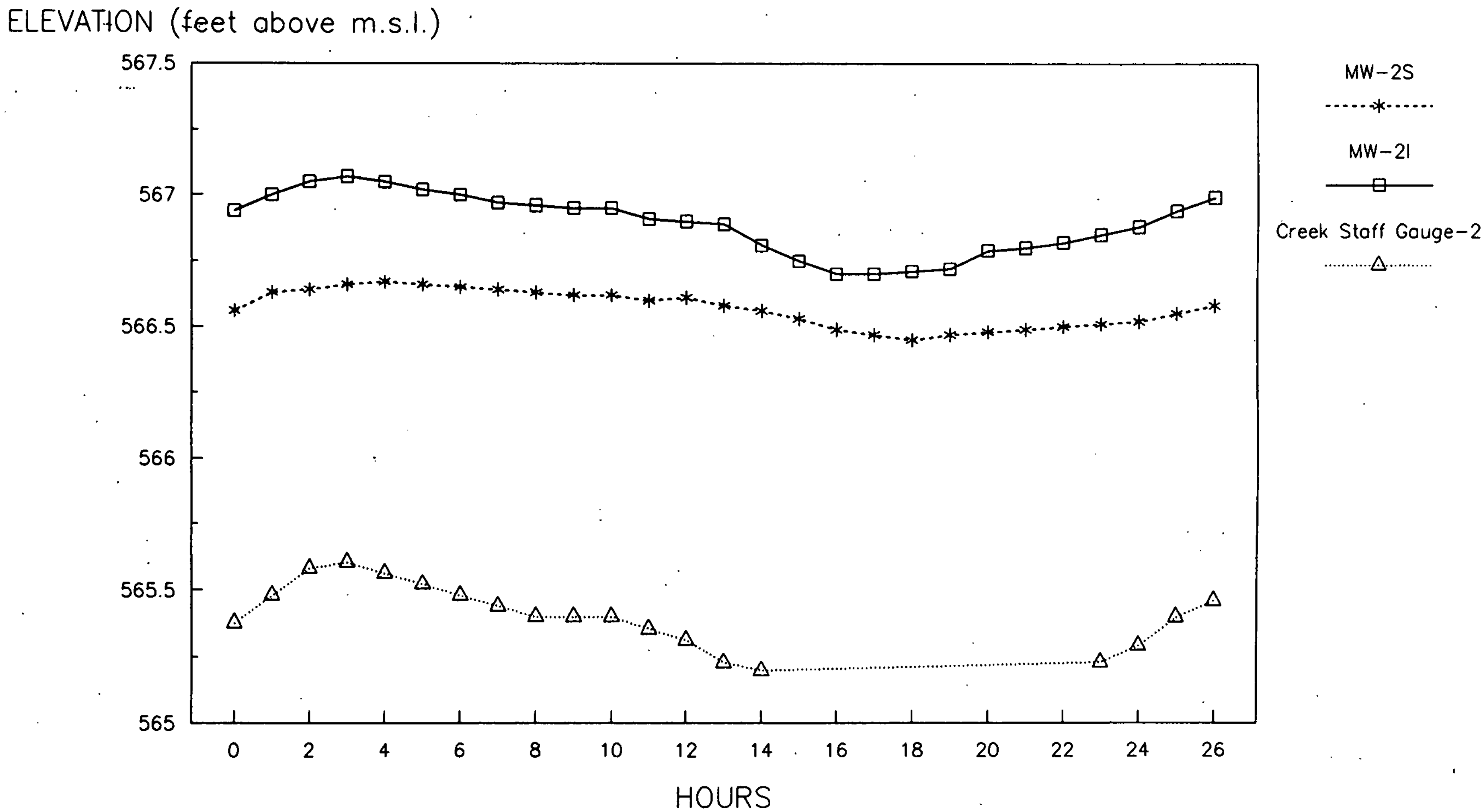

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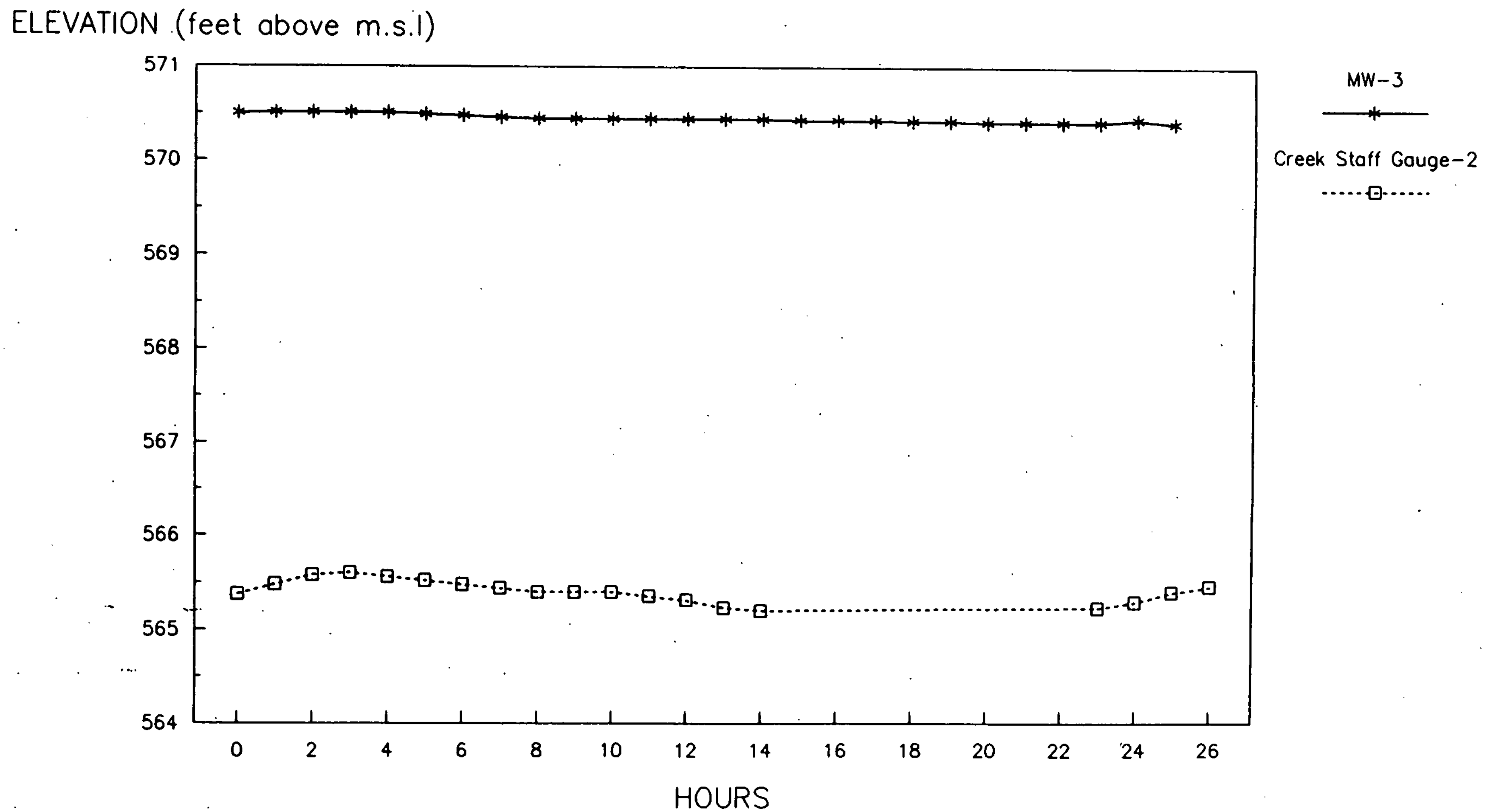
FIGURE 5-4

ELEVATION OF GROUND WATER AND SURFACE WATER AT WELL 3 AND STAFF GAUGE 2 DURING A 24-HOUR PERIOD (JUNE 1990)



MALCOLM PIRNIE

FIGURE 5-5

by ground water. The 24-hour water level monitoring results show that the wells are directly connected to the creek and flood crest elevations will directly influence ground water levels on-site. However, during flood stage when the river flood crest is higher than ground water elevations, the hydraulic gradient would be reversed and a temporary condition would exist whereby the creek would become influent or lose water to the ground water system. After the flood crest passes, the hydraulic gradient would again reverse and the river would become effluent. Figures 4-2, 4-3, and 4-5 show the relationship of the 10-year flood stage elevations to the fill material underlying the site.

6.0 SITE CONTAMINANT CHARACTERIZATION

The characterization of the nature and extent of contamination within the Columbus McKinnon site study area was accomplished by the collection and analysis of soil, ground water, and creek sediment samples. Samples were collected as a part of the present RI during three distinct sampling rounds conducted during the periods of April-May, 1990, August 22-24, 1990, and May 1-2, 1991 respectively. Procedures and rationale for both soil and sediment collection and analysis have been presented in the RI Work Plan dated November 1989 (MPI, 1989a). Procedures used for ground water collection and analysis have been presented in the Work Plan Addendum 1 dated January 1990 (MPI, 1989b) and in Work Plan Addendum 2 dated April 1991 (MPI, 1991)..

All samples collected for the Columbus McKinnon RI were analyzed by Wadsworth Alert Laboratories, Inc. for the parameters listed in Table 6-1. These parameters were identified by NYSDEC as the parameters of concern based upon the results of previous investigations at the CM site study area (NYSDEC, 1990a). A brief discussion of the sample collection program is presented below. Detailed descriptions of the procedures used to collect all samples are presented in the RI Work Plan and the Work Plan Addendums.

As required by the Order on Consent (Index No. B9-0240-88-10) dated October 2, 1989, historical data generated during previous investigations of site contamination has also been used to characterize the nature and extent of such contamination. The historical data used for this purpose is documented in Section 6.1.

6.1 HISTORIC ANALYTICAL RESULTS

During the period July 1979 through September 1981, twelve boreholes were completed in the vicinity of the alleged former waste pit by VSSR, Inc. Soil samples were collected for the analyses of PCBs, heavy metals, oil and grease, and selected pesticides. Leachable metal content was determined on select samples. All analyses were performed by ACTS Testing Labs, Inc. A summary of the analytical results for PCBs and select total

TABLE 6-1

COLUMBUS McKINNON CORPORATION

ANALYTICAL PARAMETERS AND METHODOLOGY

SAMPLE PARAMETER	ANALYTICAL METHODOLOGY (1)	SAMPLE MATRIX		
		SOIL	SEDIMENTS	GROUND WATER
Volatile Organic Compounds(2)	8010	X		X
PCBs	8080	X	X	X(3)
Cadmium	6010/7131	X	X	X(3)
Lead	7421	X	X	X(3)
Chromium	6010/7191	X	X	X(3)
Nickel	6010	X	X	X(3)

NOTES:

(1) SW846 - "Test Methods for Evaluating Solid Waste Physical/Chemical Methods," Third Edition, September 1986.

(2) Specific VOCs are identified in Table 6-2.

(3) Total metals and PCBs were analyzed in May 1990. Both total and field-filtered metals and PCBs were analyzed in May 1991.

MALCOLM PIRNIE

TABLE 6-2 COLUMBUS McKINNON CORP. HALOGENATED VOLATILE ORGANIC PARAMETERS
Bromodichloromethane
Bromoform
Bromethane
Carbon tetrachloride
Chlorobenzene
Chloroethane
2-Chloroethyl vinyl ether
Chloroform
Chloromethane
Dibromochloromethane
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
1,1-Dichloroethane
1,2-Dichloroethane
1,1-Dichloroethylene
trans-1-,2-Dichloroethylene
1,2-Dichloropropane
cis-1,3-Dichloropropene
trans-1,3-Dichloropropene
Methylene chloride
1,1,2,1-Tetrachloroethene
Tetrachloroethylene
1,1,1-Trichloroethane
1,1,2-Trichloroethane
Trichloroethylene
Vinyl chloride

metals is presented on Tables 6-3 and 6-3a. Additional results from the period 1979 to 1981 are presented in Appendix E.

During the period November 1981 through January 1983, a total of sixty-three (63) boreholes were completed on the CM property by Advanced Environmental Systems, Inc. (AES) of Niagara Falls, NY. Soils samples were collected from these boreholes at various depth intervals and analyzed for PCBs. All sample analyses were performed by Advanced Environmental Systems, Inc. A summary of these analytical results is presented in Table 6-3.

The historic borehole sampling locations are shown on Plate 1. Historic PCB sampling results for surficial soil (0-2' depth) are shown in plan view on Plate 4. Historic PCB sampling results for subsurface soil (0-11' depth) are shown in cross-section on Plate 6. These sampling locations are identified by the letters "BH" and "B" to differentiate between historic locations and the present RI sampling locations (the RI soil boring locations identified as SB-90). Historic soil sample collection procedures and analytical methodology used for BH series samples are given in the report prepared by Advanced Environmental Systems, Inc. (AES, 1983). Sample collection procedures and analytical methodologies used for B series samples are presented with the boring logs in Appendix B1, and with the ACTS Testing lab reports in Appendix E.

In addition to the soil samples, twenty-four (24) sediment samples were collected by Advanced Environmental Systems, Inc. during the period July 1983 through January 1986. These samples were also analyzed by AES for PCBs. A summary of the analytical results is presented on Tables 6-4a and 6-4b. Procedures and methodology used for the collection and analysis of the historic samples are given in the reports referenced on Tables 6-3, 6-4a, and 6-4b.

The historic creek sediment sample locations are presented on Plate 1. Historic sediment samples were collected along traverse lines oriented perpendicular to the creek bank. Traverse lines are denoted by the triangles on Plate 1. Analytical results for creek sediments collected during the present RI are denoted by the letters CS (i.e., CS-1).

MALCOLM PIRNIE

TABLE 6-3

COLUMBUS McKINNON CORP.

SUMMARY OF HISTORIC PCB DATA FOR SOIL[1][2]

(Values in mg/kg)

SAMPLE LOCATION	SAMPLE DATE	DEPTH INTERVAL (feet)			
		SURFACE - 2	2 - 4	4 - 6	>6
B2	7/13/79	51	115		14
B3		13			0.8
B4	9/13/79	11	1	0.13	0.69
B5		30	14	0.76	0.86
B6		0.22	2.2		<0.001
B7	1/28/80	0.52	0.17[3]		
B8			1.5[3]	2.6[3]	
B9			1.7[3]	0.15	
B10	9/4/81	478	122		
B11		225[3]	172[3]	106	
B12			254[3]	99[3]	
BH-1	11/12/81	124			
BH-2		109[3]		62[3]	49
BH-3		164		0.27[3]	0.23
BH-4		269		153[3]	141
BH-5		102		9.9[3]	17
BH-6	11/12/81	37[3]		6.6[3]	6.0
BH-7		275[3]	549	56[3]	59
BH-8		<0.5	0.21	0.26[3]	0.36
BH-9		125	8.9	0.30[3]	0.04
BH-10	5/82	1210			
BH-11	5/82	1260			
BH-12		294			
BH-13		798			
BH-14	8/82	440	221		
BH-15		44	188		
BH-16	8/82	1077[3]			
BH-17		58	0.81		
BH-18		<1.7	0.25		
BH-19		65	9.6		
BH-20		209[3]			
BH-21	8/82	89[2]	506		
BH-22	9/82	24			
BH-23	8/82	599	147		
BH-24		25[3]			
BH-25	9/82	363			

(Continued)

MALCOLM PIRNIE

TABLE 6-3

COLUMBUS McKINNON CORP.

SUMMARY OF HISTORIC PCB DATA FOR SOIL(1)(2)
(Values in mg/kg)

SAMPLE LOCATION	SAMPLE DATE	DEPTH INTERVAL (feet)			
		SURFACE - 2	2 - 4	4 - 6	>6
BH-26	9/82	4.9			
BH-27		0.78			
BH-28		2220			
BH-29		94			
BH-30		272			
BH-31	9/82	427			
BH-32	11/82	1.9			
BH-33		8.4			
BH-34		126			
BH-35		<2.2			
BH-36	11/82	<0.10			
BH-37		20			
BH-38		46			
BH-39		125			
BH-40		<0.09			
BH-41	11/82	20			
BH-42		52			
BH-43		<.74			
BH-44		<0.36			
BH-45		61			
BH-46	11/82	67			
BH-47		<0.33			
BH-48		20			
BH-49		<1.5			
BH-50		<3.4			
BH-51	11/82	34			
BH-52		6.7			
BH-53		7.1			
BH-54	1/83	2.1			
BH-55		15			
BH-56	1/83	5.0			
BH-57		4.4			
BH-58		24			
BH-59		86			
BH-60		1.0			

(Continued)

MALCOLM PIRNIE

TABLE 6-3

COLUMBUS McKINNON CORP.

SUMMARY OF HISTORIC PCB DATA FOR SOIL[1][2]
(Values in mg/kg)

SAMPLE LOCATION	SAMPLE DATE	DEPTH INTERVAL (feet)			
		SURFACE - 2	2 - 4	4 - 6	>6
BH-61	1/83	1.7			
BH-62		<2.0			
BH-63		<3.4			

NOTES:

(1) Analytical results for BH-series samples from report entitled "Groundwater and Additional Sampling Program," prepared by Advanced Environmental Systems, Inc. for Columbus McKinnon Corp., dated December 1983. Analytical results for B-series samples obtained from ACTS Testing Labs Inc. reports presented in Appendix E.

(2) Arochlor 1254 was the only PCB detected.

(3) Indicates an average of 2 values for that depth range.

(Continued)

MALCOLM PIRNIE

TABLE 6-3a

COLUMBUS McKINNON CORP.

SUMMARY OF SELECTED HISTORIC TOTAL METALS DATA FOR SOIL[1]
(Values in mg/Kg, Dry Wgt)

SAMPLE LOCATION	SAMPLE	PARAMETER	DEPTH INTERVAL (ft)			
			SURFACE 2	2 - 4	4 - 6	>6
B2	7/13/79	Cadmium		17		
		Chromium		154		
		Nickel		498		
		Lead		2638		
B3	7/13/79	Cadmium			9.6	
		Chromium			208	
		Nickel			891	
		Lead			1266	
B4	9/13/79	Cadmium	15	31	1.6	<1.0
		Chromium	91	70	7.2	4.4
		Nickel	121	194	24	17
		Lead	1627	735	24	<9
B5	9/13/79	Cadmium	6.6	<2.0	1.4	<2.0
		Chromium	351	29	46	5.0
		Nickel	380	339	157	<12
		Lead	149	35	114	<12
B6	9/13/79	Cadmium	<1.0	5.6		1.0[2]
		Chromium	39	152		8.5[2]
		Nickel	472	614		24[2]
		Lead	195	2020		<8[2]

NOTES:

(1) Historic total metals data obtained from ACTS Testing Labs Inc. reports (see Appendix E). Data for silver, mercury, selenium, barium, arsenic, zinc, and manganese are also included in the ACTS Testing Laboratory report.

(2) Indicates an average of two values for that depth range.

MALCOLM PIRNIE

TABLE 6-4a

COLUMBUS McKINNON CORP.

HISTORIC CREEK SEDIMENT TOTAL PCB ANALYTICAL RESULTS
(mg/kg)

Date	Distance from Bank (ft)	LOCATION							
		1	2	3	4	5	6	7	8
10/8/82	5	<0.12		107	366				
(1)	15	1.5	10	127	222				
10/29/82	5					18	<0.43	<2.9	<3.3
(1)	15					10.1	<0.36	<0.26	
7/6/83	15		0.97*		19*				
(1)	25	0.29		0.33	0.39				
1/16/86	15		8.8 11*	53	60 9.7*				
(2)	25			2.4	40				

NOTES:

* Sample Collected between two locations.

(1) "Groundwater and Additional Sampling Program" report prepared for Columbus McKinnon Corp. by Advanced Environmental Systems, Inc., December 1983.

(2) "Ellicott Creek Surface Sediment, Re-analysis for PCBs" report prepared for Columbus McKinnon Corp. by Advanced Environmental Systems, Inc., July 1986.

TABLE 6-4b

COLUMBUS McKINNON CORP.

HISTORIC PCB CONCENTRATION (mg/Kg) OF "AT DEPTH" CREEK SEDIMENT SAMPLES(1)

SAMPLE LOCATION		3	3	4	4
DISTANCE FROM SHORE (ft)		5	20	7	17
DEPTH OF SAMPLE:					
0 - 0.5 ft below creek bottom	PCB 1260 PCB 1254 PCB 1242	<0.5 0.9 (14)* <0.6	BDL 0.9 BDL	1.0 16 <1.0	BDL 0.1 BDL
0.5 - 1 ft below creek bottom	PCB 1260 PCB 1254 PCB 1242	No Sample	<0.2 4.9 <0.2	No Sample	BDL BDL BDL
1 - 1.5 ft below creek bottom	PCB 1260 PCB 1254 PCB 1242	No Sample	BDL 0.3 BDL	No Sample	BDL BDL BDL
1.5 ft - 2.0 ft below creek bottom	PCB 1260 PCB 1254 PCB 1242	No Sample	BDL 0.02 BDL	No Sample	BDL 0.02 BDL

NOTES:

Analysis performed by Advanced Environmental Systems.

* indates duplicate analysis

(1) This table from "Depth of PCBs at Four Locations in Ellicott Creek," report prepared by Advanced Environmental Systems, Inc. and Conestoga Rovers Associates, dated July 1985.

Ground water samples were collected from two (2) monitoring wells installed by AES during separate sampling events conducted in 1983, 1984, and in 1985. Samples were collected and analyzed by AES personnel according to the procedures given in the reports referenced on Table 6-5. Table 6-5 also presents volatile organic and PCB results for the historic ground water samples. The locations of these monitoring wells are shown on Plate 1. The wells are designated as OW1-83 and OW2-83 to differentiate between historic monitoring wells and monitoring wells installed during the present RI (denoted as MW-1, etc.).

The historic analytical data identified above has been used to characterize the nature of soil/ground water contamination and to identify the general area of contamination within the study area. Additional sampling was conducted during the present RI to, in conjunction with the historic data, more precisely define the horizontal and vertical extent of soil/fill contamination and to verify the presence/absence of ground water contamination.

6.2 RI SAMPLING PROGRAM

6.2.1 Soil

A total of 38 soil borings were completed on the Columbus McKinnon property, as a part of the present RI, during the period April 10 to April 19, 1990 to collect soil samples required to further define the vertical and horizontal distribution of site-related contaminants. Ten additional soil borings were completed on the adjacent Conrail property during the period August 21 to August 24, 1990. The locations of all boreholes are shown on Plate 1. Each of the borings was advanced to at least the top of the zone of saturation. The boring number, total depth, and sampling intervals for the samples collected are provided on Table 6-6.

All borings were sampled continuously from the surface. In accordance with the RI Work Plan, soil boring locations were selected using a sampling grid established across the entire study area (see Section 4.2.1). Soil samples collected for PCB and metals analysis at each sampling location were selected as follows:

MALCOLM PIRNIE

TABLE 6-5

COLUMBUS McKINNON CORP.

SUMMARY OF HISTORIC GROUND WATER MONITORING DATA (ug/l)

DATE	REFERENCE	SAMPLED BY	PARAMETER	* OW 1-83	* OW 2-83	DUPLICATE	FIELD BLANK	COMMENTS
8/15/83	(1)	AES	THO TVHO PCBs	1.7 19 ND	74 3142 ND		ND 3.4 ND	
10/20/83	(1)	AES	TVHO TCE Tetrachloroethene Methylene Chloride	39	1844 56 34 72	2710 58 31 162	15 ND ND ND	
8/27/84	(1)	AES	Vinyl Chloride Trans 1,2-DCE		160 160		ND ND	Tested for 113 organic Organic priority pollutants
1/14/85	(2)	AES	Vinyl Chloride Trans 1,2-DCE		115 100			Sample split with NYSDEC
9/25/85	(3)		TCE Vinyl Chloride 1,1-DCE		120 290 129			No semi volatiles detected

REFERENCES:

(1) "Ground Water and Additional Sampling Program," report prepared by Advanced Environmental Systems, Inc. for Columbus McKinnon Corp. dated December 1983.

(2) "OW-2 Groundwater Sample Split with the DEC," report prepared by Advanced Environmental Systems, Inc. for Columbus McKinnon Corp. dated February 18, 1985.

(3) NYSDEC, December 1985; Letter to Mr. John Dicky from Mr. Peter Beuchi, NYSDEC.

ND = Not Detected

* = Earth Dimensions, Inc. installed Wells OW 1-83 and OW 2-83 on August 8 and 9, 1983.

MALCOLM PIRNIE

TABLE 6-6

COLUMBUS McKINNON CORP.

BORING DEPTHS AND SAMPLING INTERVALS

Boring No.	Total Depth (ft)	Analytical Sampling Interval (ft below ground surface)
SB 90-1	8	0-2 4-6 6-8
SB 90-2	8	0-2 4-6 6-8
SB 90-3	8	4-6 6-8
SB90-4	8	0-2 4-6 6-8
SB 90-5	8	0-2 4-6 6-8
SB 90-6	6	0-2 4-6
SB 90-7	8	0-2 6-8
SB 90-8	6	4-6
SB 90-9	8	4-6
SB 90-10	14	0-2 6-8 12-14
SB 90-11	6	0-2 4-6
SB 90-12	8	0-2 4-6
SB 90-13	10	0-2 4-6 8-10
SB 90-14	16	4-6 8-10 14-16
SB 90-15	14	4-6 8-10 12-14
SB 90-16	8	4-6 6-8
SB 90-17	8	4-6 6-8

(continued)

MALCOLM PIRNIE

TABLE 6-6

COLUMBUS McKINNON CORP.

BORING DEPTHS AND SAMPLING INTERVALS

Boring No.	Total Depth (ft)	Analytical Sampling Interval (ft below ground surface)
SB 90-18	8	4-6 6-8
SB 90-19	10	4-6 8-10
SB 90-20	14	6-8 10-12 12-14
SB 90-21	16	6-8 14-16
SB 90-22	12	0-2 6-8 10-12
SB 90-23	12	4-6 10-12
SB 90-24	12	4-6 10-12
SB 90-25	10	0-2 4-6 8-10
SB 90-26	12	0-2 4-6 10-12
SB 90-27	8	0-2 6-8
SB 90-28	12	0-2 4-6 10-12
SB 90-29	12	4-6 6-8 8-10 10-12
SB 90-30	12	4-6 6-8 10-12
SB 90-31	10	4-6 8-10
SB 90-32	12	4-6 10-12
SB 90-33	22	4-6 6-8 20-22

(continued)

TABLE 6-6

COLUMBUS McKINNON CORP.

BORING DEPTHS AND SAMPLING INTERVALS

Boring No.	Total Depth (ft)	Analytical Sampling Interval (ft below ground surface)
SB 90-34	18	4-6 8-10 10-12 16-18
SB 90-35	14	4-6 6-8 8-10 12-14
SB 90-36	12	4-6 6-8 10-12
SB 90-37	16	0-2 4-6 6-8 14-16
SB 90-38	12	0-2 4-6 10-12
SB 90-39	12	4-6 10-12
SB 90-40	14	4-6 12-14
SB 90-41	14	4-6 8-10 12-14
SB 90-42	12	0-2 4-6 10-12
SB 90-43	14	0-2 4-6 12-14
SB 90-44	12	0-2 4-6 10-12
SB 90-45	14	0-2 4-6 12-14
SB 90-46	14	0-2 4-6 12-14
SB 90-47	14	0-2 4-6 10-12

(continued)

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TABLE 6-6

COLUMBUS McKINNON CORP.

BORING DEPTHS AND SAMPLING INTERVALS

Boring No.	Total Depth (ft)	Analytical Sampling Interval (ft below ground surface)
SB 90-48	10	0-2 4-6 8-10
MW-1D	32	0-2 4-6 6-8 18-20 36-38
MW-2D	36	0-2 4-6 6-8
MW-3	30	4-6

- at the surface (0-2 foot depth) at locations where PCB concentrations have not previously been determined;
- at the 4-6 foot interval;
- at the apparent unsaturated/saturated zone interface as determined during drilling;
- at select intervals based on field evidence of contamination (i.e., sheen, discoloration, odor, or high total organic vapor analyzer measurements); and
- at the interval 2 to 4 feet below the maximum depth of any apparent contamination.

In addition, in accordance with the RI Work Plan Addendum (MPI, 1990c), a minimum of twenty (20) soil samples were collected for halogenated volatile organic analysis (see Table 6-2). Specific samples selected for analysis were those exhibiting an HNu total organic vapor analyzer reading greater than 3 ppm above background using the screening procedure presented in the RI Work Plan Addendum (MPI, 1990c).

Split-spoon samples were continuously logged with respect to sample recovery and soil/sediment color, grain size, moisture, and any evidence of contamination based upon visual observation and/or total organic vapor readings recorded using an HNu photoionization detector with a 10.2 eV probe. Organic vapor concentrations were determined by headspace analyses. Field observations of apparent contamination recorded during the RI soil boring program which served as a guide for the selection of specific soil samples for laboratory analysis are summarized in Table 6-7. Also included in Table 6-7 are observations recorded for historic borings. Detailed soil boring logs are provided in Appendices B-3 and B-4.

6.2.2 Ground Water

The five (5) monitoring wells installed during the RI were sampled initially May 18 and May 19, 1990. Well locations are shown on Plate 1. After discussion of the first round monitoring results with NYSDEC, it was agreed to perform a second round of ground water monitoring during May 1991 in order to resolve questions regarding the interpretation of the May

TABLE 6-7

COLUMBUS McKINNON CORP.

SOIL BORING FIELD OBSERVATIONS[1]

BORING NUMBER	BOREHOLE INTERVAL[2]	HEADSPACE ANALYSIS HNu RANGE (ppm)	FIELD OBSERVATIONS	BOREHOLE INTERVALS ANALYZED	FILL THICKNESS
SB 90-10	6-8 8-10 10-12	2.0 2.5 2.0	oil sheen; odor oil sheen; odor	0-2 6-8 12-14	4.3 <6.0
SB 90-13	4-6	2.5	oil sheen; odor	0-2 4-6 8-10	<6.5 <8.0
SB 90-14	6-8	0.0	oil sheen	4-6 8-10 14-16	8.3
SB 90-15	6-8 8-10	2.0 NA	odor odor	4-6 8-10 12-14	6.2
SB 90-16	4-6 6-8	2.5 .5		4-6 6-8	2.3
SB 90-20	6-8 8-10 10-12	0.0 0.0 0.0	oil sheen, odor oil sheen oil sheen	6-8 10-12 12-14	>2.8 <6.0
SB 90-21	6-8 8-10 10-12	0.0 0.0 2.0	oil sheen oil sheen oil sheen	6-8 14-16	>6.5 <8.0
SB 90-22	6-8	0.0	odor	0-2 6-8 10-12	>2.3 <6.0
SB 90-23	0-2 4-6	.5 1.5		4-6 10-12	>.3 <2.0
SB 90-24	2-4	1.0		4-6 10-12	.5
SB 90-26	4-6	20.0	staining, odor	0-2 4-6 10-12	2.2
SB 90-28	6-8	0.0	oil sheen	0-2 4-6 10-12	8.1
SB 90-29	6-8	NA	odor	4-6 6-8 8-10 10-12	>4.4 <6.0
SB 90-30	6-8	NA	staining	4-6 6-8 10-12	>2.2 <4.0

(Continued)

MALCOLM PIRNIE

TABLE 6-7

COLUMBUS McKINNON CORP.

SOIL BORING FIELD OBSERVATIONS[1]

BORING NUMBER	BOREHOLE INTERVAL[2]	HEADSPACE ANALYSIS HNu RANGE (ppm)	FIELD OBSERVATIONS	BOREHOLE INTERVALS ANALYZED	FILL THICKNESS
SB 90-37	0-2 6-8 8-10 10-12 12-14	NA 100.0 70.0 7.0 5.0	odor staining staining	0-2 4-6 6-8 14-16	6.4
SB 90-39	2-4	.5		4-6 10-12	>4.4 <6.0
SB 90-40	0-2 2-4 4-6 6-8 8-10 10-12	2.0 4.0 200.0 3.5 6.0 10.0		4-6 12-14	6.2
SB 90-41	6-8 8-10 10-12	50.0 50.0-100.0 200.0	odor odor	4-6 8-10 12-14	>7.1 <8.0
SB 90-43	8-10	0.0	staining	0-2 4-6 12-14	>6.6 <8.0
SB 90-44	2-4 4-6 8-10	2.0 1.0 NA	staining	0-2 4-6 10-12	>4.4 <6.0
SB 90-45	6-8 8-10	1.0 1.0	staining	0-2 4-6 12-14	6.6
SB 90-46	8-10 10-12	0.0 0.0	staining staining	0-2 4-6 12-14	>2.7 <8.0
SB 90-47	8-10	0.0	staining	0-2 4-6 10-12	6.9
SB 90-48	8-10	0.0	staining	0-2 4-6 8-10	4.8
MW 1D	0-2 6-8	.5 0.0	staining	0-2 4-6 6-8 18-20	6.2

(Continued)

TABLE 6-7

COLUMBUS McKINNON CORP.

SOIL BORING FIELD OBSERVATIONS[1]

BORING NUMBER	BOREHOLE INTERVAL[2]	HEADSPACE ANALYSIS HNu RANGE (ppm)	FIELD OBSERVATIONS	BOREHOLE INTERVALS ANALYZED	FILL THICKNESS
MW 1S	5-7 7-9 9-11 11-13	2.0 3.0 2.0 1.0	staining, odor, sheen staining staining	-	>5.5 <7.0
MW 2D	2-4 4-6	1.0 1.5		0-2 4-6 6-8	6.7
MW 2S	5-7 7-9 9-11 11-13 13-15	3.0 50.0 9.0 2.0 1.0	staining	-	>6.4 <7.0
CM 1-89	8-10 10-12 12-14 14-16 16-18 18-20	45.0 7.0 4.0 4.0 4.0 2.0	petroleum odor	-	8.2
CM 2-89	2-4 4-6 6-8 8-10 10-12 14-16	2.0 1.0 0.0 8.0 1.0 0.0	oil sheen tarry material oil sheen, odor discoloration, odor oil sheen	-	8.3
CM 3-89	4-6 6-8 8-10 10-12	2.0 2.0 1.0 1.0	oil sheen oil sheen oil sheen	-	8.1
CM 4-89	None				2.6
CM 5-89	None				0.0
BH 1-81	-	NA	refusal @ .5 ft		NA
BH 2-81	5.5 - 7.0	NA	odor	0 -.5 1.0 - 2.0 4.0 - 5.5 5.5 - 7.0	>7.0

(Continued)

MALCOLM PIRNIE

TABLE 6-7

COLUMBUS McKINNON CORP.

SOIL BORING FIELD OBSERVATIONS[1]

BORING NUMBER	BOREHOLE INTERVAL[2]	HEADSPACE ANALYSIS HNu RANGE (ppm)	FIELD OBSERVATIONS	BOREHOLE INTERVALS ANALYZED	FILL THICKNESS
BH 3-81	-	NA	-	0.5 2.0 - 4.5 4.5 - 5.5 5.5 - 7.0	4.5
BH 4-81	-	NA	-	0.2 .4 - 2.0 4.0 - 5.5 5.5 - 7.0	>7.0
BH 5-81	5.5 - 7.0	NA	odor	0 - .4 1.0 - 1.8 4.0 - 4.5 5.5 - 7.0	>7.0
BH 6-81	-	NA		0 - .2 .8 - 1.7 4.0 - 5.5 5.5 - 7.6	>7.6
BH 7-81	5.5 - 7.0	NA	odor	0 - .4 1.3 - 2.5 4.0 - 5.5 5.5 - 7.0	>7.0
BH 8-81	-	NA	-	0 - .1 3.3 - 3.5 3.5 - 5.5 5.5 - 7.0	3.3
BH 9-81	-	NA	-	0 - 2.0 2.0 - 4.0 4.0 - 5.5 5.5 - 7.0	5.5
B-1-79	.5 - 1.0	NA	oily substance, solvent odor	none	-
B-2-79	.5 - 1.0 1.0 - 1.5 6.0 - 7.0	NA	oily substance oil film or liquid	.5 - 1.5 2.5 - 3.0 6 - 7	-
B-3-79	-	NA	-	0 - 1.0 5.5 - 6.5	
B-4-79	-	NA	-	0 - 2.5 2.5 - 5.0 5.0 - 6.5 7 - 9	

(Continued)

MALCOLM PIRNIE

TABLE 6-7

COLUMBUS McKINNON CORP.

SOIL BORING FIELD OBSERVATIONS[1]

BORING NUMBER	BOREHOLE INTERVAL[2]	HEADSPACE ANALYSIS HNu RANGE (ppm)	FIELD OBSERVATIONS	BOREHOLE INTERVALS ANALYZED	FILL THICKNESS
B-5-79	0 - 1.5 1.5 - 3.5 5 - 6 8 - 9 10 - 11	NA	oil odor in all samples	0 - 1.5 1.5 - 3.5 5 - 6 10 - 11	6.0
B-6-79	0 - 2.5 2.5 - 5	NA	fine metal fragments	0 - 2.5 2.5 - 5.0 7 - 8 9 - 11	7.2
B-7-80	 2.5 - 3.0 3.0 - 3.5	NA	 solvent odor solvent odor	.5 - 1.5 2.5 - 3.0 3.0 - 3.5	
B-8-80	2.5 - 3.0 4.0 - 4.5 4.5 - 5.0	NA	oily film and odor	2 - 2.5 2.5 - 3.0 4 - 4.5 4.5 - 5	-
B-9-80	.5 - 1.0	NA	black carbon waste	2 - 2.5 3.5 - 4 5 - 5.5	-
B-10-81	.5 - 1.0 2 - 3	NA	oil film oily film and metal fragment	.5 - 1.0 2 - 3	-
B-11-81	0 - 1 1.5 - 2 2.5 - 3 3 - 3.5 3.5 - 4 4.5 - 5	NA	oily film oily film oily film wet w/oil liquid wet w/oil liquid wet w/oil liquid	0 - 1 1.5 - 2 2.5 - 3 3 - 3.5 3.5 - 4 4.5 - 5	-
B-12-81	3 - 3.5 5 - 5.5	NA	oily film oily film	2 - 2.5 3 - 3.5 4 - 4.5 4.5 - 5	

NOTES:

(1) Table 6-7 lists only those borings exhibiting detectable organic vapors in headspace or other field evidence of contamination.

(2) Intervals exhibiting field evidence of contamination.

1990 sampling results due to the high sediment content of these samples. Field procedures used during the May 1991 sampling event were modified, based on observations recorded during the May 1990 sampling event, in order to minimize the turbidity (i.e. sediment content) of the ground water samples. Details of all modifications to field procedure are explained in Work Plan Addendums No. 1 and No. 2. Each well was thoroughly purged prior to sampling. All ground water samples were collected using a teflon bailer, which was cleaned between wells using the procedure for decontamination of nondedicated sampling equipment presented in the RI Work Plan (MPI, 1990a). Sampling field logs for May 1990 are provided in Appendix B-7. All documentation for the May 1991 sampling event is presented in Appendix G.

Ground water monitoring parameters and analytical methods are presented in Table 6-1. Field filtered metals and field filtered PCBs were added to the parameter list for the May 1991 event in order to evaluate the influence of suspended soil/fill particles on sampling results. Field filtration was performed, in accordance with the NYSDEC-approved Work Plan Addendum No. 2, by pressurizing the sampling bailer and allowing the sample to pass from the bailer through tubing with an in-line 0.45 μm filter, and then directly into the laboratory-cleaned sample container. This procedure minimized potential sample aeration.

Two (2) monitoring wells installed for the RI (MW-1D and MW-2D) were not sampled. As discussed in the RI Work Plan Addendum, these wells were installed only to evaluate ground water flow parameters.

6.2.3 Creek Sediment

A total of ten (10) creek sediment samples were collected from Ellicott Creek adjacent to the Columbus McKinnon site on May 14 to May 15, 1990. Sediment sampling locations are shown on Plate 1. Historic creek sediment sampling locations are also presented.

Historic sediment sampling previously defined an area of PCB contamination in Ellicott Creek in the vicinity of the alleged former waste oil disposal area extending a distance of 20 to 25 feet into the creek. It is conceivable that PCB-contaminated creek sediments could be removed by stream scour which may occur during the spring runoff. Therefore, the objective of the sediment sampling program conducted during the present RI was to verify the continued presence of PCB contamination of creek sediments in this area.

Sediment sampling included six (6) samples from the area of known contamination (CS-5 to CS-10); two (2) samples (CS-1 and CS-2) collected 100 feet and 160 feet, respectively, downstream from the area of previously identified contamination; and two (2) samples (CS-3 and CS-4) collected upstream in an area previously identified as uncontaminated.

Creek sediment samples were analyzed for the parameters listed in Table 6-1. A description of the creek sediment samples is provided in Table 6-8.

Sediment samples were collected with a stainless steel Ponar Grab Dredge. Collection protocols were in accordance with "Procedures for Collection of Bottom Sediment Samples in Deep Water" provided in the RI Work Plan (MPI, 1990a).

6.3 ANALYTICAL RESULTS

All samples collected during the present RI were analyzed by Wadsworth Alert Laboratories, Inc. The methodology employed for analysis of the soil/sediment and ground water samples has been specifically identified in the RI Work Plan (MPI, 1990a and MPI, 1990b), and is summarized in Table 6-1. The analytical results are summarized in Tables 6-9 through 6-12. These tables present only those parameters for which a value above the laboratory detection limit was found. The complete analytical report is presented in Appendix D. The laboratory report of analytical results and documentation package is provided as Appendix D-1. In addition, an analytical data validation performed to assess the data quality is presented in Appendix D-2. A discussion of the analytical results for all environmental media is presented below.

TABLE 6-8

COLUMBUS McKINNON CORPORATION

CREEK SEDIMENT SAMPLING STATION DESCRIPTIONS

Sampling Station	Approximate Water Depth (ft.)	Observations
1	6.5	Black silt, organic matter
2	6	Black silt, leaves, oily sheen
3	6	Black silt, leaves, very "swampy" odor
4	3	Black silt, leaves; closest to concrete abutment
5	9	Black silt; some black-top encountered
6	6	Black silt
7	8	Black silt, oily film, organic material; 10 feet from bank
8	8	Black silt; 20 feet from bank
9	7	Black silt, oily film, odor of tar/oil; 15 feet from bank
10	8	Black silt, oily film, organic matter; 23 feet from bank

TABLE 6-9
COLUMBUS McKINNON CORP.
TONAWANDA FACILITY
SOIL SAMPLE RESULTS (1)(2)

BORING No. / SAMPLING DEPTH (feet)	MDL (3)	SB 90-1 (0-2)	SB 90-1 (4-6)	SB 90-1 (6-8)	SB 90-2 (0-2)	SB 90-2 (4-6)	SB 90-2 (6-8)	SB 90-3 (4-6)	SB 90-3 (6-8)
VOLATILE ORGANICS (mg/kg)		NA	NA	NA	NA	NA	NA	NA	NA
PCB'S (mg/kg)									
PCB-1254	0.16	0.37 (0.46)	ND	ND	0.29 (0.36)	ND	ND	ND	ND
METALS (mg/kg)									
Cadmium	0.5	1.5 (1.9)	ND	ND	0.60 (0.75)	ND	ND	ND	ND
Chromium	1.0	9.3 (12)	4.7 (7.8)	5.4 (9.0)	14 (18)	6 (10)	5 (8.3)	7.5 (13)	5.8 (9.7)
Nickel	2.0	32 (40)	6.1 (10)	9.5 (16)	26 (33)	8.2 (14)	6 (10)	8.8 (15)	8.6 (14)
Lead	2.5	34 (43)	4.1 (6.8)	4.9 (8.2)	45 (56)	4.7 (7.8)	2.9 (4.8)	4.5 (7.5)	4.9 (8.2)

BORING No. / SAMPLING DEPTH (feet)	MDL (3)	SB 90-4 (0-2)	SB 90-4 (4-6)	SB 90-4 (6-8)	SB 90-5 (0-2)	SB 90-5 (4-6)	SB 90-5 (6-8)	SB 90-6 (0-2)	SB 90-6 (4-6)
VOLATILE ORGANICS (mg/kg)		NA	NA	NA	NA	NA	NA	NA	NA
PCB'S (mg/kg)									
PCB-1254	0.16	1.2 (1.5)	ND	ND	ND	0.19 (0.32)	ND	0.38 (0.48)	ND
PCB-1260	0.16	ND	ND	ND	0.26 (0.33)	ND	ND	ND	ND
METALS (mg/kg)									
Cadmium	0.5	0.80 (1)	ND	ND	4.4 (5.5)	ND	ND	ND	0.80 (1.3)
Chromium	1.0	33 (41)	6.1 (10)	4.7 (7.8)	71 (89)	4.6 (7.7)	7 (12)	5.2 (6.5)	16 (27)
Nickel	2.0	34 (43)	8.5 (14)	7.4 (12)	12 (15)	7.2 (12)	11 (18)	7.4 (9.3)	10 (17)
Lead	2.5	91 (114)	7 (12)	5.2 (8.7)	960 (1200)	5.8 (9.7)	4.5 (7.5)	13 (16)	100 (167)

NOTE:

1. Only those parameters are shown for which any value above laboratory detection limits was found.
2. Concentrations shown in parentheses are the adjusted dry weight concentrations that were calculated according to the procedure described in Section 6.3.1.
3. Method Detection Limit

NA - Not Analyzed

ND - Not Detected at a concentration greater than the indicated detection limit.

J - Estimated value due to limitations identified during the quality control review.

* Field duplicate sample.

TABLE 6-9
COLUMBUS McKINNON CORP.
TONAWANDA FACILITY
SOIL SAMPLE RESULTS (1)(2)

BORING No. SAMPLING DEPTH (feet)	MDL (3)	SB 90-7 (0-2)	SB 90-7 (6-8)	SB 90-8 (4-6)	SB 90-9 (4-6)	SB 90-10 (0-2)	SB 90-10 (6-8)	SB 90-10 (12-14)
VOLATILE ORGANICS (mg/kg)		NA	NA	NA	NA	NA	NA	NA
PCB'S (mg/kg)								
PCB-1254	0.16	ND	ND	ND	ND	1.2 (1.5)	0.2 (0.33)	ND
METALS (mg/kg)								
Cadmium	0.5	0.50 (0.63)	ND	2.2 (3.7)	ND	1.4 (1.8)	1.2 (2.0)	ND
Chromium	1.0	14 (18)	4.9 (8.2)	54 (90)	7 (12)	62 (78)	17 (28)	7.4 (12)
Nickel	2.0	12 (15)	6.2 (10)	97 (162)	15 (25)	47 (59)	26 (43)	13 (22)
Lead	2.5	52 (65)	8.8 (15)	210 (350)	8.8 (15)	180 (225)	84 (140)	6.4 (11)
BORING No. SAMPLING DEPTH (feet)	MDL (3)	SB 90-11 (0-2)	SB 90-11 (4-6)	SB 90-12 (0-2)	SB 90-12 (4-6)	SB 90-13 (0-2)	SB 90-13 (4-6)	SB 90-13 (8-10)
VOLATILE ORGANICS (mg/kg)		NA	NA	NA	NA	NA	NA	NA
PCB'S (mg/kg)								
PCB-1254	0.16	27 (34)	8.7 (11)	0.3 (0.38)	13 (16)	23 (29)	2.1 (2.6)	1.1 (1.8)
METALS (mg/kg)								
Cadmium	0.5	1.3 (1.6)	5.1 (6.4)	1.2 (1.5)	ND	6.3 (7.9)	ND	ND
Chromium	1.0	31 (39)	160 (200)	41 (51)	17 (21)	240 (300)	9.4 (12)	18 (30)
Nickel	2.0	34 (43)	230 (288)	8.1 (10)	10 (13)	77 (96)	13 (16)	23 (38)
Lead	2.5	81 (101)	57 (71)	31 (39)	34 (43)	230 (288)	43 (54)	54 (90)

NOTE:

1. Only those parameters are shown for which any value above laboratory detection limits was found.
2. Concentrations shown in parentheses are the adjusted dry weight concentrations that were calculated according to the procedure described in Section 6.3.1.
3. Method Detection Limit

NA - Not Analyzed
ND - Not Detected at a concentration greater than the indicated detection limit.
J - Estimated value due to limitations identified during the quality control review.
* Field duplicate sample.

TABLE 6-9
COLUMBUS McKINNON CORP.
TONAWANDA FACILITY
SOIL SAMPLE RESULTS (1)(2)

BORING No. SAMPLING DEPTH (feet)	MDL (3)	SB 90-14 (4-6)	SB 90-14 (8-10)	SB 90-14 (14-16)	SB 90-15 (4-6)	SB 90-15 (8-10)	SB 90-15 (12-14)	SB 90-15* (12-14)
VOLATILE ORGANICS (mg/kg)	0.002	NA	ND	NA	NA	ND	NA	ND
PCB'S (mg/kg)								
PCB-1254	0.16	1.9 (3.2)	NA	20 (33)	0.81 (1.0)	NA	ND	ND
METALS (mg/kg)								
Cadmium	0.5	0.90 (1.5)	NA	ND	2.2 (2.8)	NA	ND	ND
Chromium	1.0	67 (112)	NA	21 (35)	36 (45)	NA	4.6 (7.7)	6.1 (10)
Nickel	2.0	89 (148)	NA	19 (32)	25 (31)	NA	7.2 (12)	8.7 (15)
Lead	2.5	110 (183)	NA	14 (23)	56 (70)	NA	4.4 (7.3)	4.6 (7.7)
BORING No. SAMPLING DEPTH (feet)	**MDL (3)**	**SB 90-16 (4-6)**	**SB 90-16 (6-8)**	**SB 90-17 (4-6)**	**SB 90-17* (4-6)**	**SB 90-17 (6-8)**	**SB 90-18 (4-6)**	**SB 90-18 (6-8)**
VOLATILE ORGANICS (mg/kg)		NA	NA	NA	NA	NA	NA	NA
PCB'S (mg/kg)	0.16	ND	ND	ND	ND	ND	ND	ND
METALS (mg/kg)								
Cadmium	0.5	ND	ND	ND	ND	ND	ND	ND
Chromium	1.0	9.2 (12)	8.2 (14)	14 (18)	10 (13)	10 (17)	11 (14)	8.9 (15)
Nickel	2.0	11 (14)	13 (22)	14 (18)	14 (18)	17 (28)	14 (18)	13 (22)
Lead	2.5	8 (10)	5 (8.3)	10 (13)	18 (23)	6.5 (11)	6.3 (7.9)	5.9 (9.8)

NOTE:
1. Only those parameters are shown for which any value above laboratory detection limits was found.
2. Concentrations shown in parentheses are the adjusted dry weight concentrations that were calculated according to the procedure described in Section 6.3.1.
3. Method Detection Limit

NA - Not Analyzed
ND - Not Detected at a concentration greater than the indicated detection limit.
J - Estimated value due to limitations identified during the quality control review.
* Field duplicate sample.

TABLE 6-9
COLUMBUS McKINNON CORP.
TONAWANDA FACILITY
SOIL SAMPLE RESULTS (1)(2)

BORING No. / SAMPLING DEPTH (feet)	MDL (3)	SB 90-19 (4-6)	SB 90-19 (8-10)	SB 90-20 (6-8)	SB 90-20 (10-12)	SB 90-20 (12-14)	SB 90-21 (6-8)	SB 90-21 (14-16)
VOLATILE ORGANICS (mg/kg)	0.002	NA	NA	NA	ND	NA	NA	NA
PCB'S (mg/kg)								
PCB-1254	0.16	ND	ND	6.1 (10)	ND	NA	0.46 (0.77)	ND
METALS (mg/kg)								
Cadmium	0.5	ND	ND	140 (233)	NA	ND	19 (32)	ND
Chromium	1.0	8.8 (11)	11 (18)	120 (200)	NA	6.2 (10)	14 (23)	7.6 (13)
Nickel	2.0	10 (13)	13 (22)	250 (417)	NA	10 (17)	15 (25)	12 (20)
Lead	2.5	5.9 (7.4)	7 (12)	660 (1100)	NA	5.2 (8.7)	33 (55)	5.6 (9.3)

BORING No. / SAMPLING DEPTH (feet)	MDL (3)	SB 90-22 (0-2)	SB 90-22 (6-8)	SB 90-22 (10-12)	SB 90-23 (4-6)	SB 90-23 (10-12)	SB 90-24 (4-6)	SB 90-24 (10-12)
VOLATILE ORGANICS (mg/kg)		NA	NA	NA	NA	NA	NA	NA
PCB'S (mg/kg)								
PCB-1254	0.16	16 (20)	3.4 (5.7)	ND	ND	ND	ND	ND
METALS (mg/kg)								
Cadmium	0.5	18 (23)	12 (20)	1.4 (2.3)	ND	ND	ND	ND
Chromium	1.0	180 (225)	60 (100)	11 (18)	8.8 (11)	7 (12)	9.6 (12)	7.2 (12)
Nickel	2.0	240 (300)	110 (183)	18 (30)	12 (15)	12 (20)	13 (16)	12 (20)
Lead	2.5	190 (238)	290 (483)	140 (233)	6.2 (7.8)	5.6 (9.3)	5.3 (6.6)	4.7 (7.8)

NOTE:

1. Only those parameters are shown for which any value above laboratory detection limits was found.
2. Concentrations shown in parentheses are the adjusted dry weight concentrations that were calculated according to the procedure described in Section 6.3.1.
3. Method Detection Limit

NA - Not Analyzed
ND - Not Detected at a concentration greater than the indicated detection limit.
J - Estimated value due to limitations identified during the quality control review.
* Field duplicate sample.

TABLE 6-9

COLUMBUS McKINNON CORP.

TONAWANDA FACILITY

SOIL SAMPLE RESULTS (1)(2)

BORING No. / SAMPLING DEPTH (feet)	MDL (3)	SB 90-25 (0-2)	SB 90-25 (4-6)	SB 90-25 (8-10)	SB 90-26 (0-2)	SB 90-26 (4-6)	SB 90-26 (10-12)	SB 90-27 (0-2)	SB 90-27 (6-8)
VOLATILE ORGANICS (mg/kg)		NA	NA	NA	NA		NA	NA	NA
1,2-Dichlorobenzene	0.002					0.110J (0.138J)			
1,3-Dichlorobenzene	0.002					0.016J (0.02J)			
1,4-Dichlorobenzene	0.002					0.004J (0.005J)			
PCB'S (mg/kg)									
PCB-1254	0.16	11 (14)	ND	ND	0.7 (0.9)	38 (48)	ND	41 (51)	ND
METALS (mg/kg)									
Cadmium	0.5	ND	ND	ND	1.6 (2.0)	ND	ND	0.9 (1.1)	ND
Chromium	1.0	11 (14)	9.5 (12)	7.4 (12)	18 (23)	7.6 (9.5)	6.2 (10)	23 (29)	7 (12)
Nickel	2.0	15 (19)	16 (20)	10 (17)	26 (33)	12 (15)	9.9 (17)	30 (38)	9.8 (16)
Lead	2.5	15 (19)	5.9 (7.4)	4.6 (7.7)	80 (100)	4.7 (5.9)	3.1 (5.2)	65 (81)	12 (20)

BORING No. / SAMPLING DEPTH (feet)	MDL (3)	SB 90-28 (0-2)	SB 90-28 (4-6)	SB 90-28 (10-12)	SB 90-29 (4-6)	SB 90-29 (6-8)	SB 90-29 (8-10)	SB 90-29 (10-12)
VOLATILE ORGANICS (mg/kg)	0.002	NA	NA	NA	NA	ND	ND	NA
PCB'S (mg/kg)								
PCB-1254	0.16	53 (66)	2.3 (2.9)	ND	18 (23)	NA	NA	ND
METALS (mg/kg)								
Cadmium	0.5	1.8 (2.3)	18 (23)	ND	36 (45)	NA	NA	1.2 (2.0)
Chromium	1.0	160 (200)	180 (225)	5.8 (9.7)	140 (175)	NA	NA	11 (18)
Nickel	2.0	250 (313)	240 (300)	11 (18)	350 (438)	NA	NA	14 (23)
Lead	2.5	130 (163)	190 (238)	4.5 (7.5)	440 (550)	NA	NA	16 (27)

NOTE:

1. Only those parameters are shown for which any value above laboratory detection limits was found.
2. Concentrations shown in parentheses are the adjusted dry weight concentrations that were calculated according to the procedure described in Section 6.3.1.
3. Method Detection Limit

NA - Not Analyzed

ND - Not Detected at a concentration greater than the indicated detection limit.

J - Estimated value due to limitations identified during the quality control review.

* Field duplicate sample.

TABLE 6-9
COLUMBUS McKINNON CORP.
TONAWANDA FACILITY
SOIL SAMPLE RESULTS (1)(2)

BORING No. / SAMPLING DEPTH (feet)	MDL (3)	SB 90-30 (4-6)	SB 90-30 (6-8)	SB 90-30 (10-12)	SB 90-31 (4-6)	SB 90-31 (8-10)	SB 90-32 (4-6)	SB 90-32 (10-12)
VOLATILE ORGANICS (mg/kg)				NA		NA		NA
Trichloroethylene	0.002	.015J (.019J)			<0.3		<0.3	
Chlorobenzene	0.002		.009J (0.15J)					
PCB'S (mg/kg)								
PCB-1254	0.16	ND	NA	ND	2.6 (3.3)	ND	14 (18)	ND
METALS (mg/kg)								
Cadmium	0.5	2.2 (2.8)	NA	ND	ND	ND	ND	ND
Chromium	1.0	22 (28)	NA	7.5 (13)	9.8 (12)	7 (12)	11 (14)	7.5 (13)
Nickel	2.0	34 (43)	NA	11 (18)	16 (20)	12 (20)	17 (21)	14 (23)
Lead	2.5	44 (55)	NA	17 (28)	6.3 (7.9)	3.2 (5.3)	8.4 (11)	5 (8.3)
BORING No. / SAMPLING DEPTH (feet)	**MDL (3)**	**SB 90-33 (4-6)**	**SB 90-33 (6-8)**	**SB 90-33 (20-22)**	**SB 90-34 (4-6)**	**SB 90-34 (8-10)**	**SB 90-34 (10-12)**	**SB 90-34 (16-18)**
VOLATILE ORGANICS (mg/kg)								
1,2-Dichlorobenzene	0.002	5J (6.2J)	27 (45)	NA	NA	<0.28	NA	NA
1,4-Dichlorobenzene	0.002	0.38J (0.48J)						
PCB'S (mg/kg)								
PCB-1254	0.16	NA	36 (60)	ND	0.37 (0.62)	3 (5.0)	0.18 (0.3)	ND
METALS (mg/kg)								
Cadmium	0.5	NA	ND	ND	ND	ND	ND	ND
Chromium	1.0	NA	12 (20)	9.5 (16)	10 (17)	8 (13)	6.1 (10)	8.2 (14)
Nickel	2.0	NA	15 (25)	13 (22)	14 (23)	11 (18)	9.8 (16)	14 (23)
Lead	2.5	NA	6.9 (12)	7.9 (13)	10 (17)	7 (12)	5.4 (9.0)	14 (23)

NOTE:

1. Only those parameters are shown for which any value above laboratory detection limits was found.
2. Concentrations shown in parentheses are the adjusted dry weight concentrations that were calculated according to the procedure described in Section 6.3.1.
3. Method Detection Limit

NA - Not Analyzed
ND - Not Detected at a concentration greater than the indicated detection limit.
J - Estimated value due to limitations identified during the quality control review.
* Field duplicate sample.

TABLE 6-9
COLUMBUS McKINNON CORP.
TONAWANDA FACILITY
S0IL SAMPLE RESULTS (1)(2)

BORING No. / SAMPLING DEPTH (feet)	MDL (3)	SB 90-35 (4-6)	SB 90-35 (6-8)	SB 90-35 (8-10)	SB 90-35 (12-14)	SB 90-35 (20-22)	SB 90-36 (4-6)	SB 90-36 (6-8)	SB 90-36 (10-12)
VOLATILE ORGANICS (mg/kg)		NA			NA	NA			NA
cis-1,2-Dichloroethene	0.002		<0.45	<9			.019J (.024J)	<0.18	
Tetrachloroethylene	0.002						.011J (.014J)		
Trichloroethylene	0.002						.043J (.054J)		
PCB'S (mg/kg)									
PCB-1254	0.16	11 (14)	NA	NA	ND	1.8 (3.0)	ND	NA	ND
METALS (mg/kg)									
Cadmium	0.5	4.1 (5.1)	NA	NA	ND	0.8 (1.3)	20 (25)	NA	ND
Chromium	1.0	75 (94)	NA	NA	10 (17)	21 (35)	190 (238)	NA	11 (18)
Nickel	2.0	220 (275)	NA	NA	16 (27)	36 (60)	740 (925)	NA	15 (25)
Lead	2.5	210 (263)	NA	NA	13 (22)	15 (25)	1400 (1750)	NA	5.3 (8.8)

BORING No. / SAMPLING DEPTH (feet)	MDL (2)	SB 90-37 (0-2)	SB 90-37 (4-6)	SB 90-37 (6-8)	SB 90-37* (6-8)	SB 90-37 (14-16)	SB 90-37* (14-16)
VOLATILE ORGANICS (mg/kg)			NA			NA	NA
1,2-Dichlorobenzene	0.002	<0.47		<0.3	.003J (.005J)		
Dichloropropane	0.002				.017J (.028J)		
Tetrachloroethylene	0.002				.005J (.008J)		
Trichloroethylene	0.002				.004J (.007J)		
PCB'S (mg/kg)							
PCB-1254	0.16	240 (300)	2.3 (2.9)	NA	NA	ND	ND
METALS (mg/kg)							
Cadmium	0.5	3.2 (4.0)	4.6 (5.8)	NA	NA	ND	ND
Chromium	1.0	28 (35)	300 (375)	NA	NA	7.8 (13)	3.8 (6.3)
Nickel	2.0	99 (124)	560 (700)	NA	NA	13 (22)	6.6 (11)
Lead	2.5	390 (488)	1000 (1250)	NA	NA	5.5 (9.2)	4.1 (6.8)

NOTE:

1. Only those parameters are shown for which any value above laboratory detection limits was found.
2. Concentrations shown in parentheses are the adjusted dry weight concentrations that were calculated according to the procedure described in Section 6.3.1.
3. Method Detection Limit

NA - Not Analyzed
ND - Not Detected at a concentration greater than the indicated detection limit.
J - Estimated value due to limitations identified during the quality control review.
* Field duplicate sample.

TABLE 6-9
COLUMBUS McKINNON CORP.
TONAWANDA FACILITY
S0IL SAMPLE RESULTS (1)(2)

BORING No. / SAMPLING DEPTH (feet)	MDL (3)	SB 90-38 (0-2)		SB 90-38 (4-6)		SB 90-38 (10-12)		MW2D (0-2)		MW2D (4-6)		MW2D (6-8)	
VOLATILE ORGANICS (mg/kg)		NA		NA		NA		NA		NA			
1,1,1-Trichloroethene	0.002											0.003	(0.005)
PCB'S (mg/kg)													
PCB-1254	0.16	50	(63)	9.9	(12)	ND		2.1	(2.6)	5.9	(7.4)	ND	
METALS (mg/kg)													
Cadmium	0.5	17	(21)	6.5	(8.1)	ND		22	(28)	4	(5.0)	2	(3.3)
Chromium	1.0	190	(238)	130	(163)	7.1	(12)	260	(325)	230	(288)	15	(25)
Nickel	2.0	420	(525)	320	(400)	9.4	(16)	830	(1038)	540	(675)	100	(167)
Lead	2.5	5400	(6750)	420	(525)	4.5	(7.5)	1200	(1500)	310	(388)	170	(283)
BORING No. / SAMPLING DEPTH (feet)	MDL (2)	MW-1D (0-2)		MW-1D (4-6)		MW-1D (6-8)		MW-1D * (6-8)		MW-1D (18-20)		MW-3 (4-6)	
VOLATILE ORGANICS (mg/kg)		NA		NA		NA		NA		NA		NA	
PCB'S (mg/kg)													
PCB-1254	0.16	15	(19)	1.6	(2.0)	ND		ND		ND		ND	
METALS (mg/kg)													
Cadmium	0.5	16	(20)	6.4	(8.0)	ND		ND		ND		0.6	(1.0)
Chromium	1.0	83	(104)	41	(51)	6.6	(11)	9.4	(16)	3.8	(6.3)	12	(20)
Nickel	2.0	290	(363)	140	(175)	10	(17)	13	(22)	7.4	(12)	14	(23)
Lead	2.5	720	(900)	1800	(2250)	10	(17)	24	(40)	4.4	(7.3)	13	(22)

NOTE:
1. Only those parameters are shown for which any value above laboratory detection limits was found.
2. Concentrations shown in parentheses are the adjusted dry weight concentrations that were calculated according to the procedure described in Section 6.3.1.
3. Method Detection Limit

NA - Not Analyzed
ND - Not Detected at a concentration greater than the indicated detection li
J - Estimated value due to limitations identified during the quality control re
* Field duplicate sample.

TABLE 6-9
COLUMBUS McKINNON CORP.
TONAWANDA FACILITY
SOIL SAMPLE RESULTS (1,2)

BORING No. / SAMPLING DEPTH (feet)	MDL(3)	SB 90-39 (4-6)	SB 90-39 (10-12)	SB 90-40 (4-6)	SB 90-40 (12-14)	SB 90-41 (4-6)	SB 90-41 (8-10)	SB 90-41 (12-14)	
VOLATILE ORGANICS (mg/kg)	0.002	NA	NA	NA	NA	NA	ND	NA	
PCB'S (mg/kg)									
PCB-1254	0.16	0.360 (0.45)	ND	2.4 (3.0)	ND	3.2 (4.0)	17 (28)	ND	
METALS (mg/kg)									
Cadmium	0.5	8.4 (11)	ND	5 (6.3)	ND	5.2 (6.5)	0.8 (1.3)	ND	
Chromium	1	110 (138)	15 (25)	270 (338)	6.9 (12)	140 (175)	99 (165)	8.5 (14)	
Nickel	2	130 (163)	20 (33)	2200 (2750)	12 (20)	480 (600)	760 (1267)	14 (23)	
Lead	2.5	2400 (3000)	12 (20)	350 (438)	3 (5.0)	1100 (1375)	91 (152)	2.9 (4.8)	

BORING No. / SAMPLING DEPTH (feet)	MDL(3)	SB 90-42 (0-2)	SB 90-42 (4-6)	SB 90-42* (4-6)	SB 90-42 (10-12)	SB 90-43 (0-2)	SB 90-43 (4-6)	SB 90-43 (12-14)	SB 90-44 (0-2)
VOLATILE ORGANICS (mg/kg)		NA			NA	NA	NA	NA	NA
1,2-Dichloroethane			.004 J (.005J)						
Dichloromethane	0.002		.005 B (.006B)	.005 B (.006B)					
Trichloroethylene	0.002		.003 J (.004J)						
PCB'S (mg/kg)									
PCB-1254	0.16	57 (71)	ND	ND	ND	ND	0.61 (0.76)	ND	0.500 (0.63)
METALS (mg/kg)									
Cadmium	0.5	10 (13)	21 J (26J)	ND	ND	14 (18)	17 (21)	ND	91 (114)
Chromium	1	47 (59)	710 J (888J)	21 J (26J)	8.4 (14)	440 (550)	300 (375)	6.6 (11)	440 (550)
Nickel	2	60 (75)	650 J (813J)	38 J (48J)	12 (20)	600 (750)	510 (638)	9.4 (16)	890 (1113)
Lead	2.5	250 (313)	3800 J (4750J)	0.5 J (0.6J)	1.5 (2.5)	13000 (16250)	1800 (2250)	7 (12)	3000 (3750)

NOTE:

1. Only those parameters are shown for which any value above laboratory detection limits was found.
2. Concentrations shown in parentheses are the adjusted dry dry weight concentrations that were calculated according to the procedure described in Section 6.3.1.
3. Method Detection Limit.

NA - Not analyzed
ND - Not dectected at a concentration greater than the indicated detection limit.
J= Estimated value due to limitations identified during the quality control review.
B= Estimated detection limit due to blank contamination.
* Field duplicate sample.

TABLE 6-9
COLUMBUS McKINNON CORP.
TONAWANDA FACILITY
SOIL SAMPLE RESULTS (1,2)

BORING No. SAMPLING DEPTH (feet)	MDL(3)	SB 90-44 (4-6)	SB 90-44 (10-12)	SB 90-45 (0-2)	SB 90-45* (0-2)	SB 90-45 (4-6)	SB 90-45 (12-14)	SB 90-46 (0-2)	
VOLATILE ORGANICS (mg/kg)		NA	NA	NA	NA	NA	NA	NA	
PCB'S (mg/kg)									
PCB-1254	0.16	ND	ND	.180 J (0.23J)	0.86 J (1.1J)	ND	ND	4.1 (5.1)	
METALS (mg/kg)									
Cadmium	0.5	36 (45)	ND	80 J (100J)	45 J (56J)	0.6 (0.8)	ND	1.5 (1.9)	
Chromium	1	280 (350)	10 (17)	640 J (800J)	460 J (575J)	47 (59)	10 (17)	300 (375)	
Nickel	2	190 (238)	14 (23)	520 (650)	470 (588)	110 (138)	15 (25)	1000 (1250)	
Lead	2.5	2500 (3125)	5 (8.3)	2600 J (3250J)	14000 J (17500J)	990 (1238)	7 (12)	260 (325)	
BORING No. SAMPLING DEPTH (feet)	**MDL(3)**	**SB 90-46 (4-6)**	**SB 90-46 (12-14)**	**SB 90-47 (0-2)**	**SB 90-47 (4-6)**	**SB 90-47 (10-12)**	**SB 90-48 (0-2)**	**SB 90-48 (4-6)**	**SB 90-48 (8-10)**
VOLATILE ORGANICS (mg/kg)		NA	NA	NA	NA	NA	NA	NA	NA
PCB'S (mg/kg)									
PCB-1254	0.16	1.3 (1.6)	ND	3.1 (3.9)	3.8 (4.8)	ND	57 (71)	1.4 (1.8)	ND
METALS (mg/kg)									
Cadmium	0.5	15 (19)	ND	43 (54)	5.6 (7.0)	ND	44 (55)	3.1 (3.9)	ND
Chromium	1	270 (338)	14 (23)	140 (175)	150 (188)	9 (15)	270 (338)	21 (26)	10 (13)
Nickel	2	620 (775)	20 (33)	390 (488)	190 (238)	12 (20)	440 (550)	45 (56)	15 (19)
Lead	2.5	3000 (3750)	6 (10)	2000 (2500)	470 (588)	130 (217)	1300 (1625)	100 (125)	2.4 (3.0)

NOTE:

1. Only those parameters are shown for which any value above laboratory detection limits was found.
2. Concentrations shown in parentheses are the adjusted dry dry weight concentrations that were calculated according to the procedure described in Section 6.3.1.
3. Method Detection Limit.

NA - Not analyzed
ND - Not dectected at a concentration greater than the indicated detection limit.
J= Estimated value due to limitations identified during the quality control review.
B= Estimated detection limit due to blank contamination.
* Field duplicate sample.

TABLE 6-10
COLUMBUS MCKINNON CORPORATION
TONAWANDA FACILITY
GROUND WATER SAMPLE RESULTS

PARAMETER (1)	MW-1S			MW-1I			MW-2S			MW-2I			MW-3			MW-4*	MW-2I **	
	MAY 1990	MAY 1991		MAY 1990	MAY 1991		MAY 1990	MAY 1991		MAY 1990	MAY 1991		MAY 1990	MAY 1991		MAY 1990	MAY 1991	
	TOTAL	TOTAL	FF	TOTAL	TOTAL	FF	TOTAL	TOTAL	FF	TOTAL	TOTAL	FF	TOTAL	TOTAL	FF	TOTAL	TOTAL	FF
PCBs (ug/l)																		
PCB-1254	2	<1.1	<1.3	<1.0	<1.1	<1.0	40	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
PCB-1242	<0.5	<0.54	<0.63	<0.5	<0.55	<0.50	<0.5	<0.50	<0.50	0.7	<0.50	<0.50	<0.5	<0.50	<0.50	<0.5	<0.50	<0.50
VOLATILE ORGANICS (ug/l)																		
Methylene Chloride	<1.0	7.9B	-	<1.0	2.3B	-	<1.0	8.6B	-	<1.0	8.6B	-	<1.0	7.4B	-	<1.0	4.1B	-
Chloroethane	<1.0	<5.2	-	<1.0	<5.2	-	3	<5.2	-	<1.0	<5.2	-	<1.0	<5.2	-	<1.0	<5.2	-
1,1-Dichloroethane	<1.0	<0.70	-	<1.0	<0.70	-	3	2J	-	<1.0	<0.70	-	<1.0	<0.70	-	<1.0	<0.70	-
cis-1,2-Dichloroethylene	<1.0	NA	-	<1.0	NA	-	4	NA	-	<1.0	NA	-	<1.0	NA	-	<1.0	NA	-
Tetrachloroethylene	<1.0	1.6B	-	<1.0	0.58B	-	1	8.9J	-	<1.0	1.5B	-	<1.0	0.85B	-	<1.0	0.59B	-
Trichloroethylene	<1.0	<1.2	-	<1.0	<1.2	-	4	12J	-	<1.0	<1.2	-	<1.0	<1.2	-	<1.0	<1.2	-
METALS (ug/l)																		
Cadmium	9	<5.0	<5.0	<1.0	<5.0	<5.0	8	<5.0	<5.0	<1.0	<5.0	<5.0	1	<5.0	<5.0	<1.0	<5.0	<5.0
Chromium	50	14	<10	<5.0	<10	<10	130	<10	<10	<5.0	<10	<10	8	<10	<10	<5.0	<10	<10
Nickel	90	<40	<40	<4.0	<40	<40	410	88	82	<4.0	<40	<40	<4.0	<40	<40	<4.0	<40	<40
Lead	150	22	<3.0	<5.0	<3.0	<3.0	240	<3.0	<3.0	<5.0	<3.0	<3.0	20	<3.0	<3.0	<5.0	<3.0	<3.0

NOTE:
1. Only those parameters are shown for which any value above laboratory detection limits was found.
< – Not detected at a concentration greater than the indicated method detection limit.
NA – Not analyzed
FF– Field Filtered
B– Estimated detection limit due to blank contamination.
J– Estimated value due to limitations identified during the quality control review.
* Field duplicate of MW-1I for MAY 1990.
** Field duplicate of MW-2I for MAY 1991.

MALCOLM PIRNIE

TABLE 6-11

COLUMBUS McKINNON CORP.

SUMMARY OF FIELD MEASUREMENT DURING GROUND WATER SAMPLING[1]

Parameter	MW-1S		MW-1I		MW-2S		MW-2I		MW-3	
	May '90	May '91	May '90	May '91	May '90	May '91	May '90	May '91	May '90	May '91
pH (units)	7.27	7.41	6.85	7.06	7.06	7.23	6.87	7.54	7.07	7.31
Specific Conductivity (umhos/cm)	565	410	1300	800	1490	700	1275	940	1020	650
Temperature (°C)	11.3	10.2	12.4	11.7	11.6	12.6	12	17.3	9.6	10.1
Turbidity (NTU)	>100	37	50	4.7	>100	33	34	4	>100	15
Visual Appearance	Sheen noted; silty	Color, some floc	Clear	Clear	Silty	Color, some floc	Clear	Clear	Silty	Clear
Water Level (ft below TOR)	6.50	6.75	5.51	6.20	8.41	8.92	8.05	8.62	6.05	6.40
Free Product Level	None	None	None	None	None	None	None	None	None	None

NOTE (1): Sampling conducted May 18, 1990 and May 1-2, 1991.

TABLE 6-12
COLUMBUS MCKINNON CORPORATION
TONAWANDA FACILTY
CREEK SEDIMENT SAMPLE RESULTS

PARAMETER	DL(2)	Creek Sediment #1	Creek Sediment #2	Creek Sediment #3	Creek Sediment #4	Creek Sediment #5	Creek Sediment #6
PCB'S (mg/kg) (1)							
PCB-1254	0.16	0.39	0.48	0.25	ND	41	2.6
METALS (mg/kg)							
Cadmium	0.5	0.7	0.8	0.8	ND	1.4	1
Chromium	1.0	12	9	14	6.4	17	20
Nickel	2.0	11	8.9	11	5.3	26	17
Lead	2.5	47	29	67	23	59	68
PARAMETER	DL(2)	Creek Sediment #7	Creek Sediment #8	Creek Sediment #9	Creek Sediment #10	Creek Sediment #11*	
PCB'S (mg/kg) (1)							
PCB-1254	0.16	9	ND	9.3	1.5	0.27J	
METALS (mg/kg)							
Cadmium	0.5	0.6	0.6J	2.4	0.7	ND	
Chromium	1.0	16	11	23	19	9.8	
Nickel	2.0	20	9	23	14	7.2	
Lead	2.5	130	38	50	77	34	

NOTE:

1. Arochlor 1254 was the only PCB detected.
2. Analytical Detection Limit

ND - Not detected at a concentration greater than the indicated detection limit.

* Field duplicate of Creek Sediment #8

6.3.1 Soil

Soil sample results for those parameters detected at a minimum of one location are presented in Table 6-9. Analytical results for the soil analyses were reported by Wadsworth Laboratory on a wet-weight basis, and sample moisture contents were not determined. Subsequently, at the direction of NYSDEC, the analytical results (as reported by Wadsworth) were adjusted to a dry weight basis using estimated moisture contents. Analytical results are shown on an adjusted dry weight basis in parentheses on Table 6-9.

The soil moisture contents were estimated based on measured moisture contents that were determined on NYSDEC split samples. Moisture contents of unsaturated fill during the May and August soil sampling events ranged from 13 to 17% and 6 to 21%, respectively. Based on these results, all samples collected from above the water table were conservatively assigned a moisture content of 20%. Measured moisture contents from saturated samples (NYSDEC splits) ranged from 34 to 41%. Therefore, all samples collected from below the water table were assigned a moisture content of 40%. Appendix F provides a list of NYSDEC sample numbers and moisture determination results; and a listing of the assigned moisture contents for each RI soil/fill sample.

Historic data are assumed to have been reported on a dry weight basis although the reporting basis is not documented on the historic laboratory analytical reports. All concentrations of contaminants in soil/fill samples discussed in Sections 6.3.1.1 to 6.3.1.3 are on an adjusted dry weight basis.

A discussion of the character of contamination found at the site is presented below. For the purpose of the soil results discussion, the site has been segregated into the following areas (see Plates 4, 5, and 6):

- North Area - north of the office;
- Central Area - the area now covered by plastic sheeting, which includes the alleged former waste oil disposal area; and
- South Area - Conrail property, between the railroad embankment and Ellicott Creek.

A summary of historic and present RI soil sampling results for each of these areas is presented on Tables 6-13 through 6-15. Plates 4, 5, 6, and 7 have been prepared to schematically depict the spatial distribution and relative concentration of metals and PCBs detected within the soil/fill of the study area. Plate 4 maps the distribution of total PCBs in surficial soil of the study area where the surficial soil is defined as the 0-2 foot sampling interval. Historic PCB surficial soil data is also included on Plate 4. The historic sampling locations designated "BH" were not surveyed at the time of sampling; therefore, those locations are approximate.

Plate 5 presents the vertical distribution of total PCBs in subsurface soils (0-2′included) as determined from the RI sampling program. The locations of historic PCB sampling locations are also presented on Plate 5, but the vertical distribution of total PCBs at historic sampling locations is shown on Plate 6. Historic and RI PCB sampling results are shown on separate plates for clarity of presentation.

Plate 7 presents the vertical distribution of total metals (sum of total cadmium, chromium, nickel, and lead) in subsurface soils (0-2′ interval included).

6.3.1.1 <u>North Area</u>

Soil borings SB1-SB24, BH36-BH49, and BH58-BH63 were completed within the North Area. Soil samples were collected from these boring locations both at the surface (0 to 2 feet) and at depth (to a maximum of 16 feet). The magnitude of contamination found in this area was the lowest of the three areas investigated.

<u>Halogenated Volatile Organics</u> - Some soil samples collected in this area exhibited an oil sheen, an organic odor, and/or total organic vapor concentrations up to 2.5 ppm (see Table 6-7). Three samples collected from this area [SB90-14 (8-10′); SB90-15 (8-10′); and SB90-20 (10-12′)] were submitted for analysis of halogenated volatile organics (HVOCs) based upon visual evidence of contamination (i.e., oil sheen). However, no HVOCs were detected in any of these samples.

TABLE 6-13

COLUMBUS McKINNON CORPORATION

SUMMARY OF SOIL CONTAMINANT CHARACTERIZATION RESULTS FOR NORTH AREA

PARAMETER	DEPTH INTERVAL (FEET)	NUMBER OF OCCURRENCES/ NUMBER OF ANALYSES	ADJUSTED DRY WEIGHT BASIS[6]	
			Concentration Range (ppm)	Average Conc.[4,5] (ppm)
Total PCBs[1,2]	0-2	21/30	0.36 - 125	20
	4-8	9/31	0.32 - 16	1.5
	8-16	2/9	1.8 - 33[3]	4.0 (0.37)
Cadmium	0-2	9/10	0.63 - 7.9	4.0
	4-8	8/31	1.3 - 233[3]	9.5 (2.0)
	8-16	0/10	ND	<0.5
Chromium	0-2	10/10	6.5 - 300[3]	65 (39)
	4-8	31/31	7.7 - 200[3]	32 (20)
	8-16	9/9	7.7 - 35	17
Nickel	0-2	10/10	9.3 - 96	36
	4-8	31/31	6.0 - 417[3]	48 (27)
	8-16	9/9	12 - 38	23
Lead	0-2	10/10	16 - 1200[3]	215 (105)
	4-8	31/31	4.8 - 1100[3]	75 (41)
	8-16	9/9	7.3 - 90[3]	19 (11)

NOTES:

(1) Includes both historic and present RI data
(2) Only Arochlor 1254 detected.
(3) Outlier value
(4) Average computed without outlier value is in parentheses.
(5) Nondetections were averaged at the applicable detection limit and duplicate analyses were averaged prior to computing the North Area Averages.
(6) Historic data was reported on a dry weight basis; present RI data was reported on a wet weight basis and recalculated to a dry weight basis using the methods as described in Section 6.3.1.

TABLE 6-14

COLUMBUS McKINNON CORPORATION

SUMMARY OF SOIL CONTAMINANT CHARACTERIZATION RESULTS FOR CENTRAL AREA

PARAMETER	DEPTH INTERVAL (FEET)	NUMBER OF OCCURRENCES/ NUMBER OF ANALYSES	ADJUSTED DRY WEIGHT BASIS[6]	
			Concentration Range (ppm)	Average Conc.[4,5] (ppm)
Total PCBs[1,2]	0-2	46/46	0.22 - 2220[3]	249 (205)
	2-4	21/21	0.17 - 934	155
	4-8	39/43	0.04 - 153	23
	8-16	3/15	0.30 - 5.0	0.52
Cadmium[1]	0-2	10/12	1.1 - 28	10
	2-4	3/4	5.6 - 31	14
	4-8	14/22	1.4 - 45	7.7
	8-16	3/17	1.0 - 2.3	0.84
Chromium[1]	0-2	12/12	14 - 351	139
	2-4	4/4	29 - 154	101
	4-8	22/22	7.2 - 375	98
	8-16	17/17	4.4 - 18	12
Nickel[1]	0-2	12/12	19 - 1038	310
	2-4	4/4	194 - 614	411
	4-8	22/22	15 - 925	250
	8-16	17/17	11 - 30	20
Lead[1]	0-2	12/12	19 - 6750[3]	1017 (496)
	2-4	4/4	35 - 2638	1357
	4-8	22/22	5.9 - 2250	434
	8-16	16/17	5.2 - 233[3]	24 (11)

NOTES:

(1) Includes both historic and present RI data
(2) Only Arochlor 1254 detected.
(3) Outlier value
(4) Average computed without outlier value is in parentheses.
(5) Nondetections were averaged at the applicable detection limit and duplicate analyses were averaged prior to computing the Central Area Averages.
(6) Historic data was reported on a dry weight basis; present RI data was reported on a wet weight basis and recalculated to a dry weight basis using the methods described in Section 6.3.1.

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TABLE 6-15

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SUMMARY OF SOIL CONTAMINANT CHARACTERIZATION RESULTS FOR SOUTH AREA

PARAMETER	DEPTH INTERVAL (FEET)	NUMBER OF OCCURRENCES/ NUMBER OF ANALYSES	ADJUSTED DRY WEIGHT BASIS[6]	
			Concentration Range (ppm)	Average Conc.[4,5] (ppm)
Total PCBs[1,2]	0-2	18/21	0.63 - 427[3]	51 (32)
	4-8	7/10	0.45 - 4.8	1.7
	8-16	1/11	ND - 28[3]	2.7 (ND)
Cadmium	0-2	7/7	1.9 - 114	48
	4-8	10/10	0.8 - 45	13
	8-16	1/11	ND - 1.3	0.60
Chromium	0-2	7/7	59 - 688	391
	4-8	10/10	26 - 457	244
	8-16	11/11	11 - 165[3]	30 (16)
Nickel	0-2	7/7	75 - 1250	692
	4-8	10/10	56 - 2750[3]	602 (364)
	8-16	11/11	20 - 1267[3]	136 (23)
Lead	0-2	7/7	313 - 16,250[3]	5020 (3148)
	4-8	10/10	0.6 - 3750	1826
	8-16	11/11	3 - 217[3]	41 - (8.6)

NOTES:

(1) Includes both historic and present RI data
(2) Only Arochlor 1254 detected.
(3) Outlier value
(4) Average computed without outlier value is in parentheses.
(5) Nondetections were averaged at the applicable detection limit and duplicate analyses were averaged prior to computing the South Area Averages.
(6) Historic data was reported on a dry weight basis; present RI data was reported on a wet weight basis and recalculated to a dry weight basis using the methods as described in Section 6.3.1.

PCBs - PCB contamination in the North Area occurs principally in surficial soil/fill (i.e., 0-2 feet). As indicated on Table 6-13, the concentration of PCBs (i.e., Arochlor 1254) in surficial soil/fill in this area ranged from 0.36-125 ppm, with an average of 20 ppm. Five of 31 surficial soil samples collected in this area exhibited a PCB concentration of greater than 50 ppm. In contrast, none of the 43 samples collected at depth (i.e., 4-16 feet) in this area contained PCB greater than 50 ppm and only four (4) of these samples contained greater than 10 ppm PCB.

The horizontal limit of PCB contamination is defined by soil boring locations SB90-8 and SB90-9. These soil borings are located on the northwest side of the study area in the narrow access corridor between Ellicott Creek and the CM office/manufacturing building. As shown on Plates 4 and 5, this horizontal limit was verified by the analysis of 18 samples collected at depths of 0-8 feet from 7 borings made further up the narrow corridor. With a single exception [1.5 ppm PCB at SB90-4 (0-2 feet)], the concentration of PCB in these soil/fill samples was substantially less than 1 ppm (i.e., <0.16-0.48 ppm PCB).

Metals - Like PCBs, the highest concentrations of metals generally occurred within the surficial soil/fill (see Table 6-13). However, based upon the natural soil concentrations given in Table 6-16, the surficial soil/fill concentration of cadmium in the North Area is elevated above the mean background values by a factor of 2.0; chromium by a factor of 20; nickel by a factor of 4; and lead by a factor of 28.

The elevated concentrations of metals are associated principally with the fill material. However, as indicated on Plate 7, the horizontal distribution of metals within the fill is quite variable and does not exhibit any discernable pattern with respect to spatial distribution. The metal concentrations in the natural soils underlying the fill within the North Area were not elevated above expected values as given in Table 6-16.

While the source of the metals within the fill is not known, it is notable that metal filings occur throughout the fill based upon borehole logging observations.

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TABLE 6-16

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CONCENTRATION OF METALS IN NATURAL SOILS[1]
(mg/kg)

METAL	COMMON RANGE[1]	MEAN[1]	MW-3[2]
Cd	1.0 - 4.0	3.3	1.0
Cr	8.0 - 20.0	15	20
Ni	20.0 - 30.0	23	23
Pb	20.0 - 100.0	43	22

NOTE:

(1) Background concentrations in undisturbed soil from four (4) locations not affected by waste disposal sites in the Tonawanda, NY area. Source: USEPA (1985c).

(2) From Table 6-9, adjusted dry weight basis.

6.3.1.2 Central Area

Soil borings SB25-SB38, BH1-BH29, and B1-B12 were completed within the Central Area. The magnitude of contamination found in this area was the highest of the three areas investigated.

Halogenated Volatile Organics - No volatile organic compounds were detected in the surficial soil samples collected in this area. However, trace concentrations of HVOCs (most notably dichlorobenzenes) were detected at depth (i.e., 4-8 feet) at sample locations SB26, SB30, SB33, SB36, and SB37. Of these locations, only SB36 and SB37 are located within the area of the alleged former waste oil disposal area. No other specific pattern of HVOC occurrence was evident.

The magnitude of HVOCs detected in the subsurface soil was relatively low, with a single exception. The concentrations detected in soil/fill at SB26, SB30, SB36, and SB37 ranged from 0.003-0.38 ppm. Total organic vapor readings of 70-200 ppm were observed using an HNu (equipped with a 10.2 eV lamp) in soil/fill samples collected at SB26 (4-6 feet) and SB37 (6-10 feet). Soil/fill samples collected at SB33 exhibited the highest concentration of HVOC (1,2-dichlorobenzene, 6.2 ppm at 4′ to 6′, and 45 ppm at 6′ to 8′) detected within the study area during the present RI. This sampling location is immediately adjacent to the CM manufacturing building just upslope of the alleged former waste oil disposal area.

PCBs - As shown on Plates 4, 5, and 6, PCB contamination in the Central Area occurs both in surficial soil/fill and at depth. As indicated on Table 6-14, the concentration of PCBs (i.e., Arochlor 1254) in surficial soil/fill (i.e., 0-2 feet) ranged from 0.22-2220 ppm. The very high value of 2220 ppm is anomalous and could not be reproduced by additional samples collected at BH28 by AES (J. Dicky, Pers. Com.) where the initial sample analytically determined to contain this concentration of PCB was obtained. Nevertheless, the concentration of PCB in the surficial soil/fill was greater than 50 ppm at 29 of 46 sampling locations within the Central Area. The average concentration was 249 ppm.

The location of the alleged former waste oil disposal area is approximately defined by the historic sampling locations shown on Plate 6.

A comparison of subsurface PCB data on Plates 5 and 6 shows that PCB contamination at depth occurs predominantly within the area of the alleged former waste oil disposal pit. The historic subsurface sampling locations shown on Plate 6 are the only locations within the entire study area which exhibit PCB concentrations greater than 50 ppm at depths below the 0 to 2-foot interval. However, of the 47 historic samples obtained from below 0-2 feet, 32 samples contained less than 10 ppm PCB.

As indicated on Plate 5, the PCB contamination at depth occurs principally within the fill. With the exception of three (3) locations where the fill is thin (less than 2.2 feet at SB26, SB32, and SB33), no PCB concentration greater than 5 ppm was detected in the native soil underlying the fill in the Central Area. Native soil underlying the fill within the alleged waste oil disposal area sampled at location B5, exhibited a PCB concentration of less than 1 ppm.

Metals - Consistent with the vertical distribution of PCBs and metals in the North Area and PCBs in the Central Area, the highest concentration of metals in the Central Area also occurred within the surficial soil/fill (i.e., 0-2 feet). The concentrations of metals (Cd, Cr, Ni, Pb) also diminish with increasing depth through the fill and into the underlying native soil. Comparison of the data presented in Table 6-14 with the naturally occurring concentrations of metals found in soils, given in Table 6-16, indicates the concentrations of cadmium, chromium, nickel and lead are elevated within the fill of the Central Area. Most notable are nickel and lead which are present in the fill at concentrations 50-150 times above the mean natural background. The vertical extent of these elevated concentrations again appears to be limited by the depth of the fill as the metal concentrations of the natural soil underlying the fill are not elevated based upon the data given in Table 6-16.

6.3.1.3 South Area (Conrail Property)

Soil borings SB39-SB48, BH30-BH35, and BH50-BH57 were completed within the South Area. PCB 1254 and elevated concentrations of metals were found in this area; however, essentially no HVOC contamination was detected.

<u>Halogenated Volatile Organics</u> - Using the photoionization detector, total organic vapor readings of 50 to 200 ppm were obtained from samples collected at SB40 (4-6 feet) and SB41 (8-12 feet). However, the only HVOCs detected in the South Area were 0.004 ppm of trichloroethylene and 0.005 ppm of 1,2-dichloroethylene at SB42 (4-6 feet).

<u>PCBs</u> - Similar to the North Area, the PCB contamination in the South Area occurs principally within the surficial soil/fill (i.e., 0-2 feet). As summarized on Table 6-15, the concentration of PCBs (Arochlor 1254) in the surficial soil/fill range from 0.63-427 ppm and average 51 ppm. This average is skewed by 5 of 21 surficial soil samples collected in this area which contained greater than 50 ppm PCB. Of the other 16 samples, 15 samples contained less than 10 ppm PCB. Likewise, only one (1) of 21 samples collected at depth (4-16 feet) in the South Area exhibited a PCB concentration greater than 10 ppm [i.e., 28 ppm at SB41 (8-10 feet)].

No distinct pattern of PCB contamination was evident with respect to spatial distribution. However, the vertical extent of PCB contamination, as in the other two areas, is limited to the depth of the fill.

<u>Metals</u> - Elevated concentrations of metals (i.e., Cd, Cr, Ni, Pb) are present in the fill of the South Area. As illustrated on Plate 6, these metals are distributed throughout the fill. However, the concentrations of these metals in the native soil which underlies the fill are not elevated above expected values as given in Table 6-16.

Based upon a comparison of the analytical data summarized in Table 6-15 with the naturally occurring concentrations of metals in soils given in Table 6-16, it is evident that each of the four (4) metals of interest is elevated within the fill. The magnitude of elevation varies from 35 to 370, with lead being the metal most elevated above the mean naturally occurring concentration. The concentration of lead in the South Area is the highest of the three areas investigated. Again, the source of these metals is unknown, but metal filings were observed in the split-spoon samples during borehole logging activities.

6.3.2 Ground Water

The ground water monitoring results for those parameters detected at a minimum of one location are summarized in Table 6-10. Field measurements are summarized in Table 6-11. One (1) hydrogeologic unit, the shallow unconfined water-bearing zone, was monitored at the Columbus McKinnon Site (see Section 4.4). The monitoring interval of each well installed within this zone is summarized as follows:

- Straddling the Water Table:
  MW1S
  MW2S
  MW3
- Base of Shallow Water-Bearing Zone:
  MW1I
  MW2I

Well cluster MW-2 is immediately adjacent to the reported location of the alleged former waste oil disposal area. Well cluster MW-1 is also within the study area, but is somewhat removed from the alleged former waste oil disposal area in a cross-gradient direction. Well MW-3 is a background well located upgradient of the study area.

Ground water data obtained from the May 1990 sampling event for wells MW-1S, MW-2S, and MW-3 is considered to be biased due to the presence of a substantial amount of sediment in the samples (see Section 4.2.5). These wells exhibited the highest concentrations of contaminants (PCBs, metals), but also exhibited the highest turbidity (see Tables 6-10 and 6-11). It is noted that shallow wells MW-1S and MW-2S are screened opposite fill material, therefore contaminants in the turbid samples are most likely absorbed onto fill material which has entered the well. In comparison, samples collected from wells MW1I and MW2I exhibited much lower turbidity (see Table 6-11) and contaminant concentrations (see Table 6-10). Consequently, the true (dissolved) concentration of contaminants in the shallow ground water cannot be determined from the May 1990 ground water sampling results.

After discussion and agreement with NYSDEC, all ground water monitoring wells were resampled in May 1991 using procedures designed to better define the character (i.e., dissolved or particulate) and source of any contaminants present in the well. Two (2) measures were taken during the May 1991 sampling event to resolve questions due to sample turbidity: a) purging was performed at the natural recovery rate of the well to minimize sample turbidity; and b) both total and field-filtered samples were submitted for the analysis of PCBs and metals.

Observations of the physical character of the ground water samples collected in May 1991 are summarized below and are discussed in detail in Appendix G. The purging and sampling procedure that was utilized succeeded in producing ground water samples that were visually free of sediment and with a sample turbidity less than 50 NTU (see Table 6-11). Therefore, it is not expected that contaminated soil/fill material would have influenced the May 1991 sampling results. However, the samples from shallow wells MW-1S, MW-2S exhibited an orange-red precipitate or floc. As discussed in Appendix G, sampling was performed immediately following well purging to minimize any potential bias in the sampling results due to the formation of precipitate. Nevertheless, a color was present in all samples from MW-1S and MW-2S. This color disappeared during filtration, therefore, the color was most likely due to a fine precipitate greater than 0.45 μm in size.

Well Cluster MW-1 - No contaminants were detected in the ground water samples from MW1I during either of the two sampling rounds. However, during May 1990 Arochlor 1254 was detected at 2 ppb in samples collected from MW1S and metals were detected at concentrations substantially greater than background (MW-3). No PCBs and substantially lower metals were detected in MW-1S during the May 1991 event.

Well Cluster MW-2 - There were no contaminants detected in the ground water samples from MW2I, with the single exception of a low concentration of Arochlor 1242 (0.7 ppb). This result is anomalous since the 1242 isomer was not detected in any other soil or ground water sample.

Samples collected from MW2S during May 1990 contained high concentrations of contaminants. Arochlor 1254 was detected at 40 ppb. However, no PCBs were detected during the May 1991 resampling of MW-2S, which exhibited a lower sample turbidity. Ground water collected from this well in May 1990 also exhibited total metals concentrations substantially greater than background (MW-3). However, these results are suspect due to the high turbidity in the ground water samples, as discussed above. Only nickel, which was present in both the filtered and total fractions, was detected in samples collected from MW-2S during May 1991. Low concentrations (1 ppb - 125 ppb) of 1,1-dichloroethane and trichloroethylene were detected in samples collected during both sampling events.

Background Well MW-3 - The upgradient background well, MW3, exhibited only low concentrations of metals (see Table 6-10).

Discussion

A comparison of May 1990 and May 1991 ground water sampling results shows that substantially lower concentrations of PCBs and metals were present in the May 1991 ground water samples. The most likely explanation for the observed difference is the absence of soil/fill particles in the May 1991 samples (e.g., lower sample turbidity).

The orange-red floc observed in the samples from MW-1S and MW-2S was most likely caused by the precipitation of iron and/or manganese from the ground water. Precipitation is caused by changes in the reduction/oxidation potential which occurs as ground water comes into contact with air in the well bore. Heavy metals can be co-precipitated from solution by iron and manganese precipitates. Removal of the precipitates by flocculation and settling to the base of the well, or by sample filtration would also effectively reduce the concentration of metals dissolved in the well water. The removal of this precipitate potentially could have biased the field-filtered sampling results for MW-1S and MW-2S due to adsorption of dissolved metals onto the precipitate. However, the sampling results presented in Table 6-10 do not indicate any such bias, since the total and field-filtered metal concentrations are nearly identical. As discussed in Appendix G (Section 2.0), the ground water samples collected for analysis of total metals represent ground water which experienced a minimal residence time in the well. Based on these observations, the potential influence of the co-precipitation effect on the metal sampling results appears to be minimal.

6.3.3 Creek Sediments

The results of analysis of sediments collected from the bed of Ellicott Creek offshore of the Columbus McKinnon site for those parameters detected at a minimum of one location are presented in Table 6-11. Sample locations and PCB results are shown on Plate 4.

During the present RI, Arochlor 1254 was detected at 41 ppm in the sample collected from Station 5 just offshore of the alleged former waste oil disposal area. PCB was detected at concentrations less than 10 ppm at all other sediment sampling stations. The range of metal contaminants detected in Ellicott Creek sediment samples is as follows:

	Range	Location of Highest Concentration
Lead	23-130 ppm	#7
Chromium	6.4 - 23 ppm	#9
Nickel	5.3 - 26 ppm	#5
Cadmium	ND - 2.4 ppm	#9

Concentrations of metals and PCB (Arochlor 1254) at locations 5, 6, 7, 9, and 10 were elevated with respect to upstream sampling locations (CS-3/CS-4) and downstream locations (CS-1/CS-2). As shown on Plate 1, these sampling stations are located adjacent to the alleged former waste oil disposal area and to the Conrail Area where the greatest concentration of these same contaminants were detected in the soil/fill. A comparison of average contaminant levels from upstream, near site, and downstream locations is presented in Table 6-17.

Historic data for PCB in Ellicott Creek sediment is presented on Plate 4. This data indicates that the magnitude of PCB (i.e., Arochlor 1254) concentrations determined from previous sampling was higher than the present RI sampling results. However, the spatial distribution of PCB in

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TABLE 6-17

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AVERAGE CONTAMINANT CONCENTRATIONS (mg/Kg) IN CREEK SEDIMENT

Parameter	Downstream[1]		Near Site [2]		Upstream[3]	
	Average	N	Average	N	Average	N
PCBs	.44	2	14.6	5	.25	1
Cadmium	.8	2	1.2	5	.8	1
Chromium	10.5	2	19	5	10.2	2
Nickel	10	2	20	5	8.2	2
Lead	38	2	77	5	45	2

NOTES:

(1) Samples CS-1 and CS-2.
(2) Samples CS-5, CS-6, CS-7 CS-9, CS-10. CS-8 was not averaged.
(3) Samples CS-3 and CS-4.

Ellicott Creek sediment observed during previous investigations was very similar to that determined during the present RI.

6.3.4 Summary of Sampling Results

Soil/Fill

Based on the available data, PCB contamination across the study area occurs principally in the surficial soil/fill (i.e., 0-2 feet). Occurrences of PCB contamination below the 0-2 foot interval at concentrations greater than 10 ppm PCB occur locally in the North and South Areas, but no spatial pattern of PCB contamination at depth is evident. Within the Central Area, PCB contamination at depth occurs principally in the vicinity of the alleged former waste oil disposal area. Native soil underlying fill material is locally contaminated with PCBs at concentrations greater than 10 ppm PCB in areas where the fill is thin.

Heavy metals (cadmium, chromium, nickel, and lead) are present at elevated concentrations throughout the fill material. Average metal concentrations in fill in the South Area (Conrail property) are a factor of two to four times higher than the concentrations in fill on the CM property. The concentrations of metals in the native soil underlying the fill are not elevated above expected levels.

Metals occurring in the fill appear to be indigenous to the fill and present in a metallic state. This mode of occurrence is indicated by the following observations:

1) The metals occur at elevated concentrations throughout the fill;

2) Boring observations from 1979-1981 (B-series) and from the RI borings documented the presence of metallic material (filings and discrete metallic waste) in the fill; and

3) Leachability testing conducted by ACTS Testing Labs in 1979 (results are presented in Appendix E) indicated that the metals are not leachable from the fill material based on the laboratory methodology used.

4) May 1991 ground water sampling results indicate that the metals concentrations are very low to less than detectable, which indicates that the metals in the fill are not highly mobile (i.e. leachable).

Based on the above observations it appears that the source of the PCBs (i.e., alleged waste oil disposal) was different from the source of the metals (i.e., indigenous to the fill material brought to the site).

Volatile organic contamination occurs locally in the Central Area near the CM building. No other specific pattern of HVOC occurrence was evident.

Ground Water

Ground water collected from shallow wells in the study area in May 1990 exhibited elevated PCB and metal concentrations; however, the occurrence of sediment in the ground water samples most likely biased the May 1990 ground water sampling results. This observation (of bias) is supported by the results of analysis of samples collected during May 1991. These samples were relatively sediment-free and likewise contained no PCBs and much lower concentrations of metals.

Creek Sediment

The magnitude of Total PCB concentrations determined from RI creek sediment sampling was lower than historic creek sediment sampling results. However, the spatial distribution of PCB in Ellicott Creek sediment observed during the RI was very similar to that determined during previous investigations.

7.0 CONTAMINANT MIGRATION

The results of the sampling and analysis of stream sediments collected from Ellicott Creek in the vicinity of the Columbus McKinnon/Conrail properties reveal the presence of PCB and metal (Cd, Cr, Ni, Pb) contamination. Prior to this RI, mechanical erosion of contaminated soil/fill was suspected to be the mechanism of contaminant transport from the Study Area into Ellicott Creek. One objective of the RI was to assess the degree of off-site migration occurring by this mechanism as well as other potential pathways (e.g. ground water transport). The results of this assessment are presented in this Section. These results provide a basis for a risk assessment (Section 8.0) as well as for evaluation of the relative effectiveness of alternative remedial measures that will be considered during the subsequent Feasibility Study.

7.1 CONTAMINANT PATHWAYS

Any waste oil that may have been previously disposed of in the Study Area, and any contaminants in the waste oil or in the fill material, most likely partitioned between solid phase particles (by sorption onto fill material and the aquifer matrix) and into water (by dissolution). Much of the petroleum-based waste oil likely existed in a state of residual saturation while some waste oil may have migrated downward as a non-aqueous phase liquid (NAPL). Partitioning of the oil between solid, dissolved, and immiscible phases is controlled by the physical and chemical properties of the waste material and environmental conditions.

Based upon the waste disposal method allegedly practiced within the study area (i.e., disposal of waste oils and solvents into a shallow waste pit), the following potential pathways for off-site migration of contaminants have been identified:

- overland runoff and mechanical transport of contaminated soil/fill material into Ellicott Creek;
- mechanical erosion of the stream bank along the periphery of the study area resulting in the release of contaminated fill material to Ellicott Creek;

- release of solubilized waste constituents to ground water within the shallow overburden; and

- migration of nonaqueous phase liquid along the water table and/or confining unit interfaces.

Each of these potential pathways is discussed below.

7.2 ASSESSMENT METHODOLOGY

7.2.1 Erosion Pathway

Erosion of contaminated soils or fill from the site can occur by sheet and rill erosion due to runoff or by mechanical erosion of the stream bank by stream scour.

7.2.1.1 Soil Loss Due To Surface Runoff/Mechanical Transport

The loss of soil by sheet and rill erosion has been estimated by use of the Universal Soil Loss Equation as developed by the US Department of Agriculture and summarized in USEPA (1985). Major assumptions used in these calculations included:

- no soil loss occurs on the alleged former waste oil disposal area due to the plastic sheeting that covers the site surface; and

- the surficial, vegetated fill material contains 2% organics.

Areas of the site surface having a common slope of approximately 5% were subdivided into three (3) subareas on the basis of vegetative cover and slope length. These areas are well vegetated with either a grassy lawn or trees with a dense underbrush.

Areas along the creek having a common slope of approximately 50% were subdivided into areas north and south of a creek bank stabilization project completed by Columbus McKinnon in November 1990 as an Interim Remedial Measure (IRM). This project included the installation of an erosion control fabric and rip-rap on the creek bank along the alleged former waste oil disposal area (see Malcolm Pirnie, February, 1990). The erosion control fabric was installed to control erosion due to runoff from that portion of the site covered with plastic sheeting. Riprap was installed to control mechanical erosion of the stream bank.

Soil loss was calculated for both remediated and prior unremediated conditions along the area of the creek bank stabilized by the IRM. Soil loss was calculated to establish the benefit of the IRM creek bank stabilization. The IRM creek bank area in the prior unremediated condition was assumed to be unvegetated and covered with stone, but to have no erosion control fabric.

Figure 7-1 illustrates the manner in which the study area was segregated into designated areas for soil loss calculation purposes. Table 7-1 summarizes the square footage of each subarea.

Contaminant loadings to Ellicott Creek via erosion due to runoff were calculated using the soil loss calculations presented in Appendix C2 and soil/fill contaminant concentration data presented in Section 6.0. The RI concentration data were on an adjusted dry weight basis (see Section 6.3.1). Considerations made in performing the loading calculations include:

- for surficial soils/fill with 5% slopes, both historic and RI concentration data from the 0-2 foot interval were used;

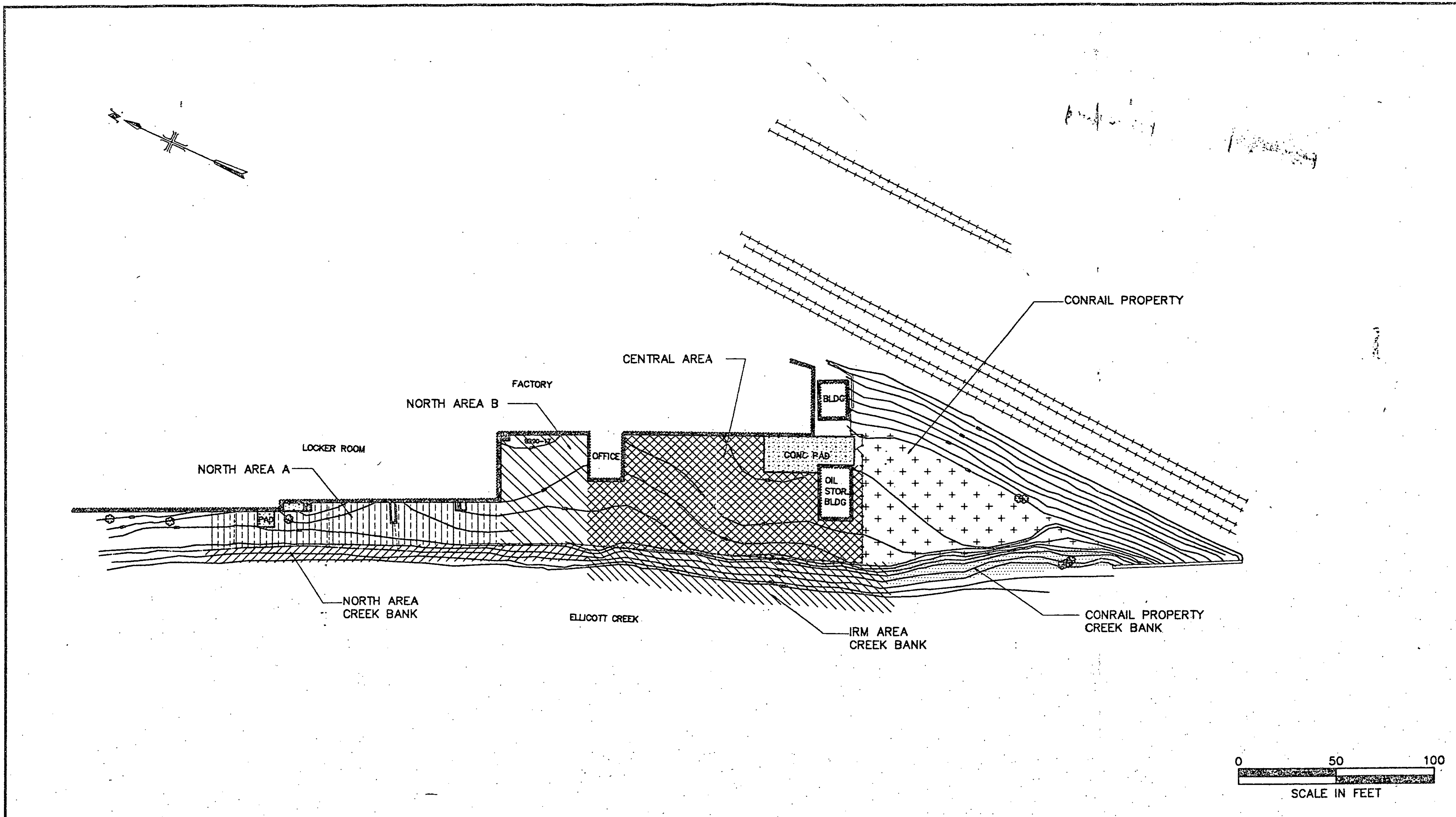
- for creek bank soil/fill with 50% slopes, both historic and RI concentration data from below 0-2 feet at locations on the perimeter of the site were used. Perimeter sampling locations used to determine average concentrations are listed in Appendix C3;

- concentration averages are arithmetic averages of all analyses. Non-detections were conservatively averaged at the reported detection limit; and

- loading calculations were made for total PCBs, total cadmium, total chromium, total nickel, and total lead. Volatile organics in soil were not detected at concentrations high enough to warrant consideration.

- Arochlor 1254 is the only PCB isomer that has been analytically verified to be present in study area soils, except for one detection of Arochlor 1260 slightly above the detection limit. Therefore, total PCBs is defined as Aroclor 1254 only.

FIGURE 7-1



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COL-01-F71

SUBAREAS USED FOR CONTAMINANT LOADING EVALUATION

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TABLE 7-1

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SOIL LOSS SUMMARY

Area Description	Area (ft^2)	Unit Soil Loss	
		($lbs/ft^2/yr$)	(in/yr)[1]
Site Surface Areas:			
North Area A	155 x 25	1.02	0.10
North Area B	45 x 60	2.47	0.24
Central Area[2]	140 x 60	1.03	0.10
Conrail Property	65 x 90 x ½	0.57	0.06
Creek Bank Areas:			
North Area Bank	200 x 5	23.6	2.3
IRM Area Bank[3]	165 x 10	23.6	2.3
Conrail Property Bank	75 x 10	23.6	2.3

NOTES:
(1) Assumes 125 lbs/ft^3
(2) Assumes Central Area is open and not covered with plastic sheeting.
(3) Soil loss under conditions existing prior to IRM improvement.

7.2.1.2 Soil Loss Due To Stream Scour

Insufficient information exists to allow an accurate estimation of the rate of potential soil loss along the creek bank due to stream erosion. Aerial photography to the appropriate scale, which could be used to estimate erosion over the period of the photographic record, could not be located. However, it should be noted that the study area is located on an inside curve of Ellicott Creek and therefore the bank adjacent to the study area is less subject to stream erosion than is the south bank. Since no means for estimating erosion rates due to stream scour was available, contaminant loadings via this pathway were not assessed.

7.2.2 Ground Water

Contaminant loadings to Ellicott Creek via the ground water pathway from the study area were estimated using the ground water discharge calculated in Section 4.4 and concentration data for the May 1991 sampling event presented in Section 6.0. Considerations made in the performance of these calculations include:

- only water in the shallow water bearing zone is contributing contaminants to Ellicott Creek;
- loading calculations were made for total PCBs, total cadmium, total chromium, total nickel, total lead, and total volatile organics.

Concentrations in ground water determined from MW-1S/MW-1I, and from MW-2S/MW-2I were utilized to determine average concentrations of contaminants (see Table 7-2). Analytical results reported as "not detected" were averaged at the analytical detection limit. Loadings were calculated using an estimated ground water discharge of 404 ft^3/day which is based on an average hydraulic gradient determined from periods of high and low ground water levels.

7.2.3 Immiscible Phase Flow Pathway

Waste oils with low solubility in water may potentially migrate as a non-aqueous phase liquid. Movement of a liquid waste phase (NAPL) is controlled by physical characteristics of the waste liquid, and of the

TABLE 7-2

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GROUND WATER LOADING

Parameter	Average Concentration[1,2] (ug/l)	Load to Creek[3] (kg/yr)
Total PCBs	<1.0	<0.004
Total Volatile Organics	14	.06
Cadmium	<5.0	<.02
Chromium	10	.04
Nickel	52	.22
Lead	7.8	.03

NOTES

(1) Average of May 1991 ground sampling results for MW-1S, MW-1I, MW-2S, and MW-2I.

(2) Analytical results reported as not detected were averaged at the analytical detection limit.

(3) Sample Calculation for Nickel:

$$52\ \frac{ug}{L} \times 28.3\ \frac{L}{ft^3} \times 404\ \frac{ft^3}{day} \times 10^{-9}\ \frac{Kg}{ug} \times 365\ \frac{day}{yr} = .22\ \frac{Kg}{yr}$$

aquifer matrix. The characteristics of any previously disposed waste oil are unknown; however, depending on its density with respect to ground water, the oil could potentially have migrated through the shallow aquifer to the top of the underlying confining layer (till sequence); or it could potentially have floated on the water table. By virtue of the screen positioning (eg. across the water table and immediately above the till), the monitoring wells installed during the RI were designed to detect the presence of any free-phase NAPL either lighter or heavier than water. The observation of oily sheens, and tarry material in split- spoon samples (Table 6-7) suggested the presence of residual NAPL. However, no free-phase NAPL was observed either in wells installed during the RI or during previous investigations. This indicates that the oily material observed in the fill is present in a state of residual saturation and is immobile under existing conditions. Consequently, it appears that under presently existing conditions, the oily material observed within the fill during this RI potentially contributes to the off-site migration of contaminants only via the mechanical erosion (sorbed onto fill material) and/or ground water (solubilized constituents) pathways.

7.2.4 Underground Utilities Pathway

The existing utility line, which routes roof drainage across the Central Area and would provide potential pathways for contaminant migration was inspected and found to be free of residual oil. No contamination was observed.

7.3 CONTAMINANT LOADING

7.3.1 Soil Loss Loading

The Universal Soil Loss Equation is a predictive tool for estimating the potential for soil loss due to sheet and rill erosion. Soil loss quantities estimated for each subarea using the USLE are presented in Table 7-1. Soil loss calculations are presented in Appendix C2. These values should not be considered absolute, but they do provide an indication of the amount of potentially contaminated soil or fill being lost to Ellicott Creek as a result of erosion. As shown in Table 7-1, estimated soil/fill loss is occurring from the study area surface at a rate of 0.1 to 0.24 inches per year. This rate is considered reasonable for a vegetated surface with moderate slope. Creek bank areas are losing soil at an estimated rate of 2.3 inches per year. This rate is considered conservatively high, since it implies a retreat of the creek bank of 23 inches in 10 years. There is no evidence of erosion of this magnitude along the Columbus McKinnon/Conrail property; however, it is reasonable to suspect that fill material is being lost to the creek at some lesser rate.

Calculated contaminant loadings to Ellicott Creek using the soil loss rates in Table 7-1 and average contaminant concentrations presented in Appendix C4 are summarized in Table 7-3. Based on all of the available data gathered to date, the yearly contaminant load to Ellicott Creek due to soil loss from the study area under presently existing conditions (with the IRM and the temporary plastic sheeting in place) is approximately 13.3 Kg/yr for the four metals of interest, and approximately 0.19 Kg/yr for PCBs.

7.3.2 <u>Ground Water</u>

Estimated contaminant loadings to Ellicott Creek from the Study Area via the ground water pathway are summarized in Table 7-2. It should be noted that these estimates are based on analytical results from the sampling event performed during May 1991. Consequently, the variability in ground water concentrations due to seasonal factors has not been assessed.

Based on current data, the yearly contaminant load to Ellicott Creek from the study area is approximately 0.3 Kg/yr for the four metals of interest, and approximately 0.06 Kg/yr for the organics of interest.

7.4 SUMMARY

A comparison of yearly contaminant loading to Ellicott Creek via ground water and soil erosion under existing conditions (e.g. includes all remedial measures implemented to date) indicates that soil erosion is the predominant contaminant migration pathway. Soil erosion appears to be contributing somewhat more lead from the Conrail property creek bank, but

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TABLE 7-3

COLUMBUS McKINNON CORP.

CONTAMINANT LOADING TO ELLICOTT CREEK VIA SOIL EROSION
FOR EXISTING CONDITIONS

Parameter (kg/yr)	Total PCBs	Cadmium	Chromium	Nickel	Lead
AREA					
Site Surface					
North Area A	0.020	0.004	0.011	0.062	0.37
North Area B	0.096	NA	NA	NA	NA
Central Area(1):					
with Plastic	0	0	0	0	0
(without Plastic)	(0.94)	(0.038)	(0.52)	(1.17)	(3.83)
Conrail Property	0.037	0.035	0.28	0.50	3.65
TOTAL SITE SURFACE:					
with Plastic	0.15	0.039	0.39	0.56	4.02
without Plastic	1.09	0.077	0.91	1.73	7.85
Creek Bank:					
North Area Bank	0.034	0.034	0.30	0.41	0.70
IRM Area Bank(2):					
with IRM	0	0	0	0	0
(without IRM)	(1.07)	(0.20)	(1.97)	(6.89)	(8.04)
Conrail Prop. Bank	0.004	0.035	1.00	1.01	4.83
TOTAL CREEK BANK					
with IRM	0.038	0.069	1.30	1.42	5.53
without IRM	1.11	0.26	3.27	8.31	13.57
TOTAL LOADING (Kg/yr)					
w/Plastic & IRM	0.19	0.11	1.69	1.99	9.55
w/o Plastic & w/o IRM	2.20	0.34	4.18	10.04	21.42
w/o Plastic; w/IRM	1.13	0.15	2.21	3.15	13.38

NA = Not Analyzed

this result is biased by a small sampling population (n=4) and a single high value (6750 mg/Kg) of lead). However, a high apparent loading of lead to the creek is consistent with the occurrence of high concentrations of lead in the surficial and subsurface fill at locations removed from the creek bank.

As previously discussed, ground water data from May 1990 was considered biased by the presence of sediment in the samples, since the wells exhibiting the highest contaminant concentrations also exhibited high turbidity. Consequently, the total metal and PCB concentration data used to estimate the loading to Ellicott Creek via the ground water pathway were taken from the May 1991 sampling results, which are more representative of the true ground water quality at the site. Based on the May 1991 sampling results, contaminant loading to Ellicott Creek via the ground water pathway appears to be negligible.

Loading results presented in Section 7.3 are applicable to existing conditions in the study area, which include remedial measures completed in the Central Area and the IRM Area Bank to mitigate contaminant migration. Total yearly loading to Ellicott Creek via soil erosion has also been calculated for the prior unremediated conditions (no plastic sheeting covering the surface of the Central Area and no erosion control fabric/riprap installed on the IRM Area bank). Mass loading from the Central Area and IRM Area Bank under the prior unremediated condition is shown on Table 7-3. The benefits derived from the installation of the IRM alone (without the temporary plastic sheeting) are also shown on Table 7-3. Total yearly loading via soil erosion from all subareas under existing and remediated conditions is summarized as follows:

TOTAL YEARLY LOADING (Kg/yr) VIA SOIL EROSION TO ELLICOTT CREEK					
	PCBs	CADMIUM	CHROMIUM	NICKEL	LEAD
Existing Conditions	0.19	0.11	1.7	2.0	9.6
Prior Unremediated Conditions	2.2	0.34	4.2	10.0	21.4
Background Load	-	0.041	0.80	0.92	0.88

As indicated, the installation of the IRM and the temporary plastic sheeting have resulted in more than a 90% reduction in PCB loading and a 55% to 80% decrease in the metal loading. Consequently, as shown on Table 7-3, the majority of the on-going cadmium, chromium, nickel and lead loading via soil erosion is attributable to the Conrail Property.

Also shown on the above table is the yearly loading that is attributable to background concentrations of cadmium, chromium, nickel, and lead in study area soil. Background levels were determined from the 4-6 foot sampling interval at boring MW-3. Loading calculations are presented in Appendix C4. Background levels may produce up to 25% of the current mass load due to cadmium, chromium, and nickel. Mass loading of lead due to study area contamination is substantially higher than the background load. Again, based on the available data (which is limited to two sampling locations) much of the lead loading above background can be attributed to the Conrail Property creek bank.

8.0 PUBLIC HEALTH AND ENVIRONMENTAL CONCERNS

8.1 INTRODUCTION

This section of the report presents an assessment of potential health risks of site contaminants to those working at the Columbus McKinnon site, those in the surrounding area, and to sensitive species near the site. The objectives of this evaluation are to provide an analysis of baseline risks in the absence of any major action to control or mitigate site contamination, and to assist in determining the need for remediation. This evaluation also provides a basis for comparing a variety of remedial alternatives, to determine which will be most protective of human health and the environment.

8.1.1 Overview of the Risk Assessment Process

This assessment is part of the Remedial Investigation/Feasibility Study (RI/FS) being conducted by Columbus McKinnon under a Consent Order (CO) from the State of New York Department of Environmental Conservation. As required by the CO, it follows the guidance contained in the U.S. Environmental Protection Agency's (USEPA) Risk Assessment Guidance for Superfund: Volume 1 - Human Health Evaluation Manual (Part A). Interim Final (1989d), and Risk Assessment Guidance for Superfund: Volume II - Environmental Evaluation Manual. Interim Final (1989e) which are companion documents to the RI/FS guidance document (USEPA's Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA, 1988a).

This baseline risk assessment is comprised of four elements, representing a number of tasks:

Hazard Identification - in which site data are reviewed to identify potential chemicals of concern;

Exposure Assessment - in which contaminant releases are analyzed; exposed populations/habitats identified; potential exposure pathways determined; exposure concentrations for pathways selected; and contaminant intakes for pathways estimated;

Toxicity Assessment - in which qualitative and quantitative toxicity information is reviewed; and appropriate toxicity values presented; and

Risk Characterization - in which the likelihood and magnitude of potential adverse health and environmental effects are characterized, the uncertainty of the process discussed; and risk information summarized.

This section of the report follows the step-wise approach to risk assessment outlined above.

8.2 HAZARD IDENTIFICATION

8.2.1 Data Evaluation

The analytical results have been discussed in detail in Section 6.0 of this report. For the purposes of the public health and environmental assessment, these data are reviewed below in order to identify contaminants of concern and representative concentrations in the affected media.

8.2.1.1 Soils/Fill

Historical sampling data indicated that on-site soil/fill has been contaminated with PCBs and with cadmium, chromium, lead and nickel. Most of those samples were collected at a depth of less than three feet, except in the alleged former waste oil disposal area where PCB concentrations were found to exceed 50 ppm at a depth of 6 ft.

Soil/fill sampling was conducted as part of the RI to establish the horizontal and vertical extent of PCB contamination over the entire site. The vertical profiling of PCBs on the site which was conducted as part of the RI indicated PCB-1254 contamination mainly in the upper fill material (0-6 feet) with few detectible concentrations at lower depths.

Eighty-six percent of surficial (0-2 feet) soil samples (which are most likely to be encountered by persons having access to the site) were found to contain PCBs. As indicated on Plate 4, surficial PCB contamination is widely distributed on the site and hence is a source of exposure to anyone whose work involves contact with the soil. Surficial soils data from historic records as well as from the RI are presented in Table 8-1.

The 95 percent upper confidence limit on the mean contaminant concentration in surficial soil (dry weight basis) is also presented in Table 8-1 to provide a representative concentration for the dataset. In many instances, environmental datasets are skewed such that the normal distribution is not a suitable model for estimating parameters such as means, proportions, confidence limits, etc. The lognormal distribution is the most commonly used probability density model for environmental contamination data. The USEPA recommends that, for environmental data, the upper confidence limit (i.e. the 95 percent upper confidence limit) on the mean of all the data should be used for evaluating reasonable maximum exposures. This procedure is described in Section 8.3.5.

Metals, unlike PCBs, are found in native soils, and so this must be taken into account when evaluating results. The vertical profiling of metals within the study area indicates greatest concentrations of total metals in the shallow soil/fill (0-6 feet in depth) with typical background metals concentrations below this depth. The surficial soil/fill samples (0-2 feet) had concentrations which were elevated in comparison to typical background, as indicated below:

COMPARISON OF AVERAGE SOILS DATA: ON-SITE VS TYPICAL U.S. VALUES

COMPOUND	ON-SITE MEAN (mg/kg)	U.S. MEAN[1] (mg/kg)	EASTERN U.S. MEAN[1] (mg/kg)
Cadmium	14	ND	ND
Chromium	143	37	33
Lead	1,386	13	11
Nickel	253	16	14

(1) (USGS, 1984a)

The metals concentrations in surficial soils on-site are elevated relative to what would be found in uncontaminated soils and, therefore, also

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TABLE 8-1

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CHEMICALS DETECTED IN SURFICIAL SOIL SAMPLES[1]

Chemical	Frequency of Detection	DRY WEIGHT BASIS[3] Range of Detected Concentrations (ppm)	UCL[2] Concentration (mg/Kg)
PCB-1254	85/97	0.22 - 2220	781
Cadmium	26/29	0.63 - 114	67
Chromium	29/29	6.5 - 688	401
Nickel	29/29	9.3 - 1250	1250
Lead	29/29	16 - 16,250	6120

(1) Inclusive of 1979 to 1990 surficial soil sampling results summarized on Tables 6-13, 6-14, and 6-15, collected at a depth of 0'- 2'.

(2) The 95 percent upper confidence limit (UCL) on the mean contaminant concentration measured in surficial soil. In accordance with USEPA guidance (USEPA 1989d) the maximum concentration was used for nickel since the UCL exceeded the maximum.

(3) Dry weight concentrations were calculated from wet weight concentrations based on assumptions discussed in Section 6.3.1.

represent a potential source of exposure for anyone contacting soils through yard work or similar outdoor activities.

8.2.1.2 Ground Water

Historical data indicated the presence of several volatile halogenated organic compounds (1,1-dichloroethene, trans-1,2-dichloroethene, methylene chloride, tetrachloroethene, trichloroethene and vinyl chloride) in one monitoring well (OW2-83) on-site at concentrations of the individual compounds ranging from 34 to 290 ug/l. Dichloroethene and vinyl chloride are degradation products of trichloroethene. Historically, no PCBs were detected in the two monitoring wells sampled (OW1-83; OW2-83).

Five (5) monitoring wells were installed and sampled on two (2) occasions during the RI. Interpretation of sampling results from the first sampling round, performed in May 1990, was subject to much uncertainty due to a potential bias introduced by high sediment content in the samples. For this reason, an agreement was reached with the NYSDEC to resample the wells in May 1991 to resolve questions regarding the true character of the ground water. The May 1990 and May 1991 results are presented and discussed in Section 6.3.2. Based on the results of the two (2) sets of sampling data (May 1990 and May 1991), it was evident that the initial (May 1990) sampling results, which indicated the presence of PCBs and relatively high concentrations of metals, were biased by the large quantity of sediment present in the samples. Since the specific wells in which contamination was detected are screened within contaminated fill, this contamination is attributed to the sediment present in the wells. The absence of PCBs and much lower concentration of metals in the relatively sediment-free samples obtained during the May 1991 monitoring event confirm this conclusion.

The historic and May 1991 ground water sampling results are summarized in Table 8-2. Due to the bias in the May 1990 data discussed above, only the May 1991 data has been used in the risk assessment.

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TABLE 8-2

COLUMBUS McKINNON CORP.

CHEMICALS DETECTED IN GROUND WATER SAMPLES[1,2]

Chemical	Frequency of Detection	Range of Detected Concentrations (ug/l)	Mean Concentration (ug/l)
PCB-1254	0/5	<1.0	<1.0
Cadmium	0/5	<5.0	<5.0
Chromium	1/5	<10-14	14
Nickel	1/5	<40-88	88
Lead	1/5	<3.0-22	22
1,1-Dichloroethane	1/5	2	2
Tetrachloroethene	1/5	8.9	8.9
Trichloroethene	1/5	12	12

NOTE:

(1) Based on RI Ground Water Sampling conducted May 1991.

8.2.1.3 Surface Water

Results of a previous investigation were reported to indicate that Ellicott Creek was not affected by PCB contamination on the site. PCB concentrations in water samples collected upstream were reportedly two orders of magnitude greater than downstream (AES, 1982).

8.2.1.4 Ellicott Creek Sediment

Historical records indicate that sediment samples from Ellicott Creek were found to be contaminated with PCBs, with the highest concentrations detected generally near the alleged former waste oil disposal area. The extent of contamination was limited to an area approximately 250 feet along the stream bank and extending 25 feet into the stream channel. In order to minimize the further release of PCBs from the site via soil erosion, Columbus McKinnon Corp. covered the PCB-contaminated soil/fill in the vicinity of the alleged waste oil disposal area with durable plastic sheeting in February 1983. Since that time, the concentration of PCBs detected in the creek sediments has been substantially lower (see Tables 6-4a and 6-4b.

The results of the sediment sampling program conducted during the present RI are provided in Table 8-3. These results are comparable to the historical sampling results for the period of time following the installation of the plastic sheeting. The trend in PCB concentration in the creek sediments is illustrated in Figure 8-1 for the two sampling locations where the highest concentrations of PCBs have been detected.

During the RI, ten sediment samples were collected. Of these, nine contained PCB-1254 at concentrations of less than 50 mg/kg. Nine of the samples contained cadmium at concentrations below 5 mg/kg. Chromium, lead and nickel were detected in all sediment samples at concentrations of less than 25 mg/kg, 150 mg/kg and 30 mg/kg, respectively.

8.2.2 Chemicals of Concern

Because of their inherent toxicity and frequency of detection in various environmental media on and adjacent to the study area, the following indicator chemicals are evaluated in this section:

TABLE 8-3

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CHEMICALS DETECTED IN SEDIMENT SAMPLES[1]

Chemical	Frequency of Detection	Range of Detected Concentrations (mg/kg)	Mean Concentration (mg/kg)
PCB-1254	9/10	0.25-41	7.2
Cadmium	9/10	0.6-2.4	1.0
Chromium	10/10	6.4-23	14.7
Nickel	10/10	5.3-26	14.5
Lead	10/10	23-130	58.8

NOTE:

(1) Based on RI creek sediment sampling conducted May 1990.

- PCBs
- Cadmium
- Chromium
- Lead
- Nickel

Insofar as PCBs are concerned, only Aroclor-1254 was detected during the RI, with the exception of one soil sample which contained 0.26 mg/kg Aroclor-1260, and one ground water sample which contained 0.7 ug/l Aroclor-1242. These latter results are anomalous.

8.2.3 Environmental Transport and Distribution

The environmental fate and transport of chemicals detected on-site are important factors in determining the ultimate hazard to people in the vicinity of the site. After a chemical is released to the environment, it may be transformed physically (e.g., by volatilization, precipitation), chemically (e.g., by photolysis, hydrolysis, oxidation, reduction, etc.), or biologically (e.g., by biodegradation). Alternatively, it may be accumulated in one or more media (including biomass), or may be transported (e.g., convected downstream in water or on suspended sediment or through the atmosphere).

The environmental fate and transport mechanisms of each of the indicator chemicals will be reviewed below with the objective of identifying the likely point of exposure for each.

Probable exposure routes (i.e., ingestion, inhalation, dermal contact) based on the media contaminated and the anticipated activities at the exposure points will be discussed in Section 8.3.

Polychlorinated Biphenyls (PCBs)

The environmental persistence of PCBs generally increases with the increase in the degree of chlorination of the biphenyl molecule; those which are highly chlorinated (1248, 1254 and 1260) are resistant to biodegradation (ATSDR, 1989c). In the environment, the chemical composition of original Aroclor products change over time as the individual congeners degrade and/or partition to different environmental compartments at different rates. PCBs, particularly the more chlorinated compounds, adsorb readily to sediments and suspended matter in surface water. PCBs can be sequestered for a relatively long period of time on sediment. A small fraction of PCBs may be redistributed to the water column, and eventually volatilize from the surface. Bioconcentration factors (in fish, shrimp, oysters and other aquatic species) are significantly high.

The low water solubility, high octanol-water partition coefficients (log K_{ow} ranging from 5.9 to 6.9) and strong adsorption of PCBs to soils and sediment indicate that leaching from soil is not a significant process, unless mediated by the presence of organic solvents.

PCBs in the atmosphere have been found to be predominantly in the vapor phase, with less than 15% adsorbed onto particulate; hence, fugitive dust may be of less interest than volatilization from soil surfaces. PCBs are removed from the atmosphere by wet and dry deposition.

PCBs are infrequently encountered in ground water, due to their strong sorption to soils and relative insolubility in water.

Cadmium

In surface water and ground water, cadmium is often present as the hydrated ion or as ionic complexes with other inorganic or organic compounds (ATSDR, 1989a). Insoluble complexes of cadmium adsorbed to sediments are relatively immobile. Cadmium in soil may be dissolved in soil water, or in insoluble complexes with inorganic and organic soil substituents. Compared to lead, cadmium is relatively mobile in surface water. Concentrations in ground water are generally low, due to sorption by mineral matter and clay, binding by humic substances, precipitation as cadmium sulfide, and precipitation as the carbonate at high alkalinities. Cadmium is not reduced or methylated by microorganisms.

Chromium

In surface water, most trivalent chromium precipitates in sediments (ATSDR, 1989b). Hexavalent chromium will be mainly soluble in surface waters, but will eventually be reduced to trivalent chromium by organic matter in water. Chromium does not bioaccumulate to any significant degree in aquatic organisms. Runoff and leaching may transport chromium to surface water and ground water. Flooding of soils and anaerobic decomposition of plant matter may increase the mobilization of chromium in soil resulting in the formation of chromium complexes.

Lead

In water, lead chemistry is highly complex because lead can be present in a number of forms (ATSDR, 1990). Lead may form compounds of low solubility with the major anions in natural water; the divalent form (Pb^{+2}) is the most stable ionic species in the natural environment. Hydroxide, sulfide and carbonate may form complexes with lead, precipitating it from water. In aquatic species, lead concentrations are usually highest in benthic organisms and algae, and lowest in upper trophic level predators. Most lead in soil is retained strongly, transported to surface water bound to soils only during heavy rains. The downward leaching of lead in soil to ground water is very slow under natural conditions, unless lead is present at concentrations that exceed the sorption capacity of the soil, or there are materials in soil which are capable of forming soluble chelates with lead. A low pH favors leaching. The fate of lead in soil is determined by adsorption at mineral interfaces, precipitation, or formation of relatively stable organic-metal complexes or chelates with soil organic matter.

Nickel

Nickel is continuously transferred between air, water and soil by natural chemical and physical processes, such as weathering, erosion, runoff, precipitation, stream/river flow, and leaching (ATSDR, 1988). In organically rich polluted waters, organic materials will keep nickel solubilized by complexation. In water with anaerobic conditions, nickel will precipitate as nickel sulfide. Nickel is relatively immobile in soil, but it also has the potential to leach through soil to ground water. Organic complexing agents in soil restrict the mobility in soil. Bioaccumulation in fish is not significant.

8.3 EXPOSURE ASSESSMENT

8.3.1 Setting

The study area consists of a small parcel of land (approximately 320 feet by 60 feet in dimension) which encompasses a portion of CM property, located between the Columbus McKinnon Corporation industrial facility at One Fremont Street in the City of Tonawanda and Ellicott Creek, and a triangular-shaped parcel owned by Conrail located south of and immediately adjacent to the CM property. The building closest to the study area is occupied by CM, while buildings to the north end of the facility are rented to a variety of commercial tenants.

The property lying along the west side of Ellicott Creek is zoned M-1, (Manufacturing District). The land along the opposite bank is zoned variously: C-2 (Central Retail District), C-M (General Commercial Services District), R-C (Residential - Restricted Business District) and M-1 (Manufacturing District) and, further upstream, R-1 (Single Family Residential District) (Tonawanda, undated).

Active railroad tracks used by Conrail are located along the eastern site boundary. A thin, reportedly uncontaminated strip of property lies to the north of the site.

Access to the site is restricted to those entering from the manufacturing building (which is currently locked) or through the storage yard on-site via a narrow corridor. From Ellicott Creek, access is impeded by a 10-foot embankment. The entire property is fenced. While the gates to the property as a whole are not guarded, it is unlikely that trespassers would be able to gain access to the contaminated area of the property.

An area of elevated PCB concentrations on the property has been covered with durable plastic weighed down with metal chains.

Ellicott Creek is classified by New York State as a Class D stream. Class D waters are suitable for fishing. The water quality of a Class D stream is considered suitable for primary (i.e., swimming) and secondary (i.e., boating) contact recreation even though other factors may limit the use for that purpose. Due to such natural conditions as intermittency of flow, or water conditions not conducive to propagation of game fishery or stream bed conditions, Class D waters will not support fish propagation. There are no posted restrictions on fishing in Ellicott Creek.

Ellicott Creek may serve as a transient habitat to fish from the Niagara River, which is located a few miles downstream. The depth of Ellicott Creek varies from 3 feet to 15 feet at various locations.

8.3.2 Exposure Pathways

A number of potential exposure pathways are possible. These pathways are identified and discussed in this Section.

Contact with Contaminated Soils by Maintenance Personnel: There may be some contact with soils by persons maintaining the yard (i.e., mowing, raking) where on-site contamination has been found. For this reason, this exposure pathway is evaluated below.

Consumption of Contaminated Fish from the Creek: There are no posted fishing restrictions, although fishing was not observed during the investigation. Apparently, fishing has occurred in the Creek (personal communication, M. Wilkinson, NYS Fish & Wildlife, 12/90), although no data is available on types or amounts of fish caught. As this may be a viable exposure pathway, it is evaluated below.

Viability of Fish in Ellicott Creek: Bioconcentration of contaminants in fish may compromise their survival. This exposure pathway is evaluated below.

Ingestion of Contaminated Soils by Trespassers: This exposure scenario is highly unlikely given the fact that access to the site is restricted (see Section 8.3.1). This pathway was not evaluated.

Adsorption and/or Ingestion of Contaminants During Swimming or Wading in Ellicott Creek: Land use along the Creek adjacent to and downstream from the Columbus McKinnon facility is a mixture of manufacturing, commercial and residential. While boating within the Creek is common, the main objective is to gain access to the Niagara River, which has greater value as a recreational resource. Likewise, no swimming beaches or public access areas are located along Ellicott Creek downstream of the Columbus McKinnon facility. However, as indicated in Section 8.3.1, Ellicott Creek is a NYS Class D stream which is considered suitable for swimming. For this reason, this potential exposure was evaluated.

Contact with Contaminated Soils by Commercial Tenants: This is highly unlikely because the area is isolated, relatively desolate, and restricted by fencing. Furthermore, the commercial tenants (presently there are two (2) such tenants) have no means of entering the area of contaminated soils from the portion of the building that they are renting. Therefore, since the tenants have no contact with the contaminated soils this exposure pathway was not evaluated.

Consumption of Drinking Water Contaminated by PCBs from the Site: One public water district (the City of Niagara Falls) obtains raw water downstream from the confluence of Tonawanda Creek and the Niagara River (Ellicott Creek discharges into Tonawanda Creek near the mouth of Tonawanda Creek). This water district has an intake in the Niagara River located seven to eight miles downstream from Tonawanda Creek. This intake location is removed from the site by a significant distance, and is unlikely to be affected by site contamination. Therefore, this exposure pathway was not evaluated.

Exposure of Endangered Species of Wildlife: The site does not contain any substantial wildlife habitats or natural areas. The site is mowed, and therefore cannot supply food or cover for wildlife species. No endangered species of wildlife are known to be present either at or near the site. Consequently, this exposure pathway was not evaluated.

Inhalation of Fugitive Dusts Contaminated with PCBs and Heavy Metals: Respirable dust levels were monitored during drilling activities on-site. Dust monitoring results are presented on the soil boring logs in Appendix B3. The maximum respirable particulate concentration detected was 0.032 mg/m^3, which is less than one percent of the Occupational Safety and Health Administration's permissible exposure limit of 5 mg/m^3 for respirable particulates (OSHA, 1990). It is also below New York State's guidance level of 150 ug/m^3 (0.15 mg/m^3) which is not to be exceeded over an integrated time period of up to 15 minutes on hazardous waste remediation sites (NYSDEC, 1990). Consequently, this pathway was not evaluated.

The pathways that have been selected for evaluation are summarized in Table 8-4. The populations which may be affected by these exposure pathways are indicated in Table 8-5. The ground water pathway is evaluated in this section by comparing May 1991 contaminant concentrations detected in on-site ground water monitoring wells (see Section 8.2.1.2) to the New York State Part 703 Ground Water Quality Standards, in Table 8-6. As indicated, only trichloroethylene slightly exceeded the State Part 703 ground water quality standards at one (1) monitoring well location.

8.3.3 Sensitive Receptors

Sensitive receptors are typically any subpopulation that may be at increased risk from chemical exposures due to increased sensitivity, behavior patterns, and/or current or past exposures from other sources. Those potentially at high risk because of specific behavior patterns include persons who may eat large amounts of locally caught fish. Based on available data, there are no subsistence fishermen who rely solely on Ellicott Creek for their fish supply. Recreational fishing (not subsistence fishing) is determined most appropriate for this analysis.

8.3.4 Potentially Affected Habitats/Populations

As indicated above, there are no substantial wildlife habitats in the vicinity of the site.

The following fish species are known to be present in Ellicott Creek: carp, bullhead catfish, suckers, fresh water drum and blunt-nosed minnows. Occasionally, the following fish species may also be present (from the Erie Canal): large mouth bass and rock bass (two species very tolerant of poor water quality); sunfish, blue gills, northern pike and yellow perch. These are generally bottom-dwelling fish species which may be affected by PCB contamination; therefore, this pathway is considered below.

8.3.5 Estimates of Contaminant Intake

8.3.5.1 Direct Contact With Soils

Exposures of maintenance personnel doing yard work at the site from inadvertent ingestion of soils and skin contact are estimated using

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TABLE 8-4

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SUMMARY OF EXPOSURE PATHWAYS

POTENTIALLY EXPOSED POPULATION	EXPOSURE ROUTE, MEDIUM AND EXPOSURE POINT	PATHWAY SELECTED FOR EVALUATION?	REASON FOR SELECTION OR EXCLUSION
Workers	Incidental ingestion of soil	Yes	Workers may accidentally ingest soil while working.
Workers	Direct contact with chemicals of potential concern in soil on the site	Yes	Contaminated soil may be dermally absorbed by workers
Residents	Ingestion of contaminated water from drinking water sources down-gradient of the site	No	There are no drinking water sources in the immediate vicinity of the site; there is no indication that other sources are contaminated
Residents	Ingestion of contaminated fish from Ellicott Creek	Yes	Fishing is a permitted use of Class D streams in New York State. Fishing has occurred in Ellicott Creek.
Fishermen	Ingestion of contaminated fish from Ellicott Creek	Yes	Fishing is a permitted use of Class D streams in New York State. Fishing has occurred in Ellicott Creek.
Recreational Visitors	Incidental ingestion and dermal contact with chemicals while swimming in Ellicott Creek	Yes	Swimming may occur in Ellicott Creek.

TABLE 8-5

COLUMBUS McKINNON CORP.

MATRIX OF POTENTIAL EXPOSURE ROUTES

Exposure Medium/ Exposure Route	Residential Population	Worker Population	Recreational Population
Ground Water			
Ingestion	--	--	--
Dermal Contact	--	--	--
Air			
Inhalation of Vapor Phase Chemicals	--	--	--
Soil/Dust			
Incidental Ingestion	--	A	--
Dermal Contact	--	A	--
Fish			
Ingestion	L	--	L
Surface Water			
Incidental Ingestion	--	--	L
Dermal Contact	--	--	L

L = Lifetime exposure
A = Exposure to adults (highest exposure is likely to occur during occupational activities)
-- = Exposure of this population via this route is not likely to occur.

TABLE 8-6

COLUMBUS McKINNON CORP.
COMPARISON OF MAXIMUM CONTAMINANT CONCENTRATIONS IN GROUND WATER
WITH NEW YORK STATE PART 703 STANDARDS
(units in ug/l)

<table>
<tr><th></th><th>Maximum Site GW Concentration[1]</th><th>NYS GWQS[2]</th><th>MCL[3] Final</th></tr>
<tr><td>Cadmium</td><td><5.0</td><td>10</td><td>10</td></tr>
<tr><td>Chromium</td><td>14</td><td>50 (CrVI)</td><td>50</td></tr>
<tr><td>1,1-Dichloroethane</td><td>2</td><td></td><td></td></tr>
<tr><td>Nickel</td><td>88</td><td></td><td></td></tr>
<tr><td>Lead</td><td>22</td><td>25</td><td></td></tr>
<tr><td>Polychlorinated Biphenyls</td><td><1.0</td><td>0.1</td><td></td></tr>
<tr><td>Tetrachloroethylene</td><td>8.9</td><td></td><td rowspan="2">5</td></tr>
<tr><td>Trichloroethylene</td><td>12</td><td>10</td></tr>
</table>

References: USEPA, 1990a; 1990c

NOTES:

(1) Based on analysis of ground water samples collected May 1991.

(2) Title 6 NYCRR Part 703 Ground Water Quality Classifications, Quality Standards, Effluent Standards and/or Limitations.

(3) Maximum Contaminant Level, promulgated under the Safe Drinking Water Act.

various factors, as presented in Tables 8-7 and 8-8. The 95 percent upper confidence limit on the mean contaminant concentration in surficial soil (dry weight basis) is used, as noted in Seciton 8.2.1.1. The equation used in this analysis (Gilbert, 1987) is:

$$UCL = e^{x\ 0.5s^2 + sH/\sqrt{(n-1)}}$$

Where:

UCL = 95th upper confidence limit on the mean
e = constant (natural log)
x = mean of the transformed data
s = the standard deviation of the transformed data
H = statistic for computing a one-sided upper 95% confidence limit on a lognormal mean
n = sample size

For all samples in which the chemical of potential concern was not positively identified, this analysis assigns a value of 1/2 the contract-required quantitation limit (CRQL). If there is great variability in measured concentrations, the upper confidence limit on the mean concentration may be high, occasionally exceeding the maximum detected value. In such a case, the maximum concentration detected is used (USEPA, 1989d). This approach is acknowledged by USEPA to be extremely conservative, but is the approach recommended in the health assessment guidance document (USEPAd) to allow for uncertainties in the risk assessment process.

The exposure scenario assumes that yard work is performed on the site on average, 26 days per year (one day a week from May to October) for 9 years, and that this work is completed in half a day.

The exposure averaging time (AT) differs for the evaluation of carcinogenic vs. noncarcinogenic effects, as indicated on Tables 8-7 and 8-8. For carcinogens, intakes are calculated by prorating the total dose over a lifetime (also called lifetime average daily intake). This is based on USEPA's assumption that a high dose of a carcinogen received over a short period of time is equivalent to a corresponding low dose spread over a lifetime. By contrast, for noncancer effects, intakes are calculated by averaging over the exposure event itself (e.g., the portion of the year exposure occurred), to evaluate the dose received at that time against a threshold of effect.

Application of the equations provided in Tables 8-7 and 8-8 results in intake or absorbed dose (expressed in mg/kg-day) as presented in Tables 8-13 and 8-14 as a "chronic daily intake" (or CDI).

8.3.5.2 Consumption of Contaminated Fish

Another source of exposure to site contaminants would be from ingestion of fish caught from Ellicott Creek. PCBs tend to bioaccumulate in fish, potentially resulting in much higher concentrations in fish than are present in the surrounding environment. By contrast, the halogenated volatile organic compounds detected in ground water at the site would tend to volatilize from surface water. The metals detected in on-site soils and sediment (cadmium, chromium, nickel and lead) do not bioaccumulate in fish to the same degree as PCBs. This analysis will therefore focus on bioaccumulation of PCBs in fish, and the resultant effect on fish viability, and human health as a result of fish consumption.

Bioaccumulation comprises two processes, bioconcentration and biomagnification. Bioconcentration is the process by which a compound is absorbed from water through gills or epithelial tissues and is concentrated in the body; while biomagnification is the concentration of a compound within successive tropic levels of the food chain. Most bioaccumulation studies for fish measure pollutant uptake as a function of bioconcentration, with the assumption that contributions from biomagnification are indirectly factored in.

The actual bioaccumulation potential is more a function of the compound's physicochemical properties than the environmental setting. Hydrophobic, lipophilic organic compounds (such as PCBs), in moving toward equichemical potential will tend to accumulate in biota at a higher ratio than the surrounding sinks (e.g., sediment, water or air). Once the concentration reaches a state of equichemical potential, the concentration in the biota should be at its maximum, which is approximated by the bioconcentration factor (BCF).

In numerous studies, bioaccumulation has been correlated with the octanol-water partition coefficient, K_{ow} (Veith et al., 1979; Veith et al.,

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TABLE 8-7

COLUMBUS McKINNON CORP.

ON-SITE ASSESSMENT OF WORKER EXPOSURE: INGESTION OF CHEMICALS IN SOIL

Equation:

$$Intake\ (mg/kg\text{-}day) = \frac{CS \times IR \times CF \times FI \times EF \times ED}{BW \times AT}$$

Where:

CS = Chemical Concentration in Soil (mg/kg)
IR = Ingestion Rate (mg soil/day)
CF = Conversion Factor (10^{-6} kg/mg)
FI = Fraction Ingested from Contaminated Source (unitless)
EF = Exposure Frequency (days/year)
ED = Exposure Duration (years)
BW = Body Weight (kg)
AT = Averaging Time (period over which exposure is averaged, in days).

Variable Values:

CS: 95 percent upper confidence limit on the mean contaminant concentration measured in surficial soil (dry weight basis as presented in Table 8-1)

IR: 100 mg/day (age groups greater than 6 years old, USEPA, 1989b)

CF: 10^{-6} kg/mg

FI: 0.5 (adjustment assumes that yardwork at site constitutes one-half of outdoor activity)

EF: 26 days/year (1 day of yard maintenance per week during the period of May - October)

ED: 9 years (national median time (50th percentile) at one residence; USEPA, 1989b)

BW: 70 kg (adult, average; USEPA, 1989b)

AT: Pathway-specific period of exposure for noncarcinogenic effects (i.e., ED x 365 days/year), and 70 year lifetime for carcinogenic effects (i.e., 70 years x 365 days/year).

Reference: USEPA, 1989d

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TABLE 8-8

COLUMBUS McKINNON CORP.

ON-SITE ASSESSMENT OF WORKER EXPOSURE: DERMAL CONTACT WITH CHEMICALS IN SOIL

Equation:

$$Absorbed\ Dose\ (mg/kg\text{-}day) = \frac{CS \times CF \times SA \times AF \times ABS \times EF \times ED}{BW \times AT}$$

Where:

CS	=	Chemical Concentration in Soil (mg/kg)
CF	=	Conversion Factor (10^{-6} kg/mg)
SA	=	Skin Surface Area Available for Contact (cm^2/event)
AF	=	Soil to Skin Adherence Factor (mg/cm^2)
ABS	=	Absorption Factor (unitless)
EF	=	Exposure Frequency (events/year)
ED	=	Exposure Duration (years)
BW	=	Body Weight (kg)
AT	=	Averaging Time (period over which exposure is averaged, in days).

Variable Values:

CS: 95 percent upper confidence limit on the mean contaminant concentration measured in surficial soil (dry weight basis as presented in Table 8-1)

CF: 10^{-6} kg/mg

SA: 4300 cm^2 (mean surface area for head, neck, arms and hands for adult males; USEPA; 1989b)

AF: 2.77 mg/cm^2 -- kaolin clay (for hands; USEPA 1988b; 1989b)

ABS: 0.01 (inorganics) and 0.05 (semivolatiles including PCBs) (USEPA, 1990d)

EF: 26 days/year (1 day of yard maintenance per week during the period of May - October)

ED: 9 years (national median time (50th percentile) at one residence; USEPA, 1989b)

BW: 70 kg (adult, average; USEPA, 1989b)

AT: Pathway-specific period of exposure for noncarcinogenic effects (i.e., ED x 365 days/year), and 70 year lifetime for carcinogenic effects (i.e., 70 years x 365 days/year).

Reference: USEPA, 1989d

1980; Kenaga and Goring, 1980; Mackay, 1982). Recently, the USEPA has drafted guidance recommending the use of the following multi-species log BCF - log K_{ow} equation for prediction of BCF values for freshwater (and marine) organisms (USEPA, 1990e):

$$\log BCF = 0.79 \log K_{ow} - 0.40$$

This relationship is derived from a data set consisting of 122 BCF values for 13 freshwater and marine species (the regression coefficient, r^2 = 0.86). The log K_{ow} value for Aroclor-1254 is listed as 6.5 (ATSDR, 1989c). Therefore, for Aroclor-1254:

$$\log BCF = 0.79(6.5) - 0.40$$
$$= 4.7$$
$$BCF = 54{,}325$$

The above equation was developed using BCF values normalized to a 7.6 percent lipid content for the whole fish. However, bioconcentration of PCBs in fish fillets, which are part of the human diet, may be evaluated by assuming a lipid content of 3 percent. The above equation is adjusted for this scenario as follows (USEPA, 1990e):

$$\log BCF = 0.79 \log K_{ow} - 0.40 - \log (7.6/3.0)$$
$$= 0.79(6.5) - 0.40 - 0.40$$
$$= 4.3$$
$$BCF = 21{,}627$$

Bioconcentration in fish is related to the availability and concentration of contaminants such as PCBs in surface water. As indicated in Table 7-3, soil erosion from the study area under prior unremediated conditions resulted in an estimated worst-case loading (i.e., no plastic sheeting in the Central Area and no IRM creek bank stabilization) of 2.20 kg PCBs/yr (or about 4.9 lbs PCBs/yr). The average flow of Ellicott Creek is 130 ft^3/sec, or 1.16 x 10^{11} liters annually (USGS, 1984b). The resulting concentration of PCBs in the stream (C_w) would be on the order of 19 x 10^{-6} mg/l or 19 parts per trillion. Most of this will partition onto sediments in the stream, based upon the high organic carbon-water partition coefficient (K_{oc}) of PCBs. However, if it is assumed that all the PCBs entering the stream are dissolved, the concentration which should partition in fish (C_f) can be calculated from:

$$C_f = C_w BCF$$
$$= (19 \times 10^{-6} \text{ mg/kg})(54,325)$$
$$= 1.03 \text{ mg/kg}$$

or, for edible fish fillets only:

$$C_f = (19 \times 10^{-6} \text{ mg/l})(21,627)$$
$$= 0.4 \text{ mg/l}$$

Thus, using a predicted BCF, and an estimated PCB concentration in water, an equilibrium PCB concentration in fish has been estimated. This estimate assumes that all PCB entering the creek from the study area will be dissolved in water and that a prior unremediated condition exists. The analysis results in an estimate of contaminant concentrations in fish with an order-of-magnitude confidence limit for most fish species (USEPA, 1990e).

If the above analysis is repeated based upon presently existing conditions at the study area, a PCB concentration in edible fish fillets (C_f) of 0.04 mg/kg is obtained. This result is based upon a total PCB loading to Ellicott Creek of 0.19 kg/year (see Table 7-3) and reflects the degree of risk reduction achieved as a result of the remedial activities (i.e., plastic sheeting in the Central Area and IRM creek bank stabilization) completed to date. This analysis also assumes that all the PCBs entering the stream are dissolved.

The above analysis has also been repeated using a BCF of 100,000. This BCF is a "guideline" value used by NYSDEC as given in NYSDEC Surface Water Quality Standard Documentation for PCBs, dated July 26, 1984. When this BCF value is used, a PCB concentration in edible fish fillets (cf) of 1.9 mg/Kg and 0.16 mg/Kg is calculated, based upon the prior unremediated and present site conditions, respectively.

8.3.5.3 <u>Ingestion/Adsorption of Contaminants During Swimming</u>

Exposures of recreational visitors due to ingestion or adsorption of contaminants while swimming in Ellicott Creek are estimated using the equations presented in Tables 8-9 and 8-10. This exposure scenario

TABLE 8-9

COLUMBUS McKINNON CORP.

ASSESSMENT OF RECREATIONAL EXPOSURE: INGESTION OF CHEMICALS WHILE SWIMMING

Equation:

$$\textit{Intake Dose (mg/kg-day)} = \frac{CW \times CR \times ET \times EF \times ED}{BW \times AT}$$

Where:

CW	=	Chemical Concentration in Water (mg/liter)
CR	=	Contact Rate (liters/hour)
ET	=	Exposure Time (hours/event)
EF	=	Exposure Frequency (events/year)
ED	=	Exposure Duration (years)
BW	=	Body Weight (kg)
AT	=	Averaging Time (period over which exposure is averaged, in days).

Variable Values:

CW: Calculated surface water concentration, based on loadings from site due to soil loss - using average stream flow and contaminant loading calculated for the prior unremediated condition

CR: 0.05 l/hr

ET: 2.6 hrs/day (national average for swimming; USEPA, 1989b)

EF: 7 days/year (national average for swimming; USEPA, 1989b)

ED: 30 years (national upper-bound time (90th percentile) at one residence; USEPA, 1989b)

BW: 70 kg (adult, average; USEPA, 1989b)

AT: Pathway-specific period of exposure for noncarcinogenic effects (i.e., ED x 365 days/year), and 70-year lifetime for carcinogenic effects (i.e., 70 years x 365 days/year).

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TABLE 8-10

COLUMBUS McKINNON CORP.

ASSESSMENT OF RECREATIONAL EXPOSURE:
DERMAL CONTACT WITH CHEMICALS IN WATER

Equation:

$$\text{Absorbed Dose (mg/kg-day)} = \frac{CW \times SA \times PC \times ET \times EF \times ED \times CF}{BW \times AT}$$

Where:

CW	=	Chemical Concentration in Water (mg/liter)
SA	=	Skin Surface Area Available for Contact (cm^2)
PC	=	Chemical-specific Dermal Permeability Constant (cm/hr)
ET	=	Exposure Time (hours/day)
EF	=	Exposure Frequency (days/year)
ED	=	Exposure Duration (years)
CF	=	Volumetric Conversion Factor for Water (1 liter/1000 cm^3)
BW	=	Body Weight (kg)
AT	=	Averaging Time (period over which exposure is averaged, in days).

Variable Values:

CW: Calculated surface water concentration, based on loadings from site due to soil loss - using average stream flow and contaminant loading calculated for the prior unremediated condition

SA: 19,400 cm^2 (50th percentile total body surface area for adult males; USEPA, 1989b)

PC: 8.4×10^{-4} cm/hr (permeability of water, used as a default value; USEPA, 1989b)

ET: 2.6 hrs/day (national average for swimming; USEPA, 1989b)

ED: 30 years (national upper-bound time (90th percentile) at one residence; USEPA, 1989b)

CF: 1 liter/1,000 cm^3

BW: 70 kg (adult, average; USEPA, 1989b)

AT: Pathway-specific period of exposure for noncarcinogenic effects (i.e., ED x 365 days/year), and 70-year lifetime for carcinogenic effects (i.e., 70 years x 365 days/year).

assumes that a recreational visitor will swim in Ellicott Creek 7 days per year for 2.6 hours each day (USEPA, 1989d).

As with the direct contact with soil scenario (see Section 8.3.5.1), the exposure averaging time (AT) differs for the evaluation of carcinogenic versus noncarcinogenic effects, as indicated in Tables 8-9 and 8-10.

Application of the equations provided in Tables 8-9 and 8-10 results in intake or adsorbed dose (expressed in mg/Kg-day) as presented in Tables 8-15 and 8-16 as a "chronic daily intake" (CDI).

8.4 TOXICITY ASSESSMENT

In this section, the inherent toxicity of the chemicals of concern is reviewed. Guidance levels for the evaluation of the likelihood and magnitude of harm to health are also presented.

8.4.1 Chemical Profiles

Polychlorinated Biphenyls

PCBs are mixtures with a variety of different congeners and impurities (ATSDR, 1989c). The general population is exposed to PCBs, primarily through consumption of fish. Dermal absorption of PCBs may occur, but there is not adequate data to determine rates of absorption. Due to their lipophilicity, PCBs are distributed to the fat, skin, and other fat-containing organs. Occupational exposure to PCBs has been associated with reversible skin lesions and subclinical alterations of serum enzymes suggestive of liver enzyme induction and possible hepatocellular damage. The USEPA has determined that the positive evidence for carcinogenicity of Aroclor 1254 in animals, along with inadequate evidence in humans, places it in Category B2, as a probable human carcinogen. USEPA has recommended that all commercial PCB mixtures be considered to have equivalent carcinogenic potential and has classified all PCB mixtures in Category B2.

Cadmium

Cadmium can enter the body by absorption from the stomach or intestines after ingestion (ATSDR, 1989a). Very little cadmium enters the body through the skin. However, once cadmium enters the body, it is very strongly retained; therefore, even low doses may build up significant cadmium levels in the body if exposure continues for a long time. Ingestion of high doses causes severe irritation to the stomach, leading to vomiting and diarrhea. Kidney and lung damage, and high blood pressure are effects that may result from chronic, low doses of exposure to cadmium. The USEPA has classified cadmium as a probable human carcinogen (B1) by the inhalation route. There are not sufficient data to consider cadmium to be carcinogenic by the oral route.

Chromium

Chromium is considered to be an essential nutrient that helps maintain normal metabolism of glucose, cholesterol and fat in humans (ATSDR, 1989b). Leachability studies conducted by ACTS Testing Labs (see Appendix E) on contaminated soils at Columbus McKinnon suggest that chromium detected on-site is metallic chromium. Chromium can occur in oxidation states ranging from Cr^{2+} to Cr^{6+} but only the trivalent and hexavalent forms are of biological significance. The trivalent form is more common. There is no evidence that trivalent chromium is converted to hexavalent in biologic systems. Kidney damage is the major acute effect associated with accidental ingestion of large amounts of chromium. Trivalent chromium is considerably less toxic than hexavalent chromium, which is not believed to be present on-site. There is no data available to evaluate the possible carcinogenicity of trivalent chromium in humans (IRIS, 1990).

Lead

Available evidence suggests that effects of lead on the formation of hemoglobin and other hemo-proteins are detectible at lower levels of lead exposure than are effects on any other organ or system (ATSDR, 1990). Neurological effects in children are indicators of lead toxicity, although the threshold for noticeable effects has not been well defined. The USEPA has classified lead as a probable human carcinogen because some lead compounds cause tumors in experimental animals, and has assigned a value of zero for the current MCGL for lead. Despite these actions, the USEPA recommends that quantitative estimates of the carcinogenic potency of lead not be used for the purposes of the risk assessment; "quantifying lead's cancer risk involves many uncertainties, some of which may be unique to lead. Age, health, nutritional state, body burden, and exposure duration influence the absorption, release and excretion of lead...thus the Carcinogen Assessment Group recommends that a numerical estimate not be used" (IRIS, 1990).

Nickel

Nickel or its compounds can affect the immune system. Continued contact with the skin can cause skin allergies. By inhalation, nickel refinery dust including nickel subsulfide has been shown to cause cancer in the lung, nasal cavity, and voice box in humans and is classified "A" - human carcinogen. Metallic nickel and nickel carbonyl are shown to be carcinogenic in humans, again via inhalation. The carcinogenic effect of oral exposure has not been established.

8.4.2 Non-Carcinogenic Effects

The potential for non-cancer health effects is evaluated by comparing an exposure level over a specified time period with a reference dose (RfD) derived for a similar exposure period (USEPA, 1987e; 1989e). This ratio of exposure to toxicity is called a hazard quotient. The non-cancer hazard quotient assumes that there is a level of exposure (i.e., the RfD) below which it is unlikely for even sensitive populations to experience adverse health effects. If the hazard quotient exceeds 1, there may be concern for potential noncancer effects. The greater the hazard quotient above unity, the greater the level of concern. The chronic RfDs used in this analysis, and their basis, are presented in Table 8-11.

In the absence of an RFD for lead, a level is derived based on evidence of biomedically adverse effects at blood lead levels of 10-15 ug/deciliter (ug/dl). Using a methodology applied previously by the

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TABLE 8-11

COLUMBUS McKINNON CORP.

TOXICITY VALUES: POTENTIAL NONCARCINOGENIC EFFECTS

Chemical	Chronic RfD (mg/kg-day)	Confidence Level	Critical Effect	RFD Basis/ RFD Source*	Uncertainty and Modifying Factors*
Oral Route					
Cadmium	5E-04	High	Kidney damage	Water/IRIS	UF=10 MF=1
Chromium (VI)	5E-03	Low	Blood, tissue pathology	Water/IRIS	UF=500 MF=1
Lead	3.2E-04	-	-	-	-
Nickel (soluble salts)	2E-02	Medium	Decreased body and organ weights	Feed/IRIS	UF=100 MF=1
Polychlorinated Biphenyls	ND(2)	-	-	-	-

(1) Based on a blood lead level of concern of 10 ug/dl.
(2) SEPA has adopted a 10-day drinking water health advisory for PCB's (noncancer effects) of 70 μg/day, which assumes that 100% of PCB exposure is from drinking water. (ATSDR, 1989c)

NA = Not Available
IRIS = Integrated Risk Information System (USEPA database) (IRIS, 1990)
UF = Uncertainty Factor, to account for inter- and intraspecies extrapolation and extrapolation from subchronic to chronic exposures.
MF = Modifying Factor, to account for uncertainty in the test program.

Reference: USEPA, 1989d.

USEPA in their derivation of a Maximum Contamination Level Goal (MCLG) for lead in drinking water, with modification, a reference dose of 3.2E-04 mg/kg-day can be derived. The assumptions used in this derivation, some of which differ from the approach taken by the USEPA, are as follows: a factor of 6.25 to convert from the PbB level to a lead concentration in drinking water; a safety factor of 10 which is protective of health; and ingestion of 1.5 liters of water per day by a 28.9 kg child. The reference dose so derived is 3.2E-04 mg/kg-day.

8.4.3 Carcinogenic Effects

Regardless of the mechanism of effect, risk assessment methods generally derive from the hypothesis that thresholds for cancer induction by carcinogens do not exist and that the dose:response relationship is linear at low doses. The methods require extrapolation from high dose animal studies to evaluate low dose exposure to humans. In the absence of adequate information to the contrary, a linearized, multistage, non-threshold low-dose extrapolation model is recommended by USEPA (1986a) as the most appropriate method for assessing chemical carcinogens. USEPA emphasizes that this procedure leads to a plausible upper limit to the risk that is consistent with some proposed mechanisms of carcinogenesis.

Through application of this approach, USEPA has derived estimates of incremental excess cancer risk from lifetime exposure to potential carcinogens. This is accomplished by establishing the carcinogenic potency of the chemical substance through critical evaluation of the various test data and the fitting of dose:response data to a low dose extrapolation model. The slope factor (which describes the dose:response relationship at low doses) is expressed as a function of intake (i.e., per mg/kg/day). This expression incorporates standard pharmacological considerations such as body weight (typically assumed to be 70 kg or about 154 lbs for an average adult). The slope factors presented in Table 8-12 are used to estimate finite, upper limits of risk at low dose levels administered over a lifetime. The linear low-dose cancer risk equation is:

$$Risk = CDI \times SF$$

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TABLE 8-12

COLUMBUS McKINNON CORP.

TOXICITY VALUES: POTENTIAL CARCINOGENIC EFFECTS

Chemical	Slope Factor (SF) $(mg/kg\text{-}day)^{-1}$	Weight-of-Evidence Classification	Type of Cancer	SF Basis/ SF Source
Oral Route				
Cadmium	NA			/IRIS, HEA
Chromium	NA			/IRIS, HEA
Lead	NA	B2		/IRIS, HEA
Nickel	NA			/IRIS, HEA
Polychlorinated Biphenyls	7.7E+00	B2	Liver	Diet/IRIS

NA = Not Available

B2 = Probable human carcinogen

IRIS = Integrated Risk Information System (USEPA database)

HEA = Health Effects Assessment Summary Tables.

References: IRIS (1990); USEPA (1990b; 1989d) where:

Risk = a unitless probability (e.g., 2×10^{-5}) of an individual developing cancer;

CDI = chronic daily intake averaged over 70 years (mg/kg-day); and

SF = slope factor, expressed in $(mg/kg\text{-}day)^{-1}$

This linear equation is valid only at low risk levels (i.e., below estimated risks of 0.01). This approach does not necessarily give a realistic prediction of risk. The true value of the risk at trace ambient concentrations is unknown, and may be as low as zero.

The slope factor for PCBs is presented in Table 8-12. The other indicator chemicals do not have assigned slope factors for oral exposures.

There are no assigned slope factors for dermal exposure (skin contact). In their absence, oral slope factors are used. This will tend to overestimate risk for carcinogens which exert their effects systemically.

8.4.4 Mixtures

To evaluate the overall potential for non-cancer and cancer effects posed by multiple chemicals, the USEPA has developed guidelines (USEPA, 1986b). For the assessment of non-cancer effects, a hazard index approach is used. This approach assumes that subthreshold exposures to several chemicals at the same time could result in an adverse health effect. It assumes that the magnitude of the adverse effect will be proportional to the sum of the ratios of the subthreshold exposures to acceptable exposures. The hazard index is equal to the sum of the hazard quotients. When the hazard index exceeds a value of one (1) there may be concern for potential health effects.

For the assessment of cancer effects, the individual risks associated with exposure to each contaminant are summed. This represents an approximation of the precise equation for combining risks which accounts for the joint probabilities of the same individual developing cancer as a consequence of exposure to two or more carcinogens. This additive approach assumes independence of action by the compounds involved (i.e., that there are no synergistic or antagonistic chemical interactions and all chemicals produce the same effect, i.e., cancer).

8.5 RISK CHARACTERIZATION

The magnitude of risk associated with exposures of Columbus McKinnon yard maintenance workers to contaminants in surficial soil on the site, and to fish which become contaminated with PCBs is evaluated in this section. Potential non-cancer health effects, those associated with long-term chronic exposure to surficial soil, are assessed through application of reference doses presented in Table 8-11. The cumulative impact of exposure from inadvertent ingestion and skin contact is estimated.

Carcinogenic risks are quantified for exposure to surficial soils, using the slope factors presented in Table 8-12.

8.5.1 Non-Cancer Risks

As presented in Table 8-13, the non-cancer risks associated with ingestion and skin contact with soils at the surface of the site during maintenance activities result in a hazard quotient for lead and an overall hazard index of 1, indicating a potential cause for concern due to possible lead exposure. This risk is actually lower than indicated due to the plastic sheeting, which covers the Central Area and minimizes the potential exposure of yard workers to contaminated soils.

As indicated in Table 8-14, the noncancer risk associated with swimming in Ellicott Creek is insignificant.

8.5.2 Cancer Risks

As presented in Table 8-15, PCBs are the only compounds of the indicator chemicals which have been assigned a cancer slope factor for exposures via ingestion (also used in the analysis of skin contact). As indicated, exposures from inadvertent ingestion and skin contact may result in risk levels of about 4 in one hundred thousand and 5 in ten thousand respectively, or, in sum, about 5 in ten thousand (5×10^4). However, the actual risk to yard maintenance workers is likely to be much less than calculated, given the fact that the most contaminated area on

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TABLE 8-13

COLUMBUS McKINNON CORP.

CHRONIC HAZARD INDEX ESTIMATES (NONCANCER EFFECTS) YARD WORKER EXPOSURE

CHEMICAL	CDI (MG/KG-DAY)	CDI ADJUSTED FOR ABSORPTION	RfD (MG/KG-DAY)	HAZARD QUOTIENT
Exposure Pathway: Ingestion of Chemicals in Soil by Workers				
Cadmium	3.4E-06	No	5E-04	0.007
Chromium	2.0E-05	No	5E-03	0.004
Lead	3.1E-04	No	3.2E-04(1)	1.0
Nickel	6.4E-05	No	2E-02	0.003
Polychlorinated Biphenyls	4.0E-05	No	1E-02(2)	0.004
Pathway Hazard Index = 1.0				
Exposure Pathway: Dermal Contact with Chemicals in Soil by Workers				
Cadmium	4.1E-05	Yes	5E-04	0.08
Chromium	2.4E-04	Yes	5E-03	0.05
Lead	3.7E-03	Yes	3.2E-04(1)	12.0
Nickel	7.6E-04	Yes	2E-02	0.04
Polychlorinated Biphenyls	4.7E-04	Yes	1E-02(2)	0.05
Pathway Hazard Index = 12.0				
Total Exposure Hazard Index = 13.0				

(1) Based on a blood lead level of concern of 10 ug/dl.
(2) Based on Non-Cancer USEPA 10-day adult health advisory (ATSDR, 1989c)
ND = None determined
CDI = Chromic Daily Intake
RfD = Reference Dose for Non-Carcinogenic Effects (IRIS, 1990; USEPA, 1990b)
Hazard Quotient = CDI ÷ RfD

Reference: USEPA:, 1989d

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TABLE 8-14

COLUMBUS McKINNON CORP.

CHRONIC HAZARD INDEX ESTIMATES (NONCANCER EFFECTS)
RECREATIONAL (SWIMMING) EXPOSURE

CHEMICAL	CONCENTRATION (mg/l)	CDI (MG/KG-DAY)	CDI ADJUSTED FOR ABSORPTION	Rfd (MG/KG-DAY)	HAZARD QUOTIENT
Exposure Pathway: Ingestion of Chemicals in Water while Swimming					
Cadmium	2.9E-06	1.0E-10	No	5E-04	2.1E-07
Chromium	3.6E-05	1.3E-09	No	5E-03	2.6E-07
Lead	1.8E-04	6.4E-09	No	3.2E-04(1)	2.0E-05
Nickel	8.6E-05	3.1E-09	No	2E-02	1.5E-07
Polychlorinated Biphenyls	1.9E-05	6.8E-10	No	1E-02(2)	6.8E-08
Pathway Hazard Index = 0.00002					
Exposure Pathway: Dermal Contact with Chemicals in Water while Swimming					
Cadmium	2.9E-06	3.4E-11	Yes	5E-04	6.7E-08
Chromium	3.6E-05	4.2E-10	Yes	5E-03	8.4E-08
Lead	1.8E-04	2.1E-09	Yes	3.2E-04(1)	6.5E-06
Nickel	8.6E-05	1.0E-09	Yes	2E-02	5.0E-08
Polychlorinated Biphenyls	1.9E-05	2.2E-10	Yes	1E-02(2)	2.2E-08
Pathway Hazard Index = 0.000006					
Total Exposure Hazard Index = 0.00003					

(1) Based on a blood lead level of concern of 10 ug/dl.
(2) Based on Non-Cancer USEPA 10-day adult health advisory (ATSDR, 1989c)
ND = None determined
CDI = Chromic Daily Intake
RfD = Reference Dose for Non-Carcinogenic Effects (IRIS, 1990; USEPA, 1990b)
Hazard Quotient = CDI ÷ RfD

Reference: USEPA:, 1989d

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TABLE 8-15

COLUMBUS McKINNON CORP.

CANCER RISK ESTIMATES - YARD WORKER EXPOSURE

CHEMICAL	CDI (MG/KG-DAY)	CDI ADJUSTED FOR ABSORPTION	SF $(MG/KG\text{-}DAY)^{-1}$	CHEMICAL-SPECIFIC RISK
Exposure Pathway: Ingestion of Chemicals in Soil by Workers				
Polychlorinated Biphenyls	5.1E-06	No	7.7E+00	3.9E-05
Total Pathway Risk: 3.9E-05				
Exposure Pathway: Dermal Contact with Chemicals in Soil by Workers				
Polychlorinated Biphenyls	6.1E-05	Yes	7.7E+00	4.7E-04
Total Pathway Risk: 4.7E-04				
Total Exposure Risk: 5.1E-04				

NOTES:

CDI = Chronic Daily Intake
SF = Carcinogenic Slope Factor (IRIS, 1990; USEPA 1990b)
Chemical-Specific Risk = CDI x SF (see text)

Reference: USEPA, 1989d

site is covered with plastic sheeting and no maintenance activities occur there.

The cancer risk associated with swimming in Ellicott Creek is much less than 1 in one million (see Table 8-16).

8.5.3 Comparison with Guidelines and Tolerances

In 1984, the U.S. Food and Drug Administration established a tolerance level for PCBs in fish at 2 mg/kg (USFDA, 1984). This tolerance level is applicable to fish consumption in New York State. The PCB concentration in fish fillets estimated in Section 8.3.5, based upon the prior unremediated conditions at the study area, is 0.4 to 1.9 mg/kg, which is slightly below to 5 times lower than the FDA tolerance limit. For current conditions, which reflect the degree of risk reduction achieved through the implementation of remedial measures to date, the estimated PCB concentration in fish fillets is 0.04 to 0.16 mg/kg. This is 13 to 50 times less than the FDA tolerance limit. The viability of fish in the Creek is discussed below, in Section 8.5.4.

The USEPA has proposed that the ambient water quality concentration should be zero for protection of human health from the potential carcinogenic effects of PCB exposure through ingestion of contaminated water and fish, but sets a recommended criterion associated with a lifetime risk of 10^{-6} of 0.079 ng/l, based predominantly on fish ingestion. The analysis presented in Section 8.3.5, for the prior unremediated conditions in the study area, resulted in an estimated PCB concentration in surface water of 19 ng/l, which is over 200 times this ambient water quality criterion. For the current conditions, which reflect the degree of risk reduction achieved through the implementation of remedial measures to date, the estimated PCB concentration in surface water is 1.6 ng/l, or 20 times the USEPA ambient water quality criterion. This assumes a total PCB loading to the creek via soil erosion of 0.19 kg/yr.

The New York State ambient water quality criterion for PCBs in a Class D stream is 0.001 ug/l (6 NYCRR Part 701). The analysis presented in Section 8.3.5, for prior unremediated conditions, estimated an upper limit water concentration of about 0.019 ug/l, which is 19 times the criterion. Conversely, when the analysis is repeated using the presently existing conditions (i.e., IRM construction completed), the estimated PCB

TABLE 8-16

COLUMBUS McKINNON CORP.

CANCER RISK ESTIMATES - RECREATIONAL (SWIMMING) EXPOSURE

CHEMICAL	CDI (MG/KG-DAY)	CDI ADJUSTED FOR ABSORPTION	SF $(MG/KG\text{-}DAY)^{-1}$	CHEMICAL-SPECIFIC RISK
Exposure Pathway: Ingestion of Chemicals in Water while Swimming				
Polychlorinated Biphenyls	2.9E-10	No	7.7E+00	2.2E-09
Total Pathway Risk: 2.2E-09				
Exposure Pathway: Dermal Contact with Chemicals in Water while Swimming				
Polychlorinated Biphenyls	9.45E-11	Yes	7.7E+00	7.3E-10
Total Pathway Risk: 7.3E-10				
Total Exposure Risk: 2.9E-09				

NOTES:

CDI = Chronic Daily Intake
SF = Carcinogenic Slope Factor (IRIS, 1990; USEPA 1990b)
Chemical-Specific Risk = CDI x SF (see text)

Reference: USEPA, 1989d

concentration in surface water of 0.0016 ug/l, which is 1.6 times greater than New York State ambient water quality criterion. It is noted that these analyses conservatively assume that all PCB entering the creek will partition into water. The high organic carbon:water partition coefficient (K_{oc} = 6.5) indicates, however, that most of the PCBs will partition to stream sediment, and thus the actual concentration will be much lower than that presented above.

8.5.4 Environmental Risks

8.5.4.1 Aquatic Risks Associated with Surface Water Quality

The federal ambient water quality criterion for protection of freshwater aquatic life is 0.014 ug/l PCB as a 24-hour average. Data from the literature indicate that acute toxicity to freshwater aquatic life may occur at concentrations above 2.0 ug/l. The conservative analysis performed in Section 8.3.5 resulted in an estimated upper limit water concentration of about 0.019 ug/l and 0.0016 ug/l for the prior unremediated and current conditions, respectively. The estimated water concentration for the prior unremediated conditions slightly exceeds the federal ambient water quality criterion for freshwater aquatic life. Both values are below the level of acute toxicity.

8.5.4.2 Aquatic Risks Associated with Sediment Pore Water

Fish present in Ellicott Creek may come into contact with the PCB-contaminated sediments which are located on the creek bottom in the immediate vicinity of the alleged former waste oil disposal area. This area of contaminated sediments is approximately 100-150 feet in length and extends into the creek about 20-25 feet. Benthic organisms which inhabit this area would also be exposed to the contaminated sediments and pore water. therefore, aquatic hazard quotients for the sediment pore water were calculated to assess aquatic risks.

The estimated pore water concentration for PCB-1254 assumes that the sediment and pore water concentration is in equilibrium as is commonly assumed for environmental contaminants (Karickhoff, 1984). This concentration was derived using the following relationship:

$$Cp = C_s/(K_{oc} - f_{oc})$$

where

C_p = pore water concentration of PCB-1254 (ug/l)

C_s = sediment concentration of PCB-1254 (ug/Kg)

K_{oc} = organic carbon partition coefficient (ug/Kg soil/ug/Kg water)

f_{oc} = sediment organic carbon content (0.02 g/g - Thomas et al., 1972)

A pore water concentration was calculated on the basis of both the maximum (41,000 ug/Kg) and the average (7,000 ug/Kg) concentrations of PCB-1254 detected within the contaminated area during the present RI. The estimated pore water concentrations and hazard quotients are presented in Table 8-17. As indicated, the hazard quotients are less than unity for acute toxicity and greater than unity for chronic toxicity. This result suggests a potential for chronic toxicity to aquatic organisms; although, as previously discussed, the extent of the sediment having measurable concentrations of PCB-1254 is limited to a small area.

8.5.5 Public Welfare

Economic losses may accrue because of the lessened value of the Columbus McKinnon site due to its ongoing hazardous waste site status. No imminent threat to occupants of the site, nor to residents in the vicinity of the site, presently exists.

8.6 DISCUSSION

The primary exposure pathways which may result in human health risk are from possible exposure to lead resulting from incidental contact with surficial soils on the site, and from ingestion of fish which may become contaminated with PCBs. The analysis presented here was highly conservative. For PCBs in soil for example, the Agency for Toxic Substances and Disease Registry (ATSDR) of the U.S. Public Health Service has stated that, "Soil ingestion and dermal contact with soil would not be expected to be significant routes of exposure at a limited access site" (ATSDR, 1989c). The ATSDR then references a study by the USEPA which calculated

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TABLE 8-17

COLUMBUS McKINNON CORPORATION

AQUATIC TOXICITY QUOTIENT CALCULATION
FOR PCB-CONTAMINATED CREEK SEDIMENT PORE WATER

	Fresh Water Aquatic Toxicity Criteria					Hazard Quotient	
	Acute (ug/l)	Chronic (ug/l)	Notes	Ref.	Pore Water Conc. (ug/l)	Acute	Chronic
PCB 1254 (max.)	2	0.014	1	1	1.48	0.74	106
PCB 1254 (avg.)	2	0.014	1	1	0.25	0.12	18

NOTES:

(1) Criteria based on total of all chlorinated isomers of the compound.

Reference:

(1) USEPA, 1986. Quality Criteria for Water. Office of Water Regulations and Standards EPA 440/5-86-001.

that PCB levels of 25 ppm in soil would present less than a 1 x 10^{-7} risk to people on site who work more than 0.1 km from the actual spill area (assuming that the spill area is <0.5 acre) (USEPA, 1987). They also state that ingestion is considered the primary route of exposure at unrestricted sites; but that dermal exposure would be of less consequence because PCBs will adsorb to soil particles, reducing the rate of dermal absorption.

The analysis of bioaccumulation of PCBs in fish was also highly conservative, resulting in the calculation of dissolved PCB concentrations which exceeded ambient water quality criteria for the protection of human health. The FDA tolerance limit for PCBs in fish as a food was not exceeded. Calculation of hazards quotients for PCB-contaminated creek sediment pore water indicated a potential for chronic toxicity to aquatic organisms.

8.7 CONCLUSIONS

In this health risk assessment, exposures to site contaminants were evaluated. Several exposure scenarios were considered:

- maintenance personnel may contact contaminated soils, resulting in absorption of contaminants through the skin;
- maintenance personnel may inadvertently ingest contaminated soils during yard work;
- residents and recreational users of Ellicott Creek may periodically consume fish caught in the creek; and
- recreational users of Ellicott Creek may periodically use the creek for swimming.

Additionally, continued viability of freshwater aquatic life in Ellicott Creek in light of site contamination, was assessed.

Contaminants which were evaluated consisted of PCBs, cadmium, chromium, lead and nickel. These compounds were selected due to their inherent toxicity and their frequency of detection in on-site soils.

The results of the human health risk assessment are summarized below. Although the approach taken to perform this risk assessment is very conservative and probably overstates the actual risks associated with the site, it is the approach recommended by USEPA to allow for uncertainties in the risk assessment process. In addition, the risk assessment has been performed on the basis of the former unremediated conditions at the site. Actual cancer risk estimates summarized below are much lower when the degree of risk reduction achieved by the interim remedial measures now in place are considered.

SOILS

Ingestion

Non-Cancer Effects: The only contaminant which may pose concern from a non-cancer standpoint, for this exposure pathway, is lead. The other four contaminants (cadmium, chromium, nickel, and PCBs) are of minimal concern for this pathway.

Cancer Effects: The incremental cancer risk associated with ingestion of PCBs in soil is about 4 in one hundred thousand.

Dermal Contact

Non-Cancer Effects: As with the ingestion pathway, the only contaminant of concern due to skin contact is lead. The hazard index for lead via this exposure pathway indicates the need for greater concern than for the ingestion pathway.

Cancer Effects: The incremental cancer risk associated with dermal contact with PCBs in soil is about 5 in ten thousand, or over a factor of 10 greater than the risk posed by the ingestion pathway.

SURFACE WATER

Ingestion

Non-Cancer Effects: None of the contaminants in surface water pose a health hazard, from a non-cancer standpoint, via ingestion.

Cancer Effects: The incremental cancer risk associated with ingestion exposure during swimming was calculated to be about 2 in one billion.

Dermal Contact

Non-Cancer Effects: None of the contaminants in surface water pose a health hazard, from a non-cancer standpoint, via skin contact.

Cancer Effects: The incremental cancer risk associated with skin contact was calculated to be about 7 in one hundred trillion.

FISH

Ingestion

The PCB concentration in fish fillets based on prior unremediated conditions was calculated to be 0.4 to 1.9 mg/kg. However, for conditions which reflect the degree of risk reduction achieved with the implementation of remedial measures to-date, the calculated PCB concentration in fish fillets is 0.05 to 0.16 mg/kg. These concentrations are lower than the FDA tolerance limit for PCBs in fish as food, which is 2 mg/kg.

The results of the environmental assessment quotients suggest a potential for chronic toxicity for aquatic organisms exposed to sediments contaminated with PCB-1254 in the creek immediately adjacent to the site. However, the extent of the contaminated sediments having measurable concentrations of PCB-1254 is limited to a small area of the creek.

9.0 LIST OF REFERENCES

Advanced Environmental Systems (1981). Inactive Waste Disposal Site Investigation to Define Final Closure Plan.

Advanced Environmental Systems (1982). Closure Plan for Inactive Landfill Site. Tonawanda, New York.

Advanced Environmental Systems/Conestoga Rovers Assoc. (1983). Ground Water and Additional Sampling Program. Tonawanda, New York.

Advanced Environmental Systems/Conestoga Rovers Assoc. (1985). Remedial Action Plan, Inactive Disposal Site.

Agency for Toxic Substances and Disease Registry (1990). Toxicological Profile for Lead. ATSDR/TP-88/17. Oak Ridge National Laboratory. Oak Ridge, TN. 207 p.

Agency for Toxic Substances and Disease Registry (1989a). Toxicological Profile for Cadmium. ATSDR/TP-88/08. Oak Ridge National Laboratory. Oak Ridge, TN. 107 p.

Agency for Toxic Substances and Disease Registry (1989b). Toxicological Profile for Chromium. ATSDR/TP-88/10. Oak Ridge National Laboratory. Oak Ridge, TN. 135 p.

Agency for Toxic Substances and Disease Registry (1989c). Toxicological Profile for Selected PCBs (Aroclor-1260, -1254, -1248, -1242, -1232, -1221, and -1016). ATSDR/TP-88/21. Oak Ridge National Laboratory. Oak Ridge, TN. 135 p.

Agency for Toxic Substances and Disease Registry (1988). Toxicological Profile for Nickel. ATSDR/TP-88/19. Oak Ridge National Laboratory. Oak Ridge, TN. 111 p.

Bouwer H. and R.C. Rice (1976). A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or partially penetrating Wells. Water Resources Research 12(3):423-428.

Buehler, E.J. and I.H. Tesmer (1963). Geology of Erie County, New York. Buffalo Society of Natural Sciences Bulletin 21(3): 118 p.

Columbus McKinnon Corporation (1986). Inactive Waste Site Investigation and Remediation Status Report.

Cooper, H.H., J.D. Bredehoeft, and I.S. Papadopulos (1967). Response of a Finite Diameter Well to an instantaneous Charge of Water. Water Resources Research, 3(1):263-269.

D'Agostino, J.P. (1958). Lake Tonawanda History and Development. Unpublished M.A.. Thesis, University of Buffalo.

Doucette, W. J., A. W. Andreu (1988). Estimation of Octanol/Water Partition Coefficients: Evaluation of Six Methods for Highly Hydrophobic Aromatic Hydrocarbons. Chemosphere 17(2):345-359.

Federal Emergency Management Agency (FEMA) 1979). Flood Insurance Study, City of Tonawanda, New York, U.S. Federal Insurance Administration.

Freeze, R.A. and J.A. Cherry (1979). Groundwater. Prentice Hall Inc., Englewood Cliffs, NJ., 604 p.

Gilbert, R.O. (1987). Statistical Methods for Environmental Monitoring. Van Nostrand Reinhold, New York.

Harding, W.E. and B.K. Gilbert (1968). Surface Water in the Erie-Niagara Basin, New York. NYS Conservation Department, Water Resource Comm. Basin Planning Report.

Hvorslev, M.J. (1951). Time Lag and Soil Permeability in Ground Water Observations. U.S. Army Corps of Engineers, Waterways Experimental Station Bulletin 36, Vicksburg, Mississippi.

IRIS. Integrated Risk Information System (data base). (1990). U.S. Environmental Protection Agency, Office of Research and Development.

Isnard, P., S. Lambert (1988). Estimating Bioconcentration Factors from Octanol-Water Partition Coefficient and Aqueous Solubility. Chemosphere 17(1):21-34.

Karickhoff, S. W., D. S. Brown, and T. A. Scott (1979). Sorption of Hydrophobic Pollutants on Natural Sediment. Water Res. 13:241-248.

Kenaga, E. E., C. A. I. Goring (1980). Aquatic Toxicology ASTM STP 707:78-115.

Lambert, S. M. (1969). Omega, A Useful Index of Soil Sorption Equilibria. J. Agr. Fd. Chem. 16(2)340 - 343.

Lambert, S. M. (1967). Functional Relationship between Sorption in Soil and Chemical Structure. J. Agr. Fd. Chem. 14(4):572 - 576.

LaSala, A.M. (1968). Ground Water Resources of the Erie-Niagara Basin, New York. NYS Conservation Department, Water Resources Comm. Basin Planning Report ENB-3.

Mackay, D. (1982). Env. Sci. Tech. 16:274-278.

Malcolm Pirnie, Inc. (1991). Addendum to RIFS Work Plan, No. 2, Columbus McKinnon Corporation. April.

Malcolm Pirnie, Inc. (1990a). Interim Remedial Measure Construction Bid Package for Creek Bank Stabilization, Columbus McKinnon Corporation.

Malcolm Pirnie, Inc. (1990b). Interim Remedial Measure Work Plan. Columbus McKinnon Corporation.

Malcolm Pirnie, Inc. (1990c). Adendum to RIFS Work Plan/Quality Assurance Plan, Columbus McKinnon Corporation.

Malcolm Pirnie, Inc. (1989). RIFS Work Plan/Quality Assurance Plan, Columbus McKinnon Corporation.

Mueller, E.H. (1977). Quaternary Geology of New York, Niagara Sheet. New York Museum of Science, Map and Chart Series Number 28.

New York State Dept. of Environmental Conservation (1990). Division Technical and Administrative Guidance Memorandum - Fugitive Dust Suppression and Particulate Monitoring Program at Hazardous Waste Sites.

New York State Dept. of Environmental Conservation (1988). PCB Concentrations in the Striped Bass from the Marine District of New York State. Technical Report 88-1 (BEP) Division of Fish and Wildlife, Division of Marine Resources. Albany, New York. 20 p. (plus extensive tables).

Occupational Safety and Health Administration (1989). Air Contaminants - Permissible Exposure Limits (Title 29 Code of Federal Regulations Part 1910.1000). OSHA 3112. Washington, DC. 78 p.

Schroeder, P.R., R.L. Peyton, B.M. McEnroe, and J.W. Sjostrom (1988). Hydrologic Evaluation of Landfill Performance (HELP) Model: Version 2. HELP'S Modeling Workshop 1989. Univ. of Wisc.-Milwaukee.

Tonawanda. Zoning District Map: City of Tonawanda, New York.

U. S. Environmental Protection Agency (1990a). Fact Sheet: Drinking Water Regulations under the Safe Drinking Water Act. May 1990. Office of Drinking Water Criteria and Standards Division. Washington, DC. 43 p.

U. S. Environmental Protection Agency (1990b). Health Effects Assessment Summary Tables. Third Quarter. FY 1990. Office of Health and Environmental Assessment. Washington, DC.

U. S. Environmental Protection Agency (1990c). National Primary and Secondary Drinking Water Regulations; Synthetic Organic Chemicals and Inorganic Chemicals. 55 Federal Register 30370. (Wednesday July 25, 1990).

U. S. Environmental Protection Agency (1990d). Personal Communication. Region II. Emergency Remedial Response Division. (December 17, 1990).

U.S. Environmental Protection Agency (1990e). Draft Guidance on Assessment and Control of Bioconcentratable Contaminants in Surface Waters. Presented at SETAC '90. Short Course on Procedures for Regulating Bioconcentratable Toxicants. National Effluent Toxicity Assessment Center, Environmental Research Laboratory - Duluth, MI. Office of Water Enforcement and Permits, Office of Water Regulations and

Standards, and Office of Health and Environmental Assessment - Cincinnati, OH.

U. S. Environmental Protection Agency (1989a). EPA Approach for Assessing the Risk Associated with Exposure to Environmental Carcinogens. Appendix B to the Integrated Risk Information System (IRIS).

U.S. Environmental Protection Agency (1989b). Exposure Factors Handbook. EPA/600/8-89/043. Office of Health and Environmental Assessment. Washington, DC.

U. S. Environmental Protection Agency (1989c). Reference Dose (RfD): Description and Use in Health Risk Assessments. Appendix A to the Integrated Risk Information System (IRIS).

U. S. Environmental Protection Agency (1989d). Risk Assessment Guidance for Superfund: Volume I - Human Health Evaluation Manual (Part A). Interim Final. EPA/540/1-89/002. Office of Emergency and Remedial Response. Washington, DC.

U. S. Environmental Protection Agency (1989e). Risk Assessment Guidance for Superfund: Volume II - Environmental Evaluation Manual. Interim Final. EPA/540/1-89/001A (OSWER Directive 9285.7-01). Office of Emergency and Remedial Response. Washington, DC.

U. S. Environmental Protection Agency (1988a). Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA (1988). Interim Final. OSWER Directive 9355.3-01. Office of Emergency and Remedial Response. Washington, DC.

U. S. Environmental Protection Agency (1988b). Superfund Exposure Assessment Manual. EPA/540/1-89/001. (OSWER Directive 9285.5-1). Office of Emergency and Remedial Response. Washington, DC.

U. S. Environmental Protection Agency (1986a). Guidelines for Carcinogen Risk Assessment. 51 Federal Register 33992 (September 24, 1986).

U. S. Environmental Protection Agency (1986b). Guidelines for Health Risk Assessment of Chemical Mixtures. 51 Federal Register 34014 (September 24, 1986).

U. S. Environmental Protection Agency (1987). Polychlorinated Biphenyl Spills Cleanup Policy. Final Rule. 52 Federal Register (63): 10688 - 10710.

U. S. Environmental Protection Agency (1985a). Development of Statistical Distributions or Ranges of Standard Factors Used in Exposure Assessments. Office of Health and Environmental Assessment. Washington, DC.

U. S. Environmental Protection Agency (1985b). Water Quality Assessment. A Screening Procedure for Toxic and Conventional Pollutants in Surface and Ground Water - Part 1. EPA/600/6-85/002a. 609 p.

U. S. Environmental Protection Agency (1985c). Preliminary Evaluation of Chemical Migration to Ground Water in the Niagara Area From Selected Waste Disposal Sites. EPA/905/4-85/001.

U. S. Food and Drug Administration (1984). Polychlorinated Biphenyls (PCBs) in Fish and Shellfish. Reduction of Tolerances. Final Decision. 49 Federal Register (100): 21514 - 21520.

U.S. Geological Survey (1984a). Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States. Professional Paper 1270. U.S. Government Printing Office. Washington, DC.

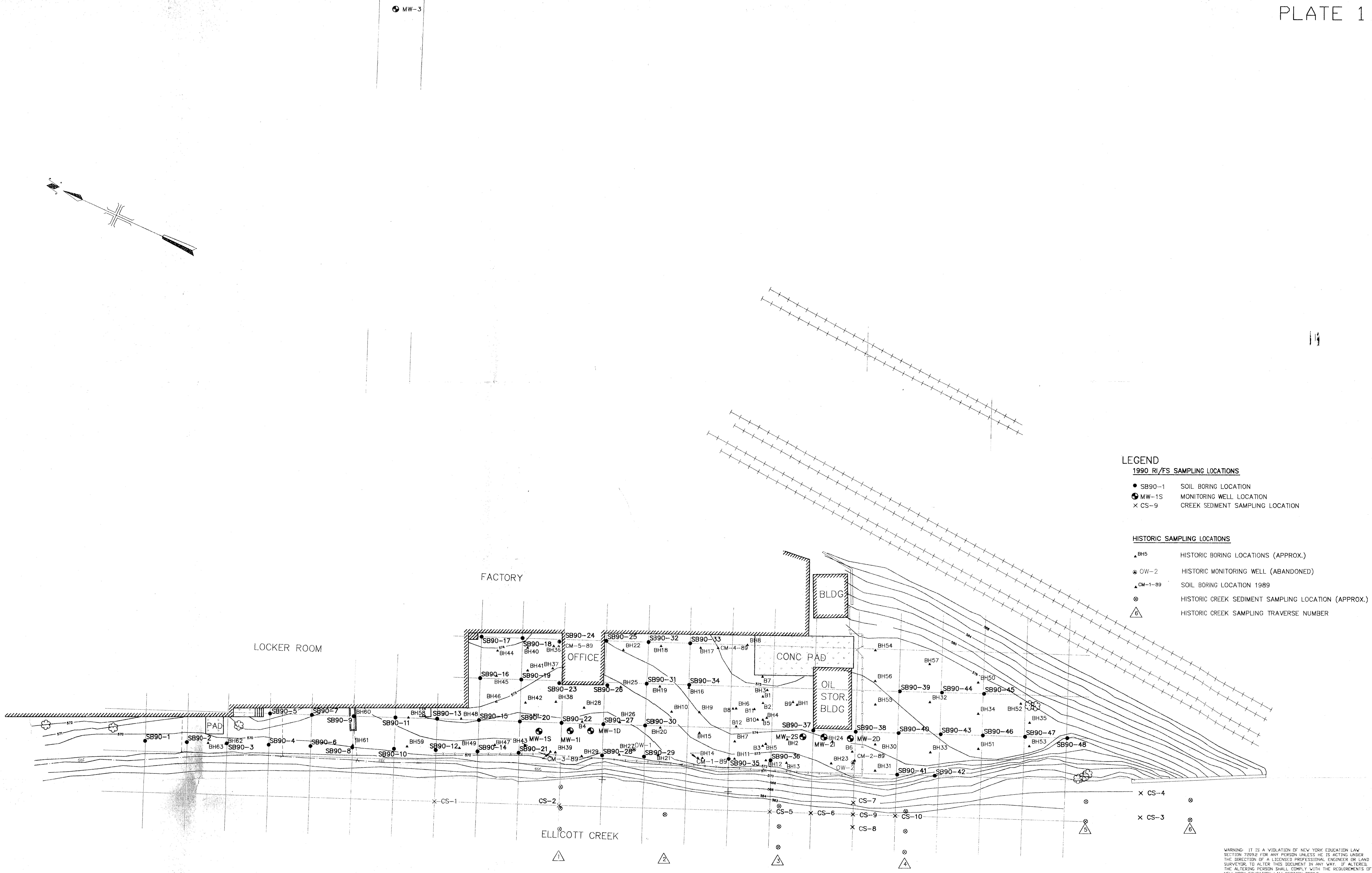
U.S. Geological Survey (1984b). Water Resources Data, New York. Water Year 1983.

Veith, G. D., K. J. Mecek, S. R. Petrocelli, J. Carroll (1980). Aquatic Toxicology. ASTM STP 707:116 - 129.

Veith, G. D., D. L. Defore, B. V. Bergstedt (1979). J. Fish Res Board Com. 36:1040-1048.

Wilkinson, M., 1990. Personal Communication. Senior Aquatic Biologist, New York State Department of Environmental Conservation, Division of Fish and Wildlife.

PLATE 1



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TONAWANDA, NEW YORK
REMEDIAL
INVESTIGATION/FEASIBILITY STUDY

COLUMBUS McKINNON CORPORATION
SITE PLAN AND
SAMPLING LOCATIONS
SCALE 1"=20.0'

MALCOLM PIRNIE, INC.
DATE JANUARY 1991
SHEET 1 OF 7
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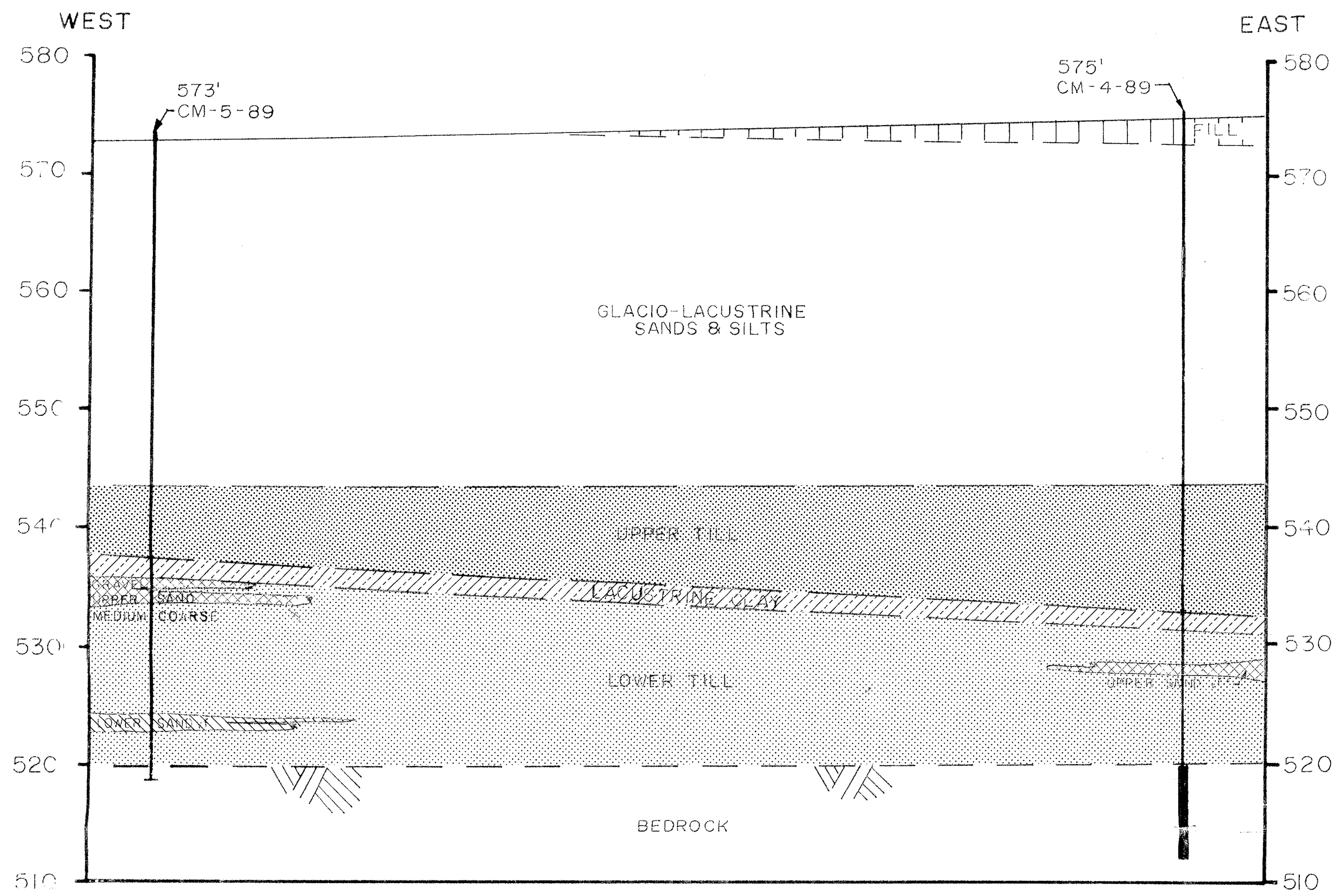
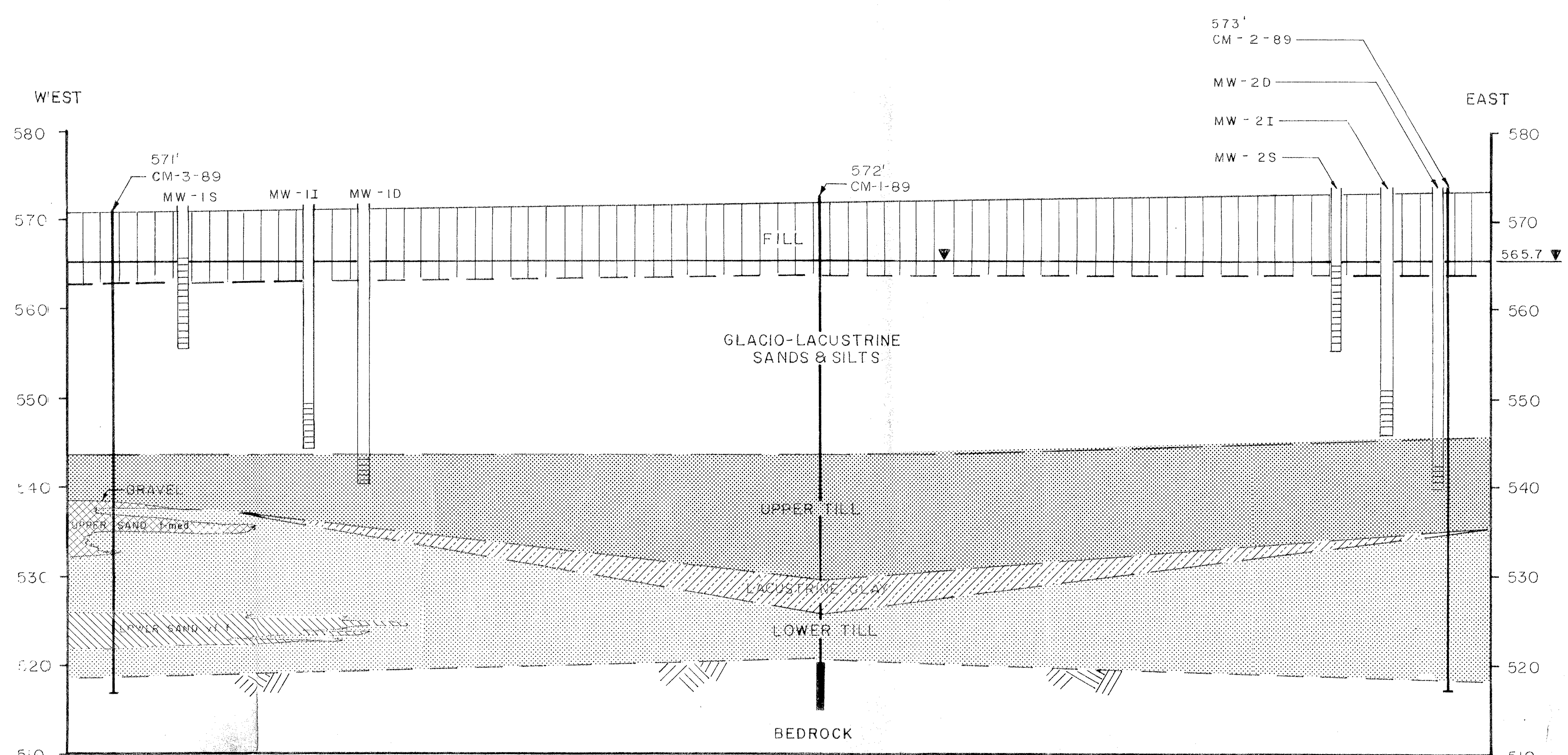




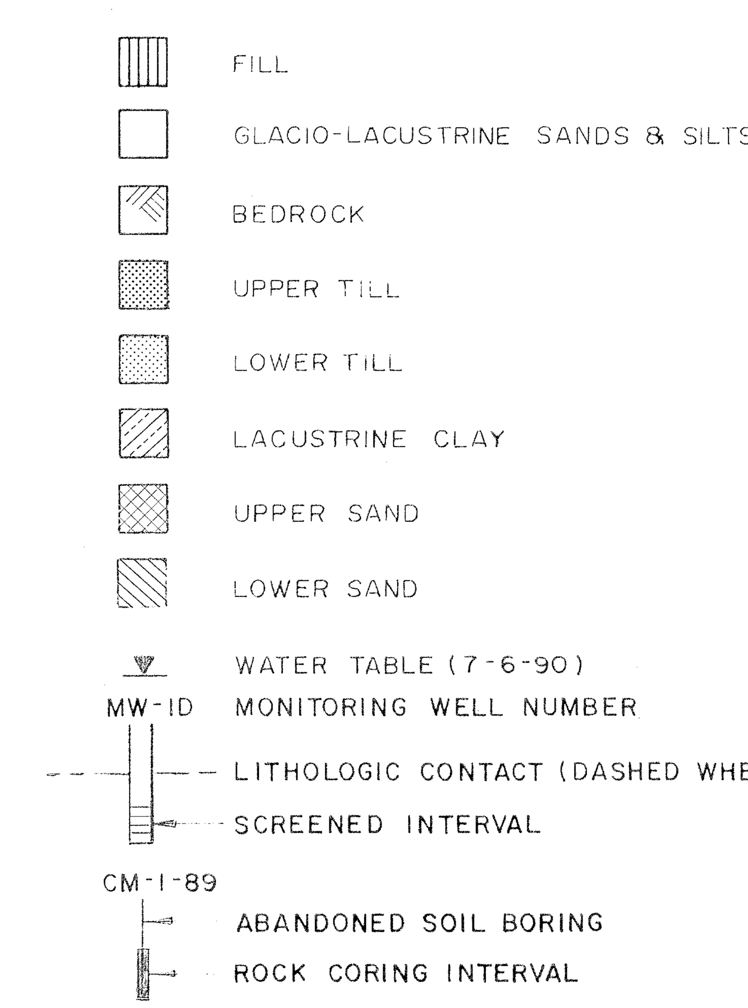
STRATIGRAPHIC SUMMARY DATA TABLE WITH –
- DEPTHS
- SUB-SURFACE ELEVATION
- THICKNESS

UNIT	CM-1	CM-2	CM-3	CM-4	CM-5	MW-1D	MW-2D
ELEVATION ±1	572'	573'	571'	575'	573'	572.23'	574.57'
FILL	0-8.2	0-9.1	0-8.1	0-2.6	NONE	0-6.2	0-6.7
GLACIO-LACUSTRINE	8.2-28.6 563.8 (20.4)	9.1-27.6 563.9 (18.5)	8.1-27.4 562.9 (19.3)	2.6-31.4 572.4 (28.8)	0-29.1 573.0 (29.1)	6.2-27.6 566.03 (21.4)	6.7-29.4 567.87 (22.7)
UPPER TILL	28.6-42.5 543.4 (13.9)	27.6-38.0 545.4 (10.4)	27.4-32.6 543.6 (5.2)	31.4-42.0 543.6 (10.6)	29.1-35.2 543.9 (6.1)	ND	ND
LACUSTRINE CLAY	42.5-46.0 529.5 (3.5)	38.0-39.6 535.0 (1.6)	NONE	42.0-43.6 533.0 (1.6)	35.2-37.1 537.8 (1.9)		
UPPER GRAVEL & SAND	NONE	NONE	32.6-38.2 538.4 (5.6)	46.2-47.0 528.8 (.8)	37.1-39.2 535.9 (2.1)		
LOWER TILL	46.0-51.2 526.0 (6.2)	39.6-54.8 533.4 (15.2)	38.2-52.3 532.8 (14.1)	43.6-54.9 531.4 (11.3)	39.2-53.0 533.8 (13.8)		
LOWER SAND	NONE	NONE	45.0-48.8 526.0 (3.8)	NONE	48.9-50.0 524.1 (1.1)		
WEATHERED BEDROCK	51.2- (520.8)	54.8- (518.2)	52.3- (518.7)	54.9- (520.1)	53.0- (520)		

NOTE:
1.) CROSS SECTIONS ARE DRAWN THROUGH THE ABANDONED BORINGS CM-5-89/ CM-4-89 AND CM-3-89/CM-1-89/CM-2-89. SEE PLATE 1 FOR BORING LOCATIONS.

2.) MONITORING WELL LOCATIONS AND THE WATER TABLE ARE PROJECTED APPROXIMATELY 12' TO THE PLANE OF THE CROSS SECTION THROUGH CM-3-89/CM-1-89/CM-2-89.

LEGEND



MALCOLM PIRNIE

REVISIONS			
NO	BY	DATE	REMARKS

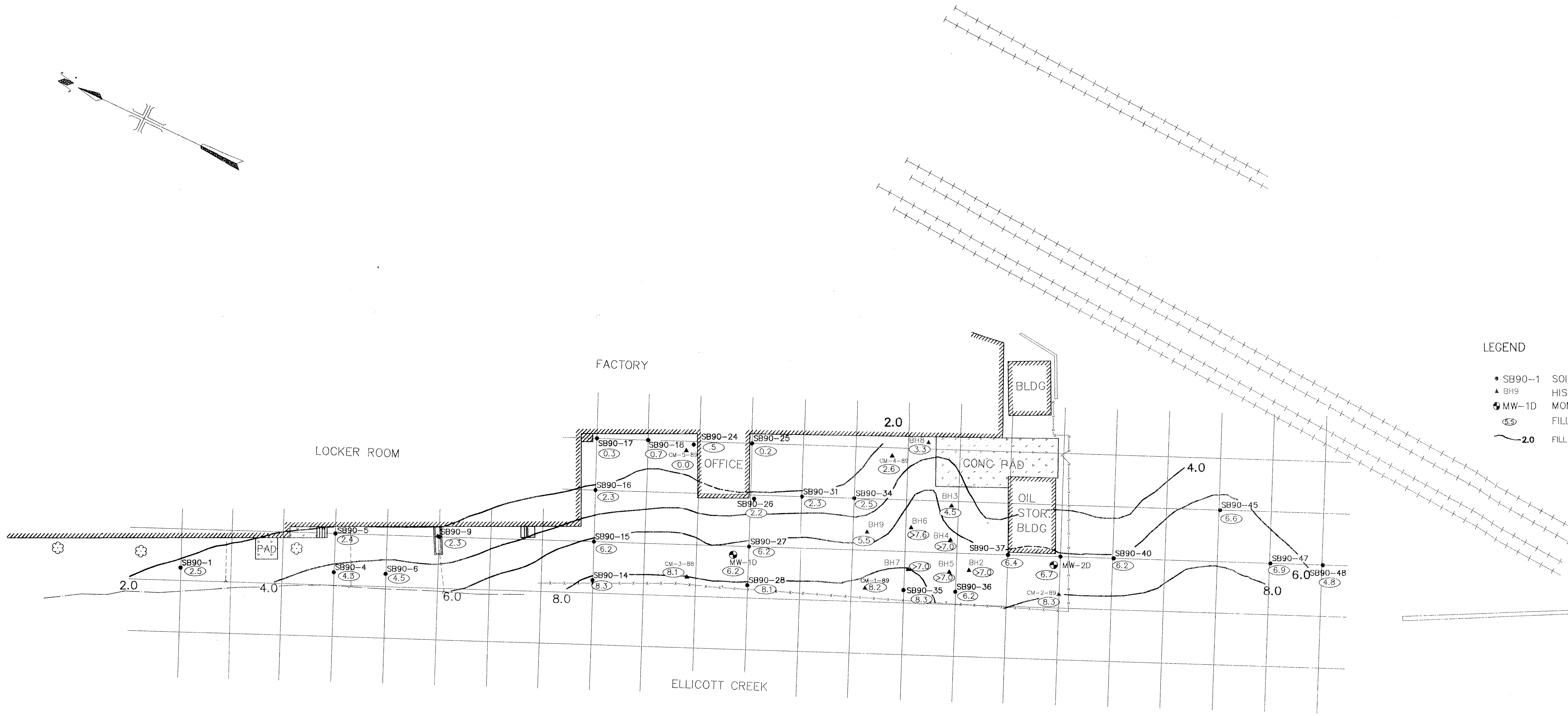
DES JPH
DWN DJG
CKD RHO

COLUMBUS-McKINNON
TONAWANDA, NEW YORK
REMEDIAL INVESTIGATION/ FEASIBILITY STUDY

COLUMBUS-McKINNON CORPORATION
STRATIGRAPHIC CROSS SECTION
SCALE: HORIZ. 1" = 10'-0", VERT. 1" = 10'-0"

MALCOLM PIRNIE, INC.
DATE ....
SHEET ...... OF ......
DWG NO. ....

PLATE 3



LEGEND

- • SB90-1 SOIL BORING LOCATION
- ▲ BH9 HISTORIC BORING LOCATION
- MW-1D MONITORING WELL LOCATION
- (5.5) FILL THICKNESS
- 2.0 FILL THICKNESS CONTOUR (FT.)

MALCOLM PIRNIE

REVISIONS			
NO.	BY	DATE	REMARKS

DES J.C.S.
DWN A.R.A.
CKD

COLUMBUS McKINNON CORPORATION
TONAWANDA, NEW YORK
REMEDIAL
INVESTIGATION/FEASIBILITY STUDY

COLUMBUS McKINNON CORPORATION

FILL THICKNESS

SCALE 1"=20.0'

MALCOLM PIRNIE, INC.

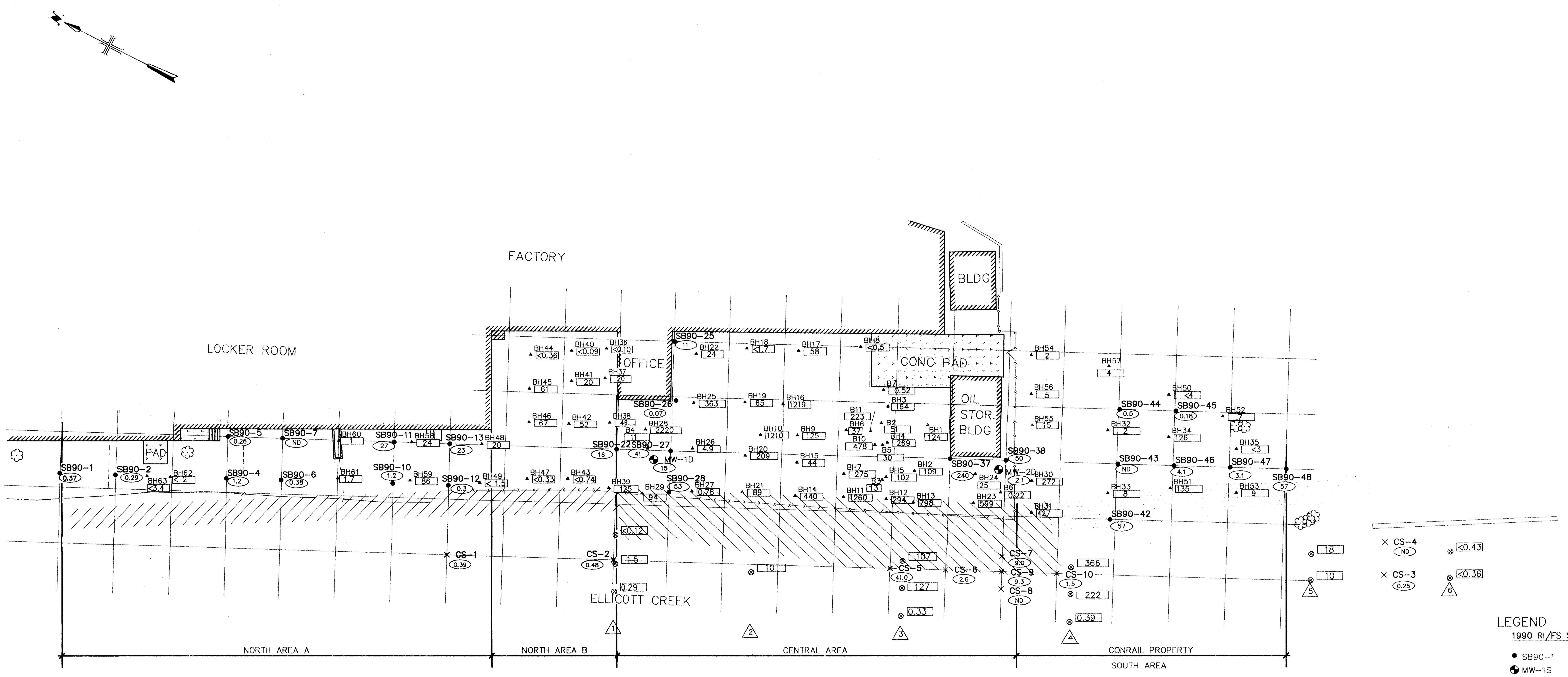
DATE NOVEMBER 1990

SHEET 3 OF 6

DWG. NO.

AIGNER : TRAINING\COLDFIL SCALE: 1:240| 11/26, 1990 at 14:55

PLATE 4



LEGEND

1990 RI/FS SAMPLING LOCATIONS

- ● SB90-1 — SOIL BORING LOCATION
- MW-1S — MONITORING WELL LOCATION
- × CS-9 — CREEK SEDIMENT SAMPLING LOCATION

HISTORIC SAMPLING LOCATIONS

- ▲BH5 — HISTORIC BORING LOCATIONS (APPROX.)
- ⊗ — HISTORIC CREEK SEDIMENT SAMPLING LOCATION (APPROX.)
- △6 — HISTORIC CREEK SAMPLING TRAVERSE NUMBER

PCB CONCENTRATION (mg/kg)

- [10.10] — HISTORIC DATA (INCLUDES SOME AVERAGE VALUES) (1,2)
- (0.25) — DATA FROM 1990 RI/FS (1)

NOTES:

1. SURFICIAL SOIL REFERS TO THE 0 -2' DEPTH INTERVAL AT EACH SAMPLING LOCATION. SOME HISTORIC DATA INCLUDED THE AVERAGE OF TWO (2) VALUES FROM THE 0 - 2' INTERVAL.
2. HISTORIC DATA OBTAINED FROM AES/CRA(1983) AND FROM ACTS TESTING LAB REPORTS IN APPENDIX E

LEGEND

- NORTH AREA CREEK BANK
- IRM CREEK BANK
- CONRAIL PROPERTY CREEK BANK

MALCOLM PIRNIE

REVISIONS			
NO.	BY	DATE	REMARKS

DES J.C.S.
DWN A.R.A.
CKD

COLUMBUS McKINNON CORPORATION
TONAWANDA, NEW YORK
REMEDIAL INVESTIGATION/FEASIBILITY STUDY

COLUMBUS McKINNON CORPORATION
DISTRIBUTION OF TOTAL PCBs IN SURFICIAL SOIL & CREEK SEDIMENT
SCALE 1"=20.0'

MALCOLM PIRNIE, INC.
DATE JANUARY 1991
SHEET 4 OF 6
DWG. NO. 1332X-91.004-0

AIGNER : ADMIN\COL01002 SCALE: 1:240 01/17/1991 at 15:09

PLATE 5

MALCOLM PIRNIE

REVISIONS			
NO.	BY	DATE	REMARKS

DES M.K.E.
DWN A.R.A.
CKD

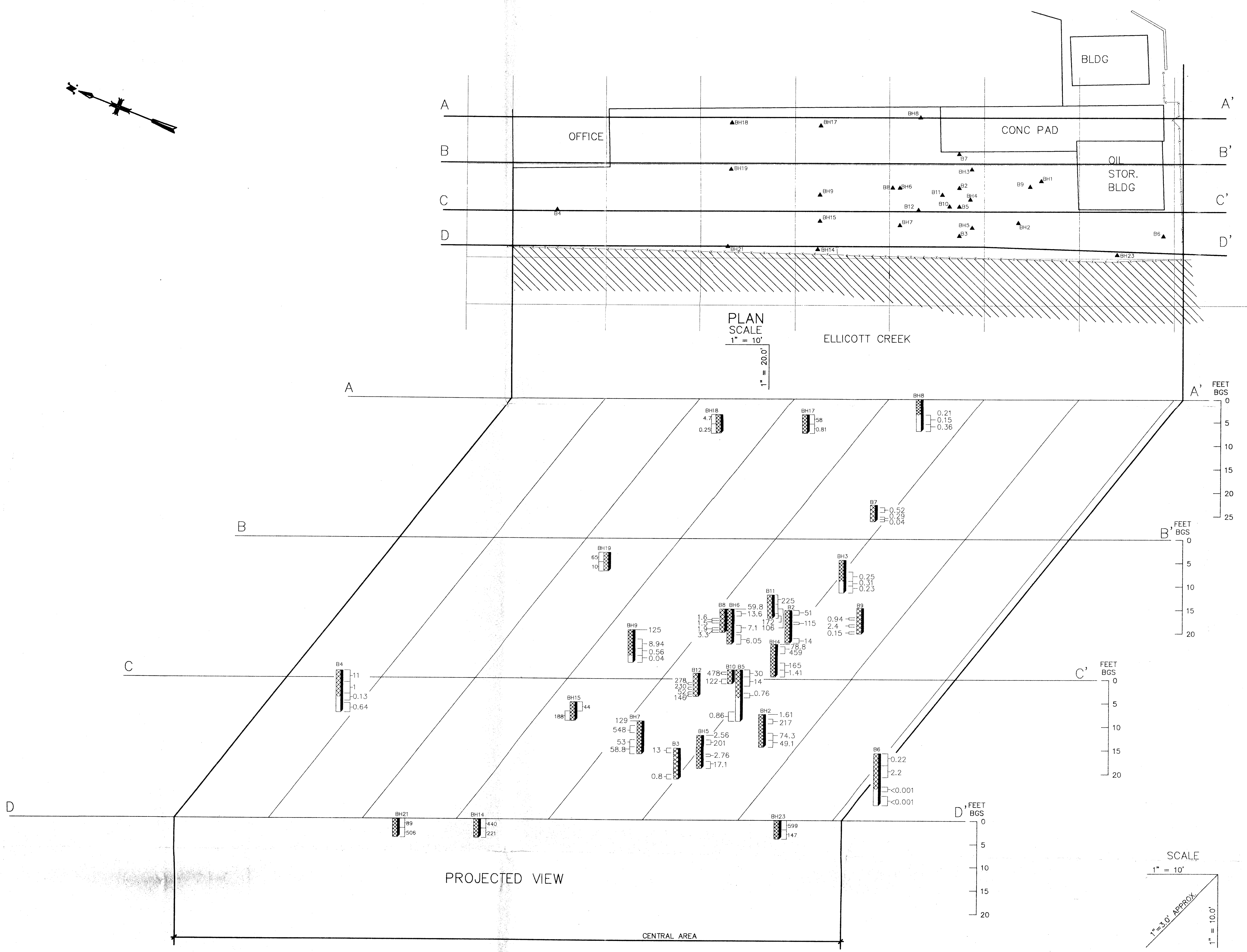
COLUMBUS McKINNON CORPORATION
TONAWANDA, NEW YORK
REMEDIAL INVESTIGATION/FEASIBILITY STUDY

COLUMBUS McKINNON CORPORATION
DISTRIBUTION OF TOTAL PCBs IN SOIL FROM RI SAMPLING
SCALE AS NOTED

MALCOLM PIRNIE, INC.
DATE MAY 1991
SHEET 5 OF 7
DWG. NO. 1332X-91.005-0

WETERS : ADMIN\COLO1PCB SCALE: 1:240! 05/15, 1991 at 10:47

PLATE 6



LEGEND

IRM CREEK BANK

▲ B5/BH5 HISTORIC SOIL BORING (1979 – 1983)

—x— FENCE

B5/BH5

FILL

NATIVE SOIL

14 TOTAL PCB CONCENTRATION FOR SPECIFIED DEPTH BELOW GROUND SURFACE (1)

ND NOT DETECTED

NA NOT ANALYZED

NOTE: 1. TOTAL PCB CONCENTRATIONS FOR B SERIES BORINGS LOCATIONS ARE HISTORIC ANALYTICAL RESULTS FROM 1979 TO 1981. DATA OBTAINED FROM ACTS TESTING LAB REPORTS PRESENTED IN APPENDIX E. TOTAL PCB CONCENTRATIONS AT BH SERIES BORING LOCATIONS ARE HISTORIC ANALYTICAL RESULTS FROM 1981. DATA OBTAINED FROM AES/CRA (1983).

2. HISTORIC SAMPLING LOCATIONS BH10 TO BH63 ARE SHOWN ON PLATE 4

MALCOLM PIRNIE

REVISIONS			
NO.	BY	DATE	REMARKS

DES M.K.E.
DWN A.R.A.
CKD

COLUMBUS McKINNON CORPORATION
TONAWANDA, NEW YORK
REMEDIAL INVESTIGATION/FEASIBILITY STUDY

COLUMBUS McKINNON CORPORATION

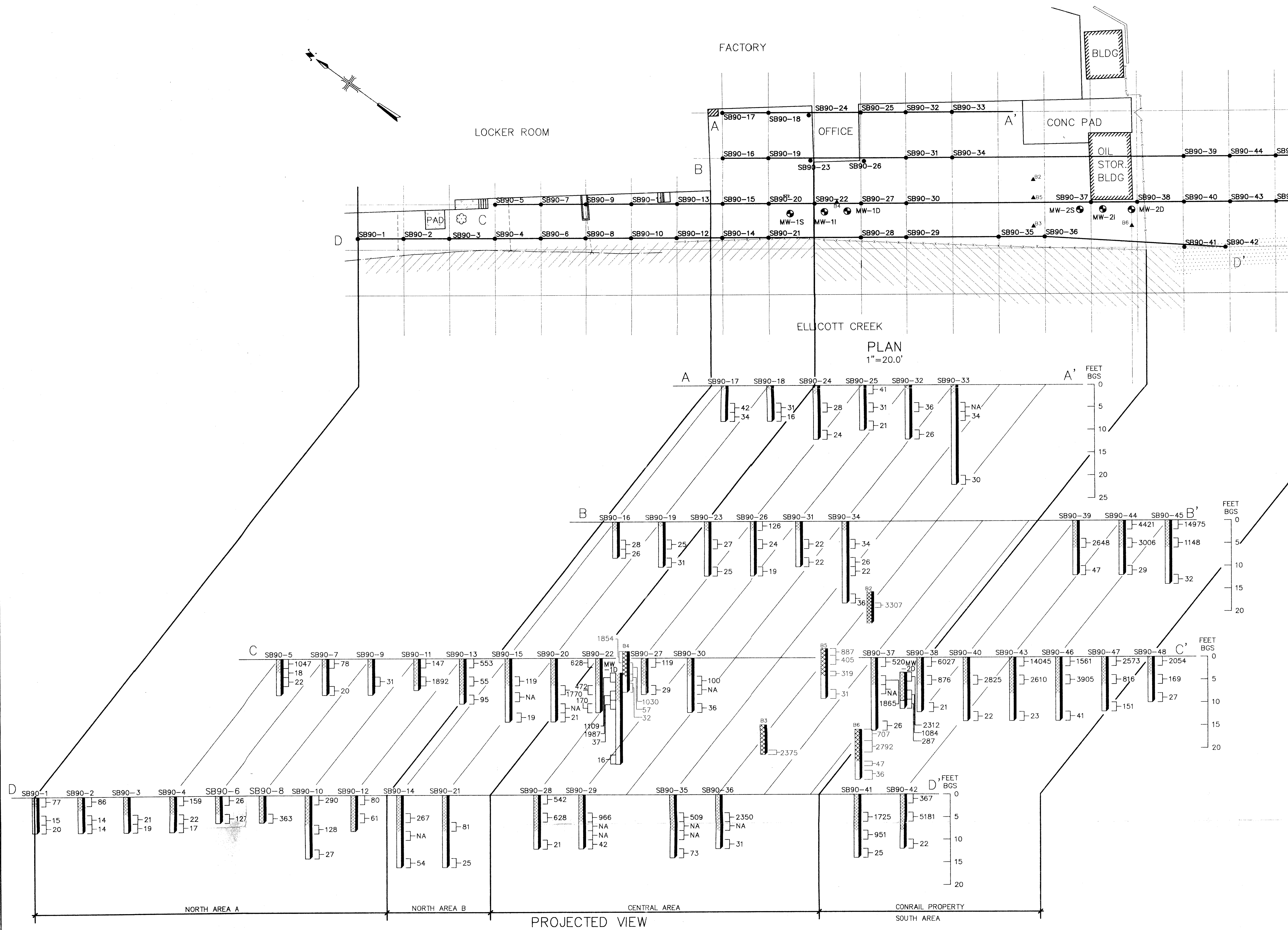
DISTRIBUTION OF TOTAL PCBs IN SOIL FROM HISTORIC BORINGS

SCALE AS NOTED

MALCOLM PIRNIE, INC.
DATE JANUARY 1991
SHEET 6 OF 7
DWG. NO. 1332X-91.006-0

WETERS : ADMIN\COL01PCH SCALE: 1:240l 05/15, 1991 at 15:55

PLATE 7



LEGEND

- NORTH AREA CREEK BANK
- IRM CREEK BANK
- CONRAIL PROPERTY CREEK BANK
- FENCE
- ● SB90-1 SOIL BORING LOCATION
- MW-1S MONITORING WELL LOCATION
- SB90-48/B5 SOIL BORING (1990)/HISTORIC SOIL BORING (1979)(1)
- FILL
- NATIVE SOIL
- 0.1 TOTAL METALS CONCENTRATION (IN WET WEIGHT) FOR SPECIFIED DEPTH
- ND NOT DETECTED
- NA NOT ANALYZED

(1) TOTAL METAL CONCENTRATION AT B SERIES BORING LOCATIONS ARE HISTORIC ANALYTICAL RESULTS FROM 1979. DATA OBTAINED FROM ACTS TESTING LAB REPORTS IN APPENDIX E.

SCALE
1" = 20.0'
1" = 5.0' APPROX
1" = 10.0'

WARNING: IT IS A VIOLATION OF NEW YORK EDUCATION LAW SECTION 7209.2 FOR ANY PERSON UNLESS HE IS ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER OR LAND SURVEYOR, TO ALTER THIS DOCUMENT IN ANY WAY. IF ALTERED, THE ALTERING PERSON SHALL COMPLY WITH THE REQUIREMENTS OF NEW YORK EDUCATION LAW SECTION 7209.2.

MALCOLM PIRNIE

REVISIONS

NO.	BY	DATE	REMARKS

DES J.D.H.
DWN A.R.A.
CKD

COLUMBUS McKINNON CORPORATION
TONAWANDA, NEW YORK
REMEDIAL INVESTIGATION/FEASIBILITY STUDY

COLUMBUS McKINNON CORPORATION
DISTRIBUTION OF TOTAL METALS IN SOIL
SCALE AS NOTED

MALCOLM PIRNIE, INC.
DATE JANUARY 1991
SHEET 7 OF 7
DWG. NO. 1332X-91.007-0

ADMIN\COLDWET SCALE: 1:240 05/15, 1991 at 16:09

Engineering Report

REMEDIAL INVESTIGATION REPORT FOR THE COLUMBUS McKINNON SITE

VOLUME 2: APPENDICES

Columbus McKinnon Corporation
Tonawanda Facility
Tonawanda, New York

June 1991
Project No. 1332-01-1

MALCOLM PIRNIE

ENVIRONMENTAL ENGINEERS, SCIENTISTS & PLANNERS

COLUMBUS McKINNON CORP.

REMEDIAL INVESTIGATION/FEASIBILITY STUDY

LIST OF APPENDICES

MALCOLM PIRNIE

APPENDIX A

WORK PLAN MODIFICATIONS

MALCOLM PIRNIE, INC.

INTEROFFICE CORRESPONDENCE

Date: September 10, 1990

To: Files

From: Jane Schiferle

Re: Columbus McKinnon
Changes to Approved Work Plan

On April 20, 1990 I met with J. Dicky (CM), G. Funk (MPI), G. May (NYSDEC), and J. Tuk (NYSDEC), for the purpose of discussing project progress and upcoming field tasks.

Specifically, the following items were discussed:

- Screen length in MW-3;
- Lack of proposed borings immediately downgradient of the disposal area; and
- Location of monitoring wells along the creek bank.

Discussion of these topics resulted in the following decisions/changes:

- reduce the screen length in MW-3 from 22 feet to 15 feet;
- adhere to the work plan and place borings only where proposed; and
- move monitoring wells away from the bank to maximize driller safety and to minimize the influence from abandoned borings previously drilled along the bank. All well locations were agreed upon by the NYSDEC representatives and MPI geologists.

MALCOLM PIRNIE

APPENDIX B

FIELD DATA INFORMATION

B1 Historic Boring Logs
B2 Location of Horizontal Grid Control Points
B3 Soil Sampling Boring Logs
B4 Monitoring Well Boring Logs
B5 Well Construction Diagrams
B6 Well Development Logs
B7 Ground Water Sampling Field Logs for the May 1990 Sampling Event

MALCOLM PIRNIE

APPENDIX B1

HISTORIC BORING LOGS

September 19, 1979

EARTH DIMENSIONS, INC.

Soil Investigations and Natural Resource Assessments

797 Center Street • East Aurora, New York 14052 • (716) 655-1717

SOILS REPORT

Columbus - McKinnon Corporation

City of Tonawanda

The soil-fill investigation on the above named parcel was undertaken in two phases; the first phase to collect fill samples for chemical analysis, the second phase on September 12, 1979 to define the extent of contaminated fill as identified by the specific chemical analysis of the fill collected during the first phase. Both phases of this investigation was under the direction of John P. Schmitt of VSSR Consulting Engineers.

In the first phase, the fill was sampled with a seven foot long bucket auger. The second phase effort was with a drilling rig securing fill-soil samples with a split spoon sampler that was advanced below hollow stem augers. Borings #1-3 were hand augered with the bucket auger, borings #3-6 with the drilling rig.

Industrial wastes were identified at all the sampling sites. The hard waste metal, slag, and brick fragments or the length of the bucket auger prevented or inhibited the penetration of the original soils. The split spoon sampler penetrated the original soils in borings #3-6.

The peninsula land area between Tonawanda (Barge Canal) and Ellicott Creeks contain soils consisting of silty and sandy glacial lake sediments over clayey glacial lake sediments at depth. Glacial lake sediments are considered stone-free. The thin horizontal laminations and bedding lenses of these lake sediments results in horizontal preferential water movement, particularly below a permanent water table. Alluvial sediments of Ellicott Creek will have similar characteristics as the silty-sandy lake sediments.

In fact, the only difference is the higher organic content of the sublayers of the alluvial sediment.

Soil borings #3-6 penetrated the original soils to a depth below a permanent water table. Depth to the original soil was similar in all three of these borings (5.5 to 7.2 feet) which suggest that the thickness of the industrial fill mantle is uniform in a parallel transect to Ellicott Creek. A 1938 aerial photograph of the City of Tonawanda indicated that the eastern edge of Ellicott Creek was much closer to the main buildings than today. Therefore, the fill mantle is likely thicker at the creek's edge than adjacent to the buildings.

Typically internal soil water flow is towards natural drainage-ways. Therefore, it can be assumed that the internal water movement at the investigated site is towards the creek, probably at an oblique angle downstream. This angle is likely to change depending on the height of the seasonally high water table and creek level.

Prepared by;

Don Owens

Donald W. Owens,
Soil Scientist

DWO/bmh
2G79

EARTH DIMENSIONS, INC.
Test Borings and Logs
797 Center Street • East Aurora, New York 14052 • (716) 655-1717

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VSSR
ARCHITECTS/CONSULT. ENGRS.

HOLE NO. 1

SURF. ELEV. ______

2G79

PROJECT Waste Pit Investigation
Columbus McKinnon Corp., City of Tonawanda

LOCATION See survey

CLIENT VSSR

DATE STARTED 7/13/79 COMPLETED 7/13/79

DEPTH (feet)	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	N	DESCRIPTION & CLASSIFICATION	WATER TABLE & REMARKS	
	1						Dry dark gray cindery fill with concrete chunks, loose	0.5	Industrial fill to refusal.
1	2						Moist dark gray with orange areas cemented cinders with an oily substance	1.0	
							Refusal due to concrete at 1.0 feet.		No water at completion
2									Noticed a solvent odor to sample #2.
									Samples secured with hand auger.

dew

N = NUMBER OF BLOWS TO DRIVE ---" SPOON ---" WITH --- lb. WT. FALLING ---" PER BLOW.

LOGGED BY Donald W. Owens, Soil Scientist

SHEET 1 OF 1

EARTH DIMENSIONS, INC.

Test Borings and Logs
797 Center Street • East Aurora, New York 14052 • (716) 655-1717

HOLE NO. 2 SURF. ELEV. ______

2G79 PROJECT Waste Pit Investigation
Columbus McKinnon Corp., City of Tonawanda LOCATION See survey

CLIENT VSSR DATE STARTED 7/13/79 COMPLETED 7/13/79

DEPTH (feet)	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	N	DESCRIPTION & CLASSIFICATION		WATER TABLE & REMARKS
	1						Dry dark gray cindery fill with concrete chunks, loose	0.5	Industrial waste fill to refusal.
1	2, 3						Moist dark gray with orange areas cemented cinders with an oily substance	1.5	
2–6	4, 5, 6, 7, 8						Moist dark gray cindery fill with chunks of bricks, glass and slag, loose but very firm in place		Samples secured with hand bucket auger.
6							---- grades downward to --------	6.0	
7	9						Wet dark gray and brown cindery fill with chunks of bricks, glass and slag, oily film to liquid, very firm in place		Water table 6.0 ft. below surface at completion.

Refusal at 7.0 feet.

dew N = NUMBER OF BLOWS TO DRIVE ---" SPOON ---" WITH --- lb. WT. FALLING ---" PER BLOW.

LOGGED BY Donald W. Owens, Soil Scientist SHEET 1 OF 1

EARTH DIMENSIONS, INC.

Test Borings and Logs
797 Center Street • East Aurora, New York 14052 • (716) 655-1717

HOLE NO. 3 SURF. ELEV. ______

2G79 PROJECT Waste Pit Investigation
Columbus McKinnon, City of Tonawanda

LOCATION See survey

CLIENT VSSR

DATE STARTED 7/13/79 COMPLETED 7/13/79

DEPTH (feet)	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	N	DESCRIPTION & CLASSIFICATION	WATER TABLE & REMARKS
	1						Dry dark gray cindery gravels, loose	
								0.5
1	2						Moist dark gray and dark brown cindery fill with slag, metal and glass fragments, firm in place	Industrial fill to completion.
2	3							
3								
4	4 (4–5)						Encountered and penetrated deteriorated barrel at 4.0 feet	
5								
							------- grades downward to -----	5.5
6							Wet brown and dark gray cindery fill with slag, glass and metal fragments, very firm in place	
7								

Boring completed at 7 feet

dew N = NUMBER OF BLOWS TO DRIVE --- " SPOON --- " WITH --- lb. WT. FALLING --- " PER BLOW.

LOGGED BY Donald W. Owens, Soil Scientist SHEET 1 OF 1

EARTH DIMENSIONS, INC.

Test Borings and Logs
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HOLE NO. 4 SURF. ELEV. ________

2G79

PROJECT: Waste Pit Investigation
Columbus-McKinnon Corporation

LOCATION: 17 feet SW of center of wall of Mr. Sullivan's office

CLIENT: VSSR

DATE STARTED 9/13/79 COMPLETED 9/13/79

DEPTH feet	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	N	Recovery	DESCRIPTION & CLASSIFICATION
	1	6	6	8	2	14	12	Slightly moist black slaggy cinders (cinders are loamy medium size sand, SAND texture) with angular slag gravel, loose fill
	1							
	1							
	1							
	1	3						2.5
	2	3	1	1	2	2	6	Moist black slaggy cinders (cinders are loamy medium size sand, SAND texture) with angular slag gravel and wood fragments, loose fill
	2							
	2							
5	2							5.5
	3	2	2	3	4	5	18	Extremely moist distinctly mottled gray silt loam (SANDY-SILT), soft, nonplastic, nonsticky
	3							
	3							
	4							----grades downward to ------ 6.5
	5	2	2	3	4	5	6	Wet distinctly mottled gray fine sandy loam (SILTY-SAND), stratified, nonplastic
	5							
	5							
	5							9.0
10								Boring and sampling completed to 9.0 feet.
15								

WATER TABLE & REMARKS

No odor noted in any of the samples.

Non-soil fill to 5.5 feet over old alluvial coarse silt and fine sand sediments,

Noticed black organic zones in the coarse silt and fine sand.

No water level recorded at completion due to collasp of bore hole but suspect water level to be at 6.5 feet below surface

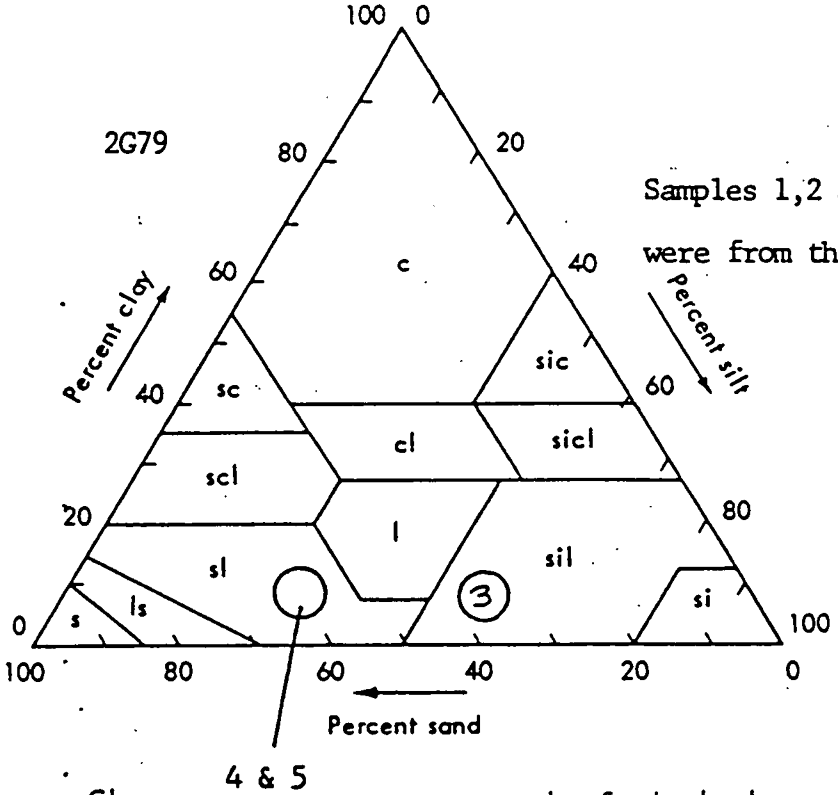
N = NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW.

bh LOGGED BY Donald W. Owens/ Soil Scientist SHEET 1 OF 1

HOLE #4:

2G79

Samples 1,2 and part of 3 were from the non-soil fill



c	Clay	scl	Sandy clay loam
si	Silt	sicl	Silty clay loam
s	Sand	cl	Clay loam
l	Loam	sil	Silt loam
sc	Sandy clay	sl	Sandy loam
sic	Silty clay	ls	Loamy sand

Textural triangle showing the percentages of clay (less than 0.002 mm), silt (0.002-0.05 mm), and sand (0.05-2.0 mm) in the basic soil textural classes (adapted from Soil Survey Staff, 1951).

EARTH DIMENSIONS, INC.

Test Borings and Logs
797 Center Street • East Aurora, New York 14052 • (716) 655-1717

HOLE NO. 5 SURF. ELEV. ______

2G79 PROJECT Waste Pit Investigation
Columbus-McKinnon Corporation, City of Tonawanda

LOCATION 9 feet towards Ellicott Creek from hole #2

CLIENT VSSR

DATE STARTED 9/13/79 COMPLETED 9/13/79

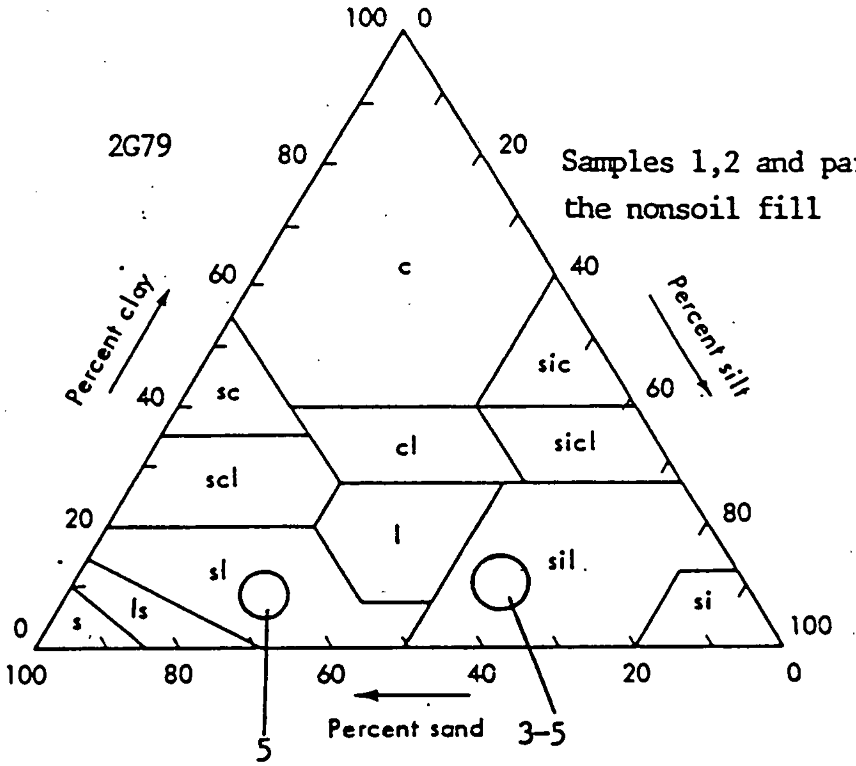
DEPTH feet	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	N	Recovery	DESCRIPTION & CLASSIFICATION		WATER TABLE & REMARKS
	1	8	10	5	5	5	24	Moist (with an oily film) black slaggy cinders (cinders are loamy medium size sand, SAND texture with 15 to 25% angular slag gravel.		Non-soil fill to 6.0 feet over coarse silt and fine sand old alluvial sediment to end of boring.
	1									
	1									
	1									
	1	6								
	2	8	13	8	4	21	4			
	2									
	2									
	2									
5										
	3	5	2	2	3	4	20		6.0	
	3							Extremely moist dark gray with black zone silt loam (SANDY-SILT), stratified with fine sand lenses, nonplastic, nonsticky		Oily odor noted in all samples.
	3									
	3									
	4	4	4	5	5	9	10			
	4									
	4									
	4									
10	5	5	4	5	·	9	14	grades downward to	10.0	
	5							Wet gray fine sandy loam (SILTY-SAND), stratified, nonplastic		
	5								11.0	
								Sampling and boring completed at 11.0 feet		Water table 10 feet below surface at completion.

N = NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

bh LOGGED BY Donald W. Owens/ Soil Scientist SHEET 1 OF 1

HOLE #5:

2G79



Samples 1,2 and part of 3 were from the nonsoil fill

c	Clay	scl	Sandy clay loam
si	Silt	sicl	Silty clay loam
s	Sand	cl	Clay loam
l	Loam	sil	Silt loam
sc	Sandy clay	sl	Sandy loam
sic	Silty clay	ls	Loamy sand

Textural triangle showing the percentages of clay (less than 0.002 mm), silt (0.002-0.05 mm), and sand (0.05-2.0 mm) in the basic soil textural classes (adapted from Soil Survey Staff, 1951).

EARTH DIMENSIONS, INC.
Test Borings and Logs
797 Center Street • East Aurora, New York 14052 • (716) 655-1717

HOLE NO. 6 SURF. ELEV.

2G79 PROJECT Waste Pit Investigation Columbus-McKinnon Corp., City of Tonawanda
LOCATION 4 feet NW of SW fence, 11 feet SW of SW corner of storage bldgs.

CLIENT VSSR
DATE STARTED 9/13/79 COMPLETED 9/13/79

DEPTH feet	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	N	Recovery	DESCRIPTION & CLASSIFICATION		WATER TABLE & REMARKS
	1	2	4	15	6	19	24	Slightly moist becoming moist at 2 feet alternating 1 to 3 inch layers of black, reddish brown, and gray cinders and fine metal fragments, loose		Non-soil fill to 7.2 feet over coarse silt old alluvial sediment to 8.0 feet over sandy old alluvial sediment to end of sampling
	1									
	1									
	1									
	1	8							2.5	
	2	7	6	3	3	9	6	Moist black cinders and fine metal fragments, loose		
	2									
	2									
	2									
5	2	3								
	3	6	7	7	6	14	10			
	3									
	3									
	3								7.2	
	4	4	5	7	6	12	18	Extremely moist distinctly mottled gray coarse silt loam (SANDY-SILT), soft, nonplastic		
	4									
	5								8.0	
	5									
	6	1	2	2	2	4		Wet gray fine sandy loam (SILTY-SAND), stratified with thin silt lenses, nonplastic		
10	6									
	6									
	6								11.0	
								Sampling and boring completed to 11.0 feet		Water table 8 feet below surface at completion
15										

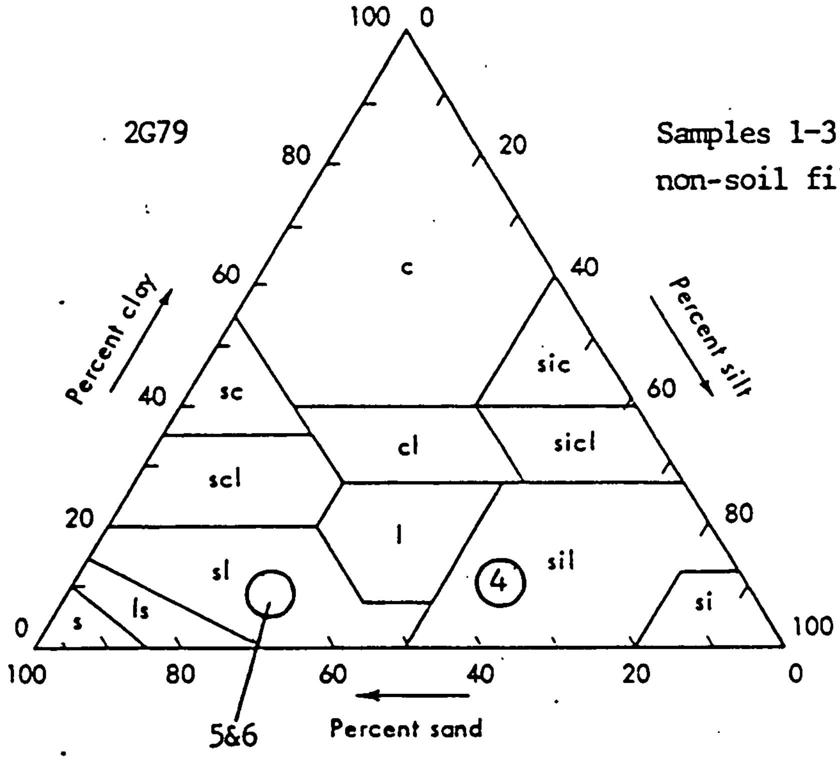
N = NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW.

bh LOGGED BY Donald W. Owens/ Soil Scientist SHEET 1 OF 1

HOLE #6:

2G79

Samples 1-3 were from the non-soil fill



c	Clay	scl	Sandy clay loam
si	Silt	sicl	Silty clay loam
s	Sand	cl	Clay loam
l	Loam	sil	Silt loam
sc	Sandy clay	sl	Sandy loam
sic	Silty clay	ls	Loamy sand

Textural triangle showing the percentages of clay (less than 0.002 mm), silt (0.002-0.05 mm), and sand (0.05-2.0 mm) in the basic soil textural classes (adapted from Soil Survey Staff, 1951).

February 1, 1980

26796

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SOILS REPORT

Columbus - McKinnon Corporation

City of Tonawanda

The man-deposited industrial waste fill was augered, visually described and sampled on the above named parcel January 25, 1980 to further define the boundary of the highly contaminated fill with PCB levels above 50 ppm. This on-site investigated sampling effort was requested by and under the guidance of John P. Schmitt of VSSR Consulting Engineers as were the previous two sampling phases accomplished on-site July 13, 1979 and September 13, 1979. The sampling identification numbers #7 and #9 January 25, 1980 were the continuation of consecutive numbers that were assigned during the previous sampling phases.

The fill samples were secured with a six foot long bucket auger. The fill samples of each significant fill strata were placed in a acetone rinsed pint glass jar and sealed with aluminum foil and metal cap. The sealed samples were given to Mr. Schmitt January 27, 1980. Little effort was made to fully clean the bucket auger between samples so that cross contamination of samples may occur. This would result in higher levels of PCB's in the lower (deeper) fill samples.

Industrial wastes were identified at all the sampling sites. The hard waste metal, slag, bricks and frozen ground inhibited the penetration and sampling of this fill. Only after extreme effort by Mr. Schmitt and myself with metal bars and the bucket auger were we able to secure samples at lower (deeper) levels. We were unable to secure samples below 5.5 feet in any of the sampling sites.

These sampling sites were located approximately fourteen feet northeast, northwest and southeast from the previous sampling site #2 that revealed high levels of PCB's. Some of the samples secured from sites #7 and #8 in the northeast and northwest direction respectively contained a slight solvent odor and/or an oily film which might suggest high levels of PCB's. Laboratory analysis is needed to confirm this assumption.

Prepared by,

Donald W. Owens
Soil Scientist

DWO/bmh

2G79b

EARTH DIMENSIONS, INC.

Test Borings and Logs
797 Center Street • East Aurora, New York 14052 • (716) 655-1717

HOLE NO. 7 SURF. ELEV. ______

2G79b

PROJECT Waste Pit Investigation
Columbus McKinnon Corp., City of Tonawanda

LOCATION See survey

CLIENT VSSR

DATE STARTED 1/25/80 COMPLETED 1/28/80

DEPTH (feet)	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	N	DESCRIPTION & CLASSIFICATION		WATER TABLE & REMARKS
	1						Moist dark gray cindery fill with concrete chunks, loose when disturbed	0.5	Samples secured with a bucket auger.
	2						Moist mixed dark gray cindery fill with distinctly mottled brownish gray silt loam (SANDY-SILT) fill, non-plastic	1.5	Mostly nonsoil fill to refusal.
	3								
	4								
5							Extremely moist dark gray cindery fill with large concrete chunks, bricks and rounded gravel	3.5	
							Refusal with sampling completed to 3.5 feet		Slight solvent odor to samples 3 and 4.
									No water at completion.

N = NUMBER OF BLOWS TO DRIVE ______ " SPOON ______ " WITH ______ lb. WT. FALLING ______ " PER BLOW

DH
Donald W. Owens/Soil Scientist

1 1

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2G79b

HOLE NO. 8 | SURF. ELEV. ______

PROJECT Waste Pit Investigation
Columbus-McKinnon Corp., City of Tonawanda

LOCATION See survey

CLIENT VSSR

DATE STARTED 1/28/80 COMPLETED 1/28/80

DEPTH (feet)	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	N	DESCRIPTION & CLASSIFICATION		WATER TABLE & REMARKS
	1						Moist dark gray cindery fill with large slag and/or bricks, loose when disturbed		Non-soil fill to refusal
	2							2.5	
	3						Extremely moist mixed dark gray and reddish brown cindery fill with slag chunks, wood fiber and rounded gravel, loose when disturbed		An oily film with a slight odor was detected in samples #3-6.
	4								
5	5 and 6							5.0	
							Refusal with sampling completed to 5.0 feet		
10									No water at completion.

N = NUMBER OF BLOWS TO DRIVE ______ " SPOON ______ " WITH ______ lb. WT. FALLING ______ " PER BLOW.

LOGGED BY Dr. Donald W. Owens/Soil Scientist SHEET 1 OF 1

EARTH DIMENSIONS, INC.

Test Borings and Logs
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HOLE NO. 9 SURF. ELEV. ______

PROJECT Waste Pit Investigation
Columbus McKinnon Corp., City of Tonawanda LOCATION See survey

2C79b

CLIENT VSSR DATE STARTED 1/28/80 COMPLETED 1/28/80

DEPTH (feet)	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	N	DESCRIPTION & CLASSIFICATION		WATER TABLE & REMARKS
	1						Moist reddish brown cindery fill, loose when disturbed	0.5	Mostly non-soil fill to refusal.
	2								
	3						Moist black carbon waste	2.0	
	4						Moist gray fill, very hard	2.5	
5	5						Extremely moist mixed black and reddish brown cindery fill, containing slag and bricks	5.5	
							Refusal with sampling completed to 5.5 feet.		
10									No water at completion.

N = NUMBER OF BLOWS TO DRIVE ______ " SPOON ______ " WITH ______ lb. WT. FALLING ______ " PER BLOW.

Donald W. Owens/Soil Scientist

LOGGED BY ______ SHEET ______ OF ______

2G79C

September 8, 1981

EARTH DIMENSIONS, INC.

Soil Investigations and Natural Resource Assessments

Roycroft Campus, 31 S. Grove St. • East Aurora, N.Y. 14052 • (716) 655-1717

SOILS REPORT

Columbus McKinnon Corporation

City of Tonawanda, N.Y.

INTRODUCTION:

Fill samples were collected at three (3) hand augered sites to further define PCB concentration at two (2) new sites and to determine if there has been a change over time of the PCB level at bore site #10, which is within one (1) foot of the earlier sampled bore hole #5. The new sampling sites are identified as bore holes 11 and 12. This is a continuing sampling effort that has been under the guidance of John P. Schmitt of VSSR Consulting Engineers. The sampling site codes have been in consecutive numbers through all the sampling phases conducted on site July 13, 1979, September 13, 1979 and January 25, 1980 and this investigation September 4, 1981.

INVESTIGATIVE PROCEDURE:

The fill samples were secured with a 7 foot long hand bucket auger. The fill samples of each significant fill strata were placed in an acetone rinsed glass jar and sealed with aluminum foil and metal caps. The sealed samples were given to Mr. Schmitt the day of sampling. Little effort was made to fully clean the bucket auger between samples so that cross contamination of samples may have occurred. This would result in higher levels of PCB's in the lower (deeper) fill samples.

FINDINGS:

Industrial wastes were identified at all the sampling sites. The hard waste metal, slag, and brick inhibited the penetration of sampling of this fill. None of the boring sites penetrated below 5.0 feet.

This sampling effort was conducted after an extended wet rainy period. All of the lower fill stratas were described as being wet or saturated with liquids. This liquid which had an oily appearance was significantly higher during this investigation when compared to the other earlier investigations. The samples were collected for laboratory analysis.

Prepared by,

Don Owens

Donald W. Owens
Soil Scientist

DWO/brl

2G79c

EARTH DIMENSIONS, INC.

Test Borings and Logs
797 Center Street • East Aurora, New York 14052 • (716) 655-1717

BORE HOLE NO. 10 SURF. ELEV. ____

2G79c PROJECT Waste Pit Investigation Columbus McKinnon Corporation, City of Tonawanda LOCATION See survey

CLIENT VSSR DATE STARTED 9/4/81 COMPLETED 9/4/81

DEPTH feet	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	N	DESCRIPTION & CLASSIFICATION	WATER TABLE & REMARKS
0–0.5	1	COMPOSIT #1					Moist (with an oily film) black slaggy cinders (cinders are loamy medium to coarse size sand), SAND texture with 20 to 30% angular slag gravel, loose	0.5
0.5–1.0							Wet (with an oily film) black slaggy cinders are loamy medium to coarse size sand, SAND texture, with 20 to 30% angular slag gravel, loose - - - clear transition to - - - - - -	Non soil fill to refusal. 1.0
1.0–3.0	2						Wet (with an oily film) black slaggy cinders (cinders are sand to silt size), partially cemented, with occasional brick and metal fragment, fill material readily liquefied when disturbed	3.0
3.0							Refusal to hand bucket auger at 3.0 feet	Liquid level 0.5 feet below surface at completion.

N = NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW.

brl LOGGED BY Donald W. Owens/Soil Scientist SHEET 1 OF 1

EARTH DIMENSIONS, INC.

Test Borings and Logs
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BORE HOLE NO. 11 SURF. ELEV. ______

2G79c PROJECT Waste Pit Investigation LOCATION See survey
Columbus McKinnon Corporation, City of Tonawanda

CLIENT VSSR DATE STARTED 9/4/81 COMPLETED 9/4/81

DEPTH feet	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	N	DESCRIPTION & CLASSIFICATION	WATER TABLE & REMARKS
	1						Moist (with an oily film) black slaggy, cinders (cinders are loamy sand (SAND), sand size with 20 to 40% angular slag gravel, loose	
1								
	2							
2							----clear transition to ------ 2.5	Non soil fill to refusal.
	3						Extremely moist (with oily film) black slaggy cinders (cinders are loam (SANDY-SILT) size with 20 to 40% angular slag gravel, loose	
3	4						----clear transition to ------ 3.0	
	5						Wet (with oil liquid) black slaggy cinders (cinders are loam (SANDY-SILT) size with 20 to 40% angular slag gravel, loose, fill material readily liquefied when disturbed	
4							4.75	
	6						Refusal to hand bucket auger at 4.75 feet	No liquid at completion.
5								

N = NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW.

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Test Borings and Logs
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BORE HOLE NO. 12 SURF. ELEV. ______

2G79c PROJECT Waste Pit Investigation LOCATION See survey
Columbus McKinnon Corporation, City of Tonawanda

CLIENT VSSR DATE STARTED 9/4/81 COMPLETED 9/4/81

DEPTH feet	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	N	DESCRIPTION & CLASSIFICATION		WATER TABLE & REMARKS
0–2							Moist (with an oily film) mixed black and brown slaggy cinders (cinders are loamy sand (SAND), sand size with 30 to 40% angular slag gravel and one brick, occasional metal fragments and wire		Non soil fill to 4.25 feet over mixed non soil and CLAYEY-SILT soil fill to 4.5 feet over non soil fill to refusal.
2–3	1						- - - -clear transition to - - - - -	3.0	
							Extremely moist (with an oily film) black slaggy cinders (cinders are silty), with 30 to 40% angular slag gravel, nonplastic	4.25	
3–4	2						Extremely moist mixed black slaggy cinders and distinctly mottled (CLAYEY-SILT) soil fill, slightly plastic	4.5	
4–5	3, 4	5					Wet black (with an oily film) black slaggy (cinders are silty) with 30 to 40% angular slag gravel, nonplastic	5.0	
5–6							Refusal to hand bucket auger at 5.0 feet		No water at completic

N = NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW.

brl LOGGED BY Donald W. Owens/Soil Scientist SHEET 1 OF 1

PROJECT NAME: Waste Identification C. M. Chain	BOREHOLE NUMBER: 1
JOB NUMBER: 9-0979	DATE COMPLETED: 11/17/81
CLIENT: C. M. Chain	GEOLOGIST/ENGINEER: J. Kay

BOREHOLE TYPE: Hand Auger

LOCATION: 17' from northwest corner of oil storage building
16' from southwest corner of oil storage building

DEPTH	DESCRIPTION AND REMARKS	SAMPLE NUMBER
0' - 0.42'	Fill - Brown sand and gravel	1-0
0.42'	Refusal - concrete	--

PROJECT NAME: Waste Identification C. M. Chain	BOREHOLE NUMBER: 2
JOB NUMBER: 9-0979	DATE COMPLETED: 12/29/81
CLIENT: C. M. Chain	GEOLOGIST/ENGINEER: J. Kay

BOREHOLE TYPE: Split Spoon

LOCATION: 34.8' southwest of northwest corner of oil storage bldg.
16.0' west of southwest corner of oil storage building

DEPTH	DESCRIPTION AND REMARKS	SAMPLE NUMBER
0' - 0.5'	Fill - cinders and black sand	2-0
0.5' - 0.58'	Fill - cinders (orange) and sand	
0.58' - 1.0'	Fill - mottled grey and tan silt and sand	
1.0' - 2.0'	Fill - some clay and angular grey stone	2-02
2.0' - 3.0'	Fill - green brown consolidated silt	
3.0' - 4.0'	Fill - dark brown silt and sand - some slag and yellow sand	
4.0' - 5.5'	Fill - dark brown sand and slag, slightly reddish	2-04
5.5' - 7.0'	Fill - dark brown sand and slag - wet at 6.5' - odorous	2-06

PROJECT NAME: Waste Identification
C. M. Chain

BOREHOLE NUMBER: 3

JOB NUMBER: 9-0979

DATE COMPLETED: 12/29/81

CLIENT: C. M. Chain

GEOLOGIST/ENGINEER: J. Kay

BOREHOLE TYPE: Split Spoon

LOCATION: 23.5' from northwest corner of oil storage building
31.7' from southwest corner of oil storage building

DEPTH	DESCRIPTION AND REMARKS	SAMPLE NUMBER
0' - 0.25'	Fill - reddish brown iron slag and sand and angular gravel	3-0
0.25'	Refusal - concrete	
	MOVED 4.0' NORTH FOR REMAINING SAMPLES	
2.0' - 4.5'	Fill - dark brown sand and cinders, some wood	3-03
4.5' - 5.5'	- medium brown silt and sand	3-04
5.5' - 7.0'	- No recovery	3-06
7.0' - 8.0'	Light yellowish-brown silt and fine sand	

PROJECT NAME:	Waste Identification C. M. Chain	BOREHOLE NUMBER:	4
JOB NUMBER:	9-0979	DATE COMPLETED:	12/29/81
CLIENT:	C. M. Chain	GEOLOGIST/ENGINEER:	J. Kay

BOREHOLE TYPE: Split Spoon

LOCATION: 31.9' from northwest corner of oil storage building
26.6' from southwest corner of oil storage building

DEPTH	DESCRIPTION AND REMARKS	SAMPLE NUMBER
0' - 0.16'	Fill - black slag and cinders	4-0
0.16' - 0.25'	Fill - grey fibrous material - fine	
0.25' - 0.42'	Fill - orange iron slag	
0.42' - 2.0'	Fill - grey black and tan colored silt and stone, some clay	4-02
2.0' - 4.0'	Fill - brick and black sand, cinders and slag and glass - some fine gravel	
4.0' - 5.5'	Fill - black sand, cinders and slag and glass - some fine gravel	4-04
5.5' - 7.0'	Fill - black sand, cinders and slag - some fine gravel, wet at 6.0'	4-06

PROJECT NAME:	Waste Identification C. M. Chain	BOREHOLE NUMBER:	5
JOB NUMBER:	9-0979	DATE COMPLETED:	12/29/81
CLIENT:	C. M. Chain	GEOLOGIST/ENGINEER:	J. Kay

BOREHOLE TYPE: Split Spoon

LOCATION: 41.6' from northwest corner of oil storage building
25.5' from southwest corner of oil storage building

DEPTH	DESCRIPTION AND REMARKS	SAMPLE NUMBER
0' - 0.42'	Fill - black cinders	5-0
0.42' - 0.58'	Fill - orange iron slag	
0.58' - 1.0'	Fill - black sand, slag, cinders and stone	
1.0' - 1.8'	Fill - black sand, gravel and cinders	5-1.8'
2.0' - 4.0'	Fill - dark brown (slightly red) sand and fine gravel, slag and cinders	
4.0' - 4.5'	Fill - black sand and brick	5-04
4.5' - 5.5'	- green brown silt	
5.5' - 7.0'	Fill - black odorous sand, wood, brick and gravel	5-06

PROJECT NAME: Waste Identification C. M. Chain

BOREHOLE NUMBER: 6

JOB NUMBER: 9-0979

DATE COMPLETED: 12/29/81

CLIENT: C. M. Chain

GEOLOGIST/ENGINEER: J. Kay

BOREHOLE TYPE: Split Spoon

LOCATION: 44.5' from northwest corner of oil storage building
40.4' from southwest corner of oil storage building

DEPTH	DESCRIPTION AND REMARKS	SAMPLE NUMBER
0' - 0.16'	Fill - cinders and slag	6-0
0.16' - 0.42'	Fill - reddish brown iron slag	
0.42' - 0.84'	Fill - slag and cinders and grey silty sand	
0.84' - 1.68'	Fill - light grey brown grading to dark grey sand, gravel and stone	6-1.7
2.0' - 4.0'	- No recovery	
4.0' - 5.5'	Fill - black sand silt and fine gravel cinders and slag	6-04
5.5' - 7.6'	Fill - black sand silt and fine gravel cinders and slag, some brown silt lenses	6-06

PROJECT NAME:	Waste Identification C. M. Chain	BOREHOLE NUMBER:	7
JOB NUMBER:	9-0979	DATE COMPLETED:	12/29/81
CLIENT:	C. M. Chain	GEOLOGIST/ENGINEER:	J. Kay

BOREHOLE TYPE: Split Spoon

LOCATION: 52.9' from northwest corner of oil storage building
40.3' from southwest corner of oil storage building

DEPTH	DESCRIPTION AND REMARKS	SAMPLE NUMBER
0' - 0.42'	Fill - black cinders and slag	7-0
0.42' - 0.58'	Fill - reddish brown slag	
0.58' - 1.25'	Fill - black stone, sand, cinders and slag	
1.25' - 2.5'	Fill - reddish brown sand - fine sand, some glass and slag	7-02
4.0' - 5.5'	Fill - black sand, cinders and slag - some reddish colored layers - gravel	7-04
5.5' - 7.0'	Fill - black sand, cinders and slag - some reddish colored layers - gravel - wet and odorous at 6.0'	7-06

PROJECT NAME: Waste Identification C. M. Chain	BOREHOLE NUMBER: 8
JOB NUMBER: 9-0979	DATE COMPLETED: 12/29/81
CLIENT: C. M. Chain	GEOLOGIST/ENGINEER: J. Kay

BOREHOLE TYPE: Split Spoon

LOCATION: 33.2' from northwest corner of oil storage building
3.8' south of shop area south wall

DEPTH	DESCRIPTION AND REMARKS	SAMPLE NUMBER
0' - 0.08'	Fill - sampled ground beside empty carbon tetrachloride barrel	8-0
0.08' - 2.0'	Fill - black and brown sand, fine gravel and brick	
2.0' - 3.3'	Fill - black and brown sand, fine gravel and brick	
3.3' - 3.5'	- tan silt and fine sand	8-02
3.5' - 5.5'	- little recovery - fill - black sand	8-04
5.5' - 7.0'	No recovery - tan silt and fine sand	8-06

PROJECT NAME: Waste Identification C. M. Chain	BOREHOLE NUMBER: 9
JOB NUMBER: 9-0979	DATE COMPLETED: 12/29/81
CLIENT: C. M. Chain	GEOLOGIST/ENGINEER: J. Kay

BOREHOLE TYPE: Split Spoon

LOCATION: 58.7' from northwest corner of oil storage building
55.8' from southwest corner of oil storage building

DEPTH	DESCRIPTION AND REMARKS	SAMPLE NUMBER
0' - 2.0'	Fill - dark brown sand and gravel, roots and topsoil	9-0.3
2.0' - 4.0'	Fill - dark brown sand, cinders, slag and gravel	9-02
4.0' - 5.5'	Fill - medium brown sand, silt, wood, gravel and cinders	9-04
5.5' - 7.0'	- grey silt	9-06

STRATIGRAPHIC AND INSTRUMENTATION LOG

PROJECT NAME : C.M. CHAIN
HOLE Nº: OW1-83
JOB Nº : 9-0979
DATE COMPLETED: AUGUST 9, 1983
CLIENT : COLUMBUS McKINNON CORP., TONAWANDA
GEOLOGIST/ENGINEER: D. MILLARD
HOLE TYPE : 6"Ø HOLLOW STEM AUGERS
GROUND ELEVATION: 573.7
LOCATION : ±20' SOUTH OF OIL STORAGE BUILDING
TOP OF PIPE ELEVATION: 576.38

PROFILE

DEPTH (ELEVATION)	STRATIGRAPHY DESCRIPTION & REMARKS
574	
	BLACK DARK BROWN & GRAY SLAG - topsoil, vegetation, metal
	BROWN-GRAY SILT & FINE SAND
	RED BROWN & GRAY BRICK, CINDERS & SLAG
	BROWN, RED BROWN & GRAY, CINDERS METAL FILINGS
570	Sand, silt, vegetation
	BROWN & RED BROWN CINDERS & PEBBLES - metal filings, sand, silt, glass
	BLACK & RED BROWN CINDERS, PEBBLES, RUBBER & BRICK - sand, silt
	BLACK GRAVEL, SAND, SLAG, STEEL & CINDERS
565	LAYERED GRAY SILT & FINE SAND - vegetation
	GRAY SILT & FINE SAND
560	
	GRAY SILT & FINE TO MEDIUM SAND - vegetation
555	NOTE: ORIGINAL BOREHOLE SAMPLED TO 20.0' THEN GROUTED

MONITOR INSTALLATION

576.38
573.7
GROUT
2"Ø BLACK IRON PIPE
1.0' BENTONITE PLUG
SANDPACK
6"Ø BOREHOLE
2.0' 2"Ø SS SCREEN (#10 SLOT)

SAMPLE / PENETRATION TEST BLOWS / FOOT (20 40 60 80)

NUMBER	TYPE	BLOWS / FOOT
1	SS	8
		19
2	SS	9
		17
3	SS	7
		8
4	SS	15
		15
5	SS	3
		4
6	SS	2
		4
7	SS	2
		3
8	SS	2
		2
9	SS	1
		2
10	SS	1
		2

○ GRAIN SIZE ANALYSIS ▼ WATER FOUND ▽ STATIC WATER LEVEL

OW1-83
August 8, 1983
Crew Members: D. Oscar, G. Moreau, D. Owens

SAMPLE DEPTH	BLOWCOUNTS	RECOVERY	DESCRIPTION	MOISTURE
0-0.5'	1-7-10-9	19"	Black, dark brown & grey slag (FILL) - some topsoil - vegetation pebbles - metal filings	Dry
0.5-1.5'			Brown-grey silt and fine sand (FILL)	Dry
1.5-2.0'			Red-brown and grey brick, cinders and slag (FILL)	Dry
2.0-4.0'	5-4-8-9	14"	Brown, red-brown, and some grey cinders and metal filings (FILL) - some sand and silt - trace vegetation	Dry
4.0-6.0'	3-4-4-4	12"	Mottled brown and red-brown cinders, pebbles (FILL) - grey metal filings - some sand and silt - trace glass	Dry
6.0-8.0'	5-10-9-6	7"	Black and red-brown cinders pebbles, rubber and brick (FILL) - some sand & silt	Dry
8.0-8.3'	2-1-2-2	13"	Black gravel and sand, slag and steel, cinders (FILL) - petroleum odor	Wet
8.3-10.0'			Interbedded layers of grey silt & fine sand (NATIVE) - trace vegetation	Wet-moist
10.0-12.0'	1-2-2-2	19"	Grey silt and fine sand (NATIVE) - increasing fine silt	Wet
12.0-14.0'	1-1-2-1	10"	Grey silt and fine sand (NATIVE)	Wet
14.0-16.0'	1-1-1-1	20"	Grey silt and fine sand (NATIVE)	Wet

OW.1-83 (Cont'd)
August 8, 1983
Crew Members: D. Oscar, G. Moreau, D. Owens

SAMPLE DEPTH	BLOWCOUNTS	RECOVERY	DESCRIPTION	MOISTURE
16.0-18.0'	1/12"-3-2	12"	Grey silt with fine to medium sand (NATIVE) - trace vegetation	Wet
18.0-20.0'	WOR-1-1-1	15"	Grey silt with fine to medium sand (NATIVE) - sand becoming coarser	Wet

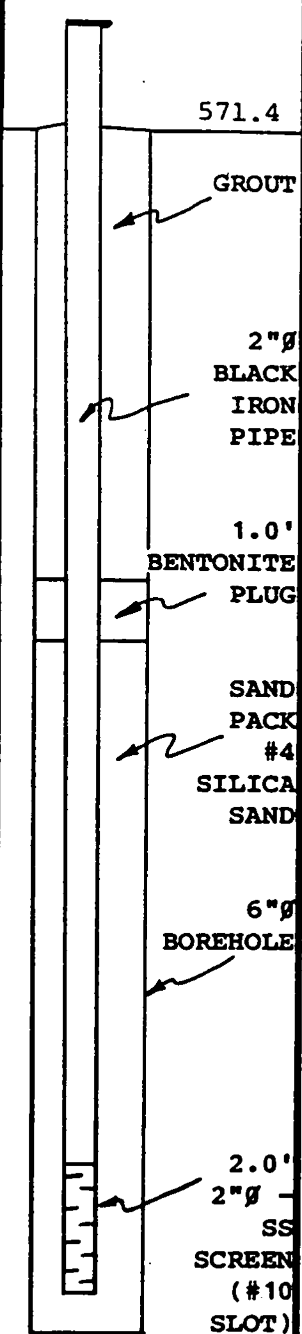
STRATIGRAPHIC AND INSTRUMENTATION LOG

PROJECT NAME : C.M. CHAIN
HOLE Nº: OW2-83
JOB Nº : 9-0979
DATE COMPLETED: AUGUST 9, 1983
CLIENT : COLUMBUS McKINNON CORP., TONAWANDA
GEOLOGIST/ENGINEER: D. MILLARD
HOLE TYPE : 6"Ø HOLLOW STEM AUGERS
GROUND ELEVATION: 571.4
LOCATION : NORTH WEST OF OIL STORAGE BUILDING
TOP OF PIPE ELEVATION: 574.96

PROFILE

DEPTH (ELEVATION)	STRATIGRAPHY DESCRIPTION & REMARKS
571	BROWN & BLACK SLAG - cinders, brick, sand, vegetation, stone
570	
	BLACK SLAG - sand
	RED BROWN CINDERS - slag, vegetation, sand
565	BLACK & DARK BROWN CINDERS - silt, glass, brick
	BLACK SILT - sand, wood
	LAYERED GRAY SILT & SAND - vegetation
560	- wood
	- vegetation
	GRAY FINE SAND & SILT
	LAYERED GRAY SILT & SAND
555	
	GRAY SILTY FINE SAND NOTE: ORIGINAL BOREHOLE SAMPLED TO 20.0' THEN GROUTED

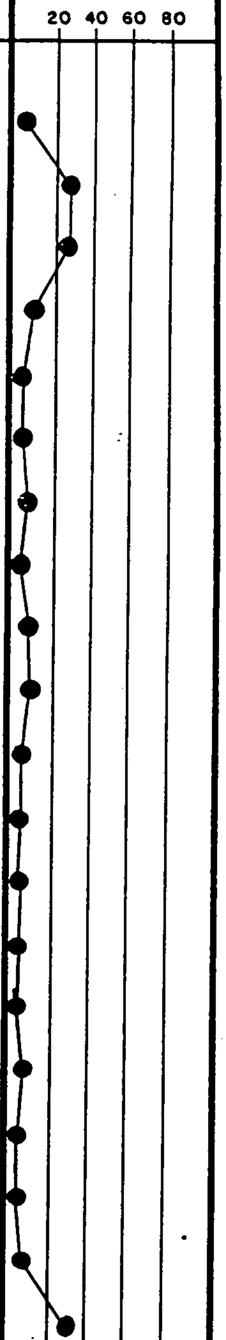
MONITOR INSTALLATION



SAMPLE

NUMBER	TYPE	BLOWS / FOOT
1	SS	5
		25
2	SS	21
		11
3	SS	2
		2
4	SS	7
		3
5	SS	7
		10
6	SS	3
		2
7	SS	2
		2
8	SS	2
		8
9	SS	2
		2
10	SS	7
		30

PENETRATION TEST BLOWS / FOOT



○ GRAIN SIZE ANALYSIS ▼ WATER FOUND ▽ STATIC WATER LEVEL

OW2-83
August 8, 1983
Crew Members: D. Oscar, G. Moreau, D. Owens

SAMPLE DEPTH	BLOWCOUNTS	RECOVERY	DESCRIPTION	MOISTURE
0-2.0'	2-3-15-10	3"	Brown and black slag - cinders - brick - sand - trace vegetation - trace shattered stone	Dry
2.0-4.0'	14-7-6-5	1"	Black slag (FILL) - sand	Dry
4.0-6.0'	1-1-1-1	3"	Red-brown cinders (FILL) - slag - trace vegetation - sand	Dry
6.0-8.0"	4-3-2-1	1"	Black and dark brown cinders (FILL) - trace silt - glass - brick	Wet-moist
8.0-8.2'	3-4-5-5	14"	Black silt (FILL) - trace sand - piece of black wood - oily sheen on water surface - petroleum odor	Wet
8.2-10.0'			Grey interbedded layers of sand and silt (NATIVE) - trace vegetation	Wet
10.0-12.0'	2-1-1-1	12"	Grey interbedded layers of silt and sand (NATIVE) - trace black piece of wood	Wet
12.0-14.0'	1-1-1-1	9"	Grey interbedded layers of silt and sand (NATIVE) - trace vegetation - sand becoming coarser	Wet
14.0-15.0'	1-1-1-7	8"	Grey interbedded layers of silt and sand (NATIVE)	Wet
15.0-16.0'			Grey fine sand and silt (NATIVE)	Wet

OW2-83 (Cont'd)
August 8, 1983
Crew Members: D. Oscar, G. Moreau, D. Owens

SAMPLE DEPTH	BLOWCOUNTS	RECOVERY	DESCRIPTION	MOISTURE
16.0-18.0'	1-1/2-1/2-1	13"	Grey interbedded layers of silt and sand (NATIVE)	Wet
18.0-20.0'	1-6-13-17	5"	Grey silty fine sand (NATIVE)	Wet

FIELD BOREHOLE LOG

CLIENT: Columbus - McKinnon
JOB NO. 1332-01-1
PROJECT: Columbus - McKinnon
LOCATION: Tonawanda, NY
BOREHOLE NO. CM-1-89
CONTRACTOR:
LOGGED BY: J P Hilton
STARTED: 9 AM 10/19 19 89
METHOD OF BORING: SOIL * HNu span @ 6.43 / 56 ppm
FINISHED: 3³⁰ PM 10/27 19 89 ** (** Discontinuous drilling)
ROCK:
CORE DIA. NX (6.0')
ELEVATIONS: DATUM

SAMPLE NO.	HNU TYPE	DEPTH	BLOWS 'N'	RECOVERY %	MOISTURE TIN NO.	SAMPLE DESCRIPTION: Color, Texture Classification, Compactness/Consistency, Moisture Condition, Weathering/Fracturing, Inclusions, Odor, Etc.	NOTES: Boring, Testing and Sampling Procedures, Water Loss and Gain, Drilling and Testing Equipment, Etc.
1	0	0 1	3 5 2 5	.6/2.0		.6 Fill Black slag, cinder, metal filings, Glass	DRY
2	0	2 3	4 3 4 3	.6/2.0		.6 Fill As above w/ roots and plastic	DRY
3	0	4 5	4 3 4 6	1.0/2.0		1.0 Fill Slag, filings, plastic & Glass	DRY
4	0	6 7	6 6 4 4	.5/2.0		.5 Fill As above w/ trace clay	DRY Fill to 8.2'
5	45	8 9	5 3 2 3	1.2/2.0		.2 Fill orange silty clay w/ slag .2 Black-Gray vf Sand w/ trace Silt .8 Gray vf-f Sand w/ silt laminae	DRY/Moist Wet oil sheen on water & wet sands
6	7	10 11	4 3 2 2	.9/2.0		.9 Gray vf Sand w/ little Silt as laminae	Saturated Oil sheen on upper .2'
7	4	12 13	WOH WOH WOH 3	2.0/2.0		2.0 Gray vf-f Sand w/ little silt as interbeds 5-10mm	Saturated Conditions in lacustrine silts & sands to top of till
8	4	14 15	WOH 1 WOH 3	2.0/2.0		2.0 Gray vf-f Sand w/ silt and silt interbeds A/A	

MALCOLM PIRNIE

CLIENT Columbus McKinnon

PROJECT

LOCATION

CONTRACTOR

METHOD OF BORING: SOIL

ROCK

JOB NO.

LOGGED BY JPH

CORE DIA.

FIELD BOREHOLE LOG

BOREHOLE NO. CM-1-89

STARTED ____ M ____ 19 ____

FINISHED ____ M ____ 19 ____

ELEVATIONS: DATUM

SAMPLE NO.	TYPE	DEPTH	BLOWS 'N'	RECOVERY %	MOISTURE TIN NO.	SAMPLE DESCRIPTION: Color, Texture Classification, Compactness/Consistency, Moisture Condition, Weathering/Fracturing, Inclusions, Odor, Etc.	NOTES: Boring, Testing and Sampling Procedures, Water Loss and Gain, Drilling and Testing Equipment, Etc.
9	4	16 17	WOH 1 1 1	2.0/2.0		2.0 GRAY vf-MED SAND w/trace silt laminae	Saturated
10	2	18 19	WOH 1 1 1	2.0/2.0		1.7 SAND A/A .3 GRAY Silt w/trace clay	
11	1	20 21	WOH 1 3 4	2.0/2.0		2.0 GRAY F-MED SAND, uniform w/no bedding evident, well drained, permeable	
12	0	22 23	1 1 2 3	1.7/2.0		1.7 SAND A/A	Problem w/sand blow into HSA
13	1	24 25	4 7 4 10	.3/2.0		.3 GRAY vf-f SAND w/minor trace silt laminae	Extreme difficulty with SAND blow in
14	1	26 27	5 2 3 7	.5/2.0		.5 GRAY-black vf-f SAND w/trace Silt	
15	0	28 29	4 6 8 12	1.9/2.0		.5 GRAY-black F-MED SAND .1 CRS SAND w/fine Gravel @ sharp contact with 1.3 Till Lt Red Silt w/little fine Gravel, trace clay firm, little plasticity	Saturated 8.2 - 28.6 Moist Till @ 28.6
16	0	30 31	4 14 24 27	1.2/2.0		1.2 Till Lt. Red w/little fine Gravel to 10mm, little CRS SAND throughout	Moist condition through till to 42.5

Sheet No. 2 of 4

MALCOLM PIRNIE

FIELD BOREHOLE LOG

CLIENT Columbus McKinnon
PROJECT
LOCATION
CONTRACTOR
METHOD OF BORING: SOIL / ROCK

JOB NO.
LOGGED BY JPH
CORE DIA.

BOREHOLE NO. CM-1-89
STARTED ____ M ____ 19 ____
FINISHED ____ M ____ 19 ____
ELEVATIONS: DATUM

SAMPLE NO.	TYPE HNU	DEPTH	BLOWS 'N'	RECOVERY %	MOISTURE TIN NO.	SAMPLE DESCRIPTION: Color, Texture Classification, Compactness/Consistency, Moisture Condition, Weathering/Fracturing, Inclusions, Odor, Etc.	NOTES: Boring, Testing and Sampling Procedures, Water Loss and Gain Drilling and Testing Equipment, Etc.
17	0	32 33	4 9 20 36	.65/2.0		.65 Till Lt Red Silt w/ little - Some fine Gravel, little Crs Sand, trace vf Sand	
18	–	34 35	23 25 35 51	0.0/2.0		No Recovery	
19	–	36 37	16 25 30 39	0.0/2.0		No Recovery	
20	0	38 39	11 19 21 34	.8/2.0		.8 Till Lt Red-Brown Silt w/ little fine Gravel, trace vf Sand, Clay	
21	0	40 41	10 12 11 11	.7/2.0		.7 Lt Red-Brown Till A/A	Moist Glacial Till 28.6 - 42.5
22	0	42 43	10 12 11 11	2.0/2.0		.5 Till A/A sharp contact w/ 1.5 Lacustrine Clay Red with minor gray interbeds (2) 5-7 mm, soft, good plasticity, easily molded w/ finger pressure	Moist lacustrine Clay contact
23	0	44 45		2.0/2.0		Shelby Tube Reddish-Gray Clay w/ trace Silt and vf Sand, occassional Trace Crs Gravel > 20 mm	Start 9:21 Stop 9:23 wait 9:34 Max pressure 900 lb Push 2.0' Rec 2.0' Moist
24		46 47	3 5 23 65	.5/2.0		.5 Lt Red-Brown Till Silt and vf Sand w/ little f Sand and fine Gravel minor Crs Gravel to 15 mm	

Sheet No. 3 of 4

MALCOLM PIRNIE

FIELD BOREHOLE LOG

CLIENT Columbus McKinnon
PROJECT
LOCATION
CONTRACTOR
METHOD OF BORING: SOIL
ROCK

JOB NO.
LOGGED BY JP/H
CORE DIA.

BOREHOLE NO. CM-1-89
STARTED ____ M ____ 19 ____
FINISHED ____ M ____ 19 ____
ELEVATIONS: DATUM

SAMPLE NO.	TYPE	DEPTH	BLOWS "N"	RECOVERY %	MOISTURE TIN NO.	SAMPLE DESCRIPTION: Color, Texture Classification, Compactness/Consistency, Moisture Condition, Weathering/Fracturing, Inclusions, Odor, Etc.	NOTES: Boring, Testing and Sampling Procedures, Water Loss and Gain Drilling and Testing Equipment, Etc.
25	○	48 49	25 31 27 38	.6/2.0		.6 Till Gray-brown Silt w/ little fine Gravel, trace vf Sand, dense	
26	○	50 51	20 19 20 31	1.3/2.0		1.2 Till Gray-brown A/A grading to .1 Weathered bedrock, Lt Brown, clayey slightly calcareous	Bedrock @ 51.2
27	○	52 53	100	.2/.5		.2 Lt Tan Dolostone w/ gypsum filling in horizontal plane appears hard massive and competent, broken along possible bedding features	
						Core Run #1 52.2 - 57.2 NX Core w/ diamond bit	Started @ 1:15 pm Stopped @ 2:30 pm Cored 6.0' Recovered 5.0'
						52.2 - 52.9 Lt Brown shaley Dolostone w/ numerous Gypsum filled horizontal fractures along wavey bedding planes	
						52.9 - 53.3 Brown shaley Dolostone w/ minor pyritization	
						53.3 - 53.5 Brown - Gray Dolostone w/ trace black shaley intra-clasts, wavey bedding planes, minor gypsum filled vugs to 5-7 mm	
						53.5 - 54.7 Gray-Brown Dolostone, shaley	
						54.7 - 55.9 Gray-White Dolostone w/ some Gypsum, wavey bedding structure w/ brown shaley clasts	
						55.9 - 56.1 Gray Dolostone, shaley	

MALCOLM PIRNIE

CLIENT Columbus-McKinnon

JOB NO.

FIELD BOREHOLE LOG

PROJECT

LOCATION

BOREHOLE NO. CM-1-89

CONTRACTOR

LOGGED BY JPH

STARTED ______ M ______ 19 ______

FINISHED ______ M ______ 19 ______

METHOD OF BORING: SOIL

ROCK

CORE DIA.

ELEVATIONS: DATUM

SAMPLE NO.	TYPE	DEPTH	BLOWS 'N'	RECOVERY %	MOISTURE TIN NO.	SAMPLE DESCRIPTION: Color, Texture Classification, Compactness/Consistency, Moisture Condition, Weathering/Fracturing, Inclusions, Odor, Etc.	NOTES: Boring, Testing and Sampling Procedures, Water Loss and Gain Drilling and Testing Equipment, Etc.
						Core Description Cont'd	
						56.1 - 56.8 Gray Dolostone, shaley w/some Gypsum filled horizontal and vertical fractures, Gypsum filled fractures to 7mm thickness	
						56.8 - 57.2 Dark Gray Dolostone, shaley w/minute horizontal, Gypsum filled fractures	

Sheet No. 5 of 5

MALCOLM PIRNIE

FIELD BOREHOLE LOG

CLIENT Columbus McKinnon
PROJECT Columbus McKinnon
LOCATION Tonawanda, NY
CONTRACTOR
METHOD OF BORING: SOIL *HNu span @ 6.43 / 56 ppm
ROCK

JOB NO. 1332-01-1
LOGGED BY J P Hilton
CORE DIA.

BOREHOLE NO. CM-2-89
STARTED 1:30 PM 10/20 19 89
FINISHED 4:30 PM 10/23 19 89
ELEVATIONS: DATUM

SAMPLE NO.	HNu ppm TYPE	DEPTH	BLOWS "N"	RECOVERY %	MOISTURE TIN NO.	SAMPLE DESCRIPTION: Color, Texture Classification, Compactness/Consistency, Moisture Condition, Weathering/Fracturing, Inclusions, Odor, Etc.	NOTES: Boring, Testing and Sampling Procedures, Water Loss and Gain Drilling and Testing Equipment, Etc.
1	0	0 / 1	2, 6, 9, 7	.7 / 2.0		.3 Fill - Slag, cinders .2 Oxidized metal filings, roots .2 loose silt & clay	Dry Dry strata to 8.0'
2	2	2 / 3	3, 3, 2, 2	.3 / 2.0		.3 Fill - loose silty clay w/plastic, metal filings, fine gravel	
3	1	4 / 5	3, 1, 9, 12	.6 / 2.0		.6 Fill - Black slag, metal filings, brick oil sheen on moistened fine gravel	
4	0	6 / 7	9, 11, 11, 4	.4 / 2.0		.4 Fill - A/A w/creosote like tar, cement fragments	
5	8	8 / 9	2, 1, 1, 2	1.4 / 2.0		.3 Fill - A/A w/ oil sheen 1.1 Black-Gray vf-fine Sand, trace silt w/interbedded sands that carry black oil staining	Moist Wet Fluvial/lacustrine Sands & Silts 8.3-27.6
6	1	10 / 11	1, 1, 2, 2	1.5 / 2.0		1.5 Gray-black vf-fine Sand w/little Silt sand interbeds A/A w/ oil staining	Wet
7	0	12 / 13	1, 1, 1, 1	1.0 / 2.0		1.0 Dark Gray vf-f Sand w/ Some Silt, trace clay	Saturated Saturated conditions to Lt Red Till @ 27.6'
8	0	14 / 15	WOH, 1, 1, 1	.4 / 2.0		.4 Gray vf-f Sand w/ Lt Gray Silt interbeds to 5mm slight oil sheen from Sands	

Sheet No. 1 of 4

MALCOLM PIRNIE

FIELD BOREHOLE LOG

CLIENT: Columbus McKinnon
JOB NO. 1332-01-1
PROJECT:
LOCATION:
BOREHOLE NO. CM-2-89
CONTRACTOR:
LOGGED BY: JPH
STARTED ______ M ______ 19 ______
FINISHED ______ M ______ 19 ______
METHOD OF BORING: SOIL ______ ROCK ______
CORE DIA. ______
ELEVATIONS: DATUM ______

SAMPLE NO.	HNu ppm TYPE	DEPTH	BLOWS 'N'	RECOVERY %	MOISTURE TIN NO.	SAMPLE DESCRIPTION: Color, Texture Classification, Compactness/Consistency, Moisture Condition, Weathering/Fracturing, Inclusions, Odor, Etc.	NOTES: Boring, Testing and Sampling Procedures, Water Loss and Gain Drilling and Testing Equipment, Etc.
9	0	16	WOH	2.0/2.0		1.4 Gray vf-fine Sand	Saturated to 27.6'
			3			.3 Gray Silt w/ vf Sand	
		17	2			.3 Gray f-Medium Sand	
			3				
10	0	18	4	2.0/2.0		2.0 Gray vf-Med Sand w/ Lt Gray Silt interbeds 3-5mm & laminae	
			1				
		19	3				
			3				
11	0	20	WOH	2.0/2.0		1.2 Lt Gray Silt w/ trace to little vf Sand	
			3			.8 Dk Gray f-Med. Sand, trace Silt as laminae	
		21	4				
			10				
12	0	22	4	2.0/2.0		2.0 Dk Gray f-Med Sand	
			3				
		23	4				
			6				
13	0	24	4	1.5/2.0		1.5 Dk Gray f-Med Sand w/ trace Silt	
			5				
		25	8				
			8				
14	0	26	3	2.0/2.0		1.0 Dk Gray f-Med Sand w/ trace Silt	
			5			.6 Gray Silt w/ contorted Dk Gray-Black Med Sand @ sharp contact w/	
		27	9				
			11			.4 Till - Lt Red Silt w/ fine Gravel	Moist
15	0	28	7	.6/2.0		.6 Till - A/A w/ Crs Sand - fine Gravel, trace Clay	
			5				
		29	10				
			17				
16	0	30	17	1.1/2.0		1.1 Till A/A	Moist
			36				
		31	37				
			26				

Sheet No. 2 of 4

MALCOLM PIRNIE

FIELD BOREHOLE LOG

CLIENT: Columbus McKinnon
JOB NO. 1332-01-1
PROJECT:
LOCATION:
BOREHOLE NO. CM-2-89
CONTRACTOR:
LOGGED BY: JPH
STARTED ____ M ____ 19 ____
FINISHED ____ M ____ 19 ____
METHOD OF BORING: SOIL ____ ROCK ____
CORE DIA. ____
ELEVATIONS: DATUM ____

SAMPLE NO.	HNu PPm TYPE	DEPTH	BLOWS "N"	RECOVERY %	MOISTURE TIN NO.	SAMPLE DESCRIPTION: Color, Texture Classification, Compactness/Consistency, Moisture Condition, Weathering/Fracturing, Inclusions, Odor, Etc.	NOTES: Boring, Testing and Sampling Procedures, Water Loss and Gain Drilling and Testing Equipment, Etc.
17	0	32 33	7 7 11 16	1.6/2.0		1.6 Till - Red Silt w/trace - little Crs Sand and fine Gravel, w/ Clay (lacustrine) interbeds .1-.3'	Moist conditions in Till and lacustrine Clay
18	0	34 35	25 26 26 36	1.0/2.0		1.0 Till - Red Silt A/A w/ little - Some Crs Sand and fine Gravel, occassional Crs Gravel	
19	0	36 37	12 18 26 32	1.4/2.0		1.4 Till A/A w/trace red Clay as .1-.2' interbeds	
20	0	38 39	6 9 14 22	2.0/2.0		1.6 Clay Lt Red, soft easily molded w/ finger pressure w/ Gray silt interbeds 5-10mm sharp contact w/ Crs Gravel top .4 Till Gray Silt and vf Sand w/ little Crs Sand + f. Gravel	Lacustrine Clay 38.0-39.6 2nd Till
21	0	40 41	27 30 39 46	1.6/2.0		1.6 Till - Gray A/A	
22	0	42 43	20 27 37 30	1.8/2.0		1.8 Till Gray Silt w/ little to Some fine + Crs Gravel, little Crs Sand throughout	
23	0	44 45	27 45 31 30	1.2/2.0		1.2 Till Gray A/A w/ Some Crs Gravel	
24	0	46 47	2 21 68 84	1.4/2.0		1.0 Till A/A .4 Till extremely dense	Moist - Dry

MALCOLM PIRNIE

FIELD BOREHOLE LOG

CLIENT Columbus McKinnon　　JOB NO. 1332-01-1

PROJECT

LOCATION

BOREHOLE NO. CM-2-89

CONTRACTOR　　LOGGED BY JPH

STARTED ____ M ____ 19 ____

METHOD OF BORING: SOIL ____ ROCK ____

FINISHED ____ M ____ 19 ____

CORE DIA. ____

ELEVATIONS: DATUM ____

SAMPLE NO.	HNu ppm TYPE	DEPTH	BLOWS "N"	RECOVERY %	MOISTURE TIN NO.	SAMPLE DESCRIPTION: Color, Texture Classification, Compactness/Consistency, Moisture Condition, Weathering/Fracturing, Inclusions, Odor, Etc.	NOTES: Boring, Testing and Sampling Procedures, Water Loss and Gain Drilling and Testing Equipment, Etc.
25	0	48	38	1.7/2.0		1.0 Till Gray A/A w/Some fine Gravel	Moist
			31			.2 fine Gravel w/some Crs Sand	
		49	60			.5 Till Gray Silt-vf Sand w/fine Gravel	
			91				
26	0	50	43	1.6/1.9		1.6 Till Gray Silt w/little to Some Crs Sand & fine Gravel	
			56				
		51	41				
			100				100 count/.4'
27	0	52	61	1.4/1.4		1.4 Till becoming very dense w/large fraction in f-Crs Gravel range	Moist - Dry
			80				
		53	100				100 count/.4'
28	0	54	28	1.2/1.2		.8 Till A/A	
			30			.4 Weathered Bedrock, brown shaly Dolostone w/calcite filled horizontal and vertical fractures	
		55	100				100 count/.2'
		56					

Sheet No. 4 of 4

MALCOLM PIRNIE

FIELD BOREHOLE LOG

CLIENT Columbus - McKinnon
PROJECT Columbus - McKinnon
LOCATION Tonawanda, NY
CONTRACTOR
METHOD OF BORING: SOIL
ROCK

JOB NO. 1332-01-1
LOGGED BY J P Hilton
CORE DIA.

BOREHOLE NO. CM-3-89
STARTED 12³⁰ PM 10/24 19 89
FINISHED 10 AM 10/27 19 89
ELEVATIONS: DATUM

SAMPLE NO.	HNu ppm TYPE	DEPTH	BLOWS "N"	RECOVERY %	MOISTURE TIN NO.	SAMPLE DESCRIPTION: Color, Texture Classification, Compactness/Consistency, Moisture Condition, Weathering/Fracturing, Inclusions, Odor, Etc.	NOTES: Boring, Testing and Sampling Procedures, Water Loss and Gain, Drilling and Testing Equipment, Etc.
1	0	0 1	4 1 1 1	.3/2.0		.3 Fill Black Slag, cinders, concrete block from creek-side rip-rap	Dry Fill to 8.1'
2	0	2 3	6 2 5 4	.7/2.0		.7 Fill Black Slag & concrete A/A, brick	Dry
3	2	4 5	17 3 3 1	.8/2.0		.8 Fill Concrete, oxidized metal filings, fine gravel as fill	Dry to 4.6 Moist to 4.8
4	2	6 7	7 7 3 3	1.2/2.0		.9 Fill Black - Orange/Brown, Concrete w/Crs Sand and fine Gravel - difficult to identify stratified components .3 Fill A/A w/thick oil sheen	Wet
5	1	8 9	1 WOH 1 WOH	2.0/2.0		.1 Fill w/Heavy oil sheen 1.9 Black vf-f Sand w/silt interbeds 3-7mm, rootlets randomly scattered throughout, oil sheen	Saturated Saturated conditions in lacustrine sands and silts to 27.4'
6	1	10 11	WOH WOH 1 1	1.6/2.0		.6 Black vf-f Sand w/trace Silt w/oil sheen especially in sand component 1.0 Gray - Dark Gray vf-f Sand w/silt laminae and interbeds to 3-5 mm	
7	0	12 13	WOH WOH WOH WOH	2.0/2.0		2.0 Gray vf Sand with interbedded light Gray Silt 3-5mm	
8	0	14 15	WOH 1 1 WOH	2.0/2.0		2.0 Gray Silt - vf Sand, interbedded throughout	

MALCOLM PIRNIE

FIELD BOREHOLE LOG

CLIENT Columbus McKinnon
PROJECT
LOCATION
CONTRACTOR
METHOD OF BORING: SOIL
ROCK

JOB NO. 1332-01-1
LOGGED BY JPH
CORE DIA.

BOREHOLE NO. CM-3-89
STARTED ____ M ____ 19 ____
FINISHED ____ M ____ 19 ____
ELEVATIONS: DATUM

SAMPLE NO.	HNu ppm TYPE	DEPTH	BLOWS "N"	RECOVERY %	MOISTURE TIN NO.	SAMPLE DESCRIPTION: Color, Texture Classification, Compactness/Consistency, Moisture Condition, Weathering/Fracturing, Inclusions, Odor, Etc.	NOTES: Boring, Testing and Sampling Procedures, Water Loss and Gain Drilling and Testing Equipment, Etc.
9	0	16 17	1 2 4 10	2.0/2.0		1.7 Gray Silt - vf Sand varved and w/ laminae .3 Gray f-Med Sand	Saturated
10	0	18 19	3 5 4 3	2.0/2.0		.4 Gray f-Med Sand .6 Gray vf-f Sand w/ Silt laminae & interbeds 1.0 Gray-brown f-Med Sand	
11	0	20 21	2 3 3 7	2.0/2.0		2.0 Gray vf-f Sand w/ trace silt as laminae < 3 mm	
12	0	22 23	2 1 4 9	2.0/2.0		2.0 Gray vf-f Sand A/A	
13	0	24 25	2 2 3 13	2.0/2.0		2.0 Gray - Dk. Gray fine Sand w/ trace Silt as interbedded laminae < 2-3 mm	
14	0	26 27	10 7 20 19	2.0/2.0		1.3 Gray Sand A/A .1 Crs Sand and fine Gravel .6 Till Red Silt w/ some Clay, little fine Gravel	Moist
15	0	28 29	7 44 26 16	1.7/2.0		1.7 Till A/A w/ little vf Sand, fine Gravel throughout	Moist conditions prevalent in 1st Red Till and Gray Till to 43.0'
16	0	30 31	48 15 28 36	.9/2.0		.9 Till A/A w/ Crs Gravel (Gypsum/Anhydrite?)	

Sheet No. 2 of 4

MALCOLM PIRNIE

FIELD BOREHOLE LOG

CLIENT Columbus McKinnon
JOB NO. 1332-01-1
PROJECT
LOCATION
BOREHOLE NO. CM-3-89
CONTRACTOR
LOGGED BY JPH
STARTED ____ M ____ 19 ____
METHOD OF BORING: SOIL
FINISHED ____ M ____ 19 ____
ROCK
CORE DIA.
ELEVATIONS: DATUM

SAMPLE NO.	HNu ppm TYPE	DEPTH	BLOWS "N"	RECOVERY %	MOISTURE TIN NO.	SAMPLE DESCRIPTION: Color, Texture Classification, Compactness/Consistency, Moisture Condition, Weathering/Fracturing, Inclusions, Odor, Etc.	NOTES: Boring, Testing and Sampling Procedures, Water Loss and Gain Drilling and Testing Equipment, Etc.
17	0	32 / 33	14 / 43 / 51 / 29	1.8 / 2.0		*.6 Till Red Silt w/ trace clay*, little - Some Crs Sand and fine Gravel *.8 Gravel Crs Gravel to Cobbles .4 Till Gray Silt w/ Some fine Gravel	* Color change in Till from Red to Gray
18	0	34 / 35	2 / 3 / 9 / 23	.2 / 2.0		.2 Till Gray w/ Some f-Med Sand, fine Gravel *Low blow counts and poor recovery may be indicative of interbedded Sand lens - Sand in Augers at this depth	
19	0	36 / 37	23 / 30 / 30 / 46	.9 / 2.0		.9 Gray-Brown Till vf Sand matrix w/ trace Silt, little fine Gravel	
20	0	38 / 39	8 / 30 / 44 / 53	1.3 / 2.0		.2 Crs Sand and fine Gravel interbed 1.1 Gray-Brown Till, vf Sand and Silt w/ little Crs Sand and f-Crs Gravel	
21	0	40 / 41	21 / 63 / 100	.9 / 1.45		.9 Gray Brown Till A/A	
22	0	42 / 43	31 / 100	.6 / .95		.6 Gray-Brown Till A/A, split-spoon refusal indicative of extremely dense, gravelly Till 100 count / .95'	Dense Till caused temporary auger refusal @ ≈ 43.0"
23	0	44 / 45	19 / 23 / 34 / 28	2.0 / 2.0		1.0 Gray-Brown Till w/ little vf Sand laminae .7 Lt Brown vf Sand w/ trace Silt .3 Lt Brown vf - f Sand	Saturated sands to 48.8'
24	0	46 / 47	3 / 9 / 13 / 18	2.0 / 2.0		2.0 Lt Brown fine Sand w/ occasional 2-3 mm red Clay clasts	

Sheet No. 3 of 4

MALCOLM PIRNIE

FIELD BOREHOLE LOG

CLIENT Columbus - McKinnon
PROJECT
LOCATION
CONTRACTOR
METHOD OF BORING: SOIL
ROCK

JOB NO. 1332-01-1

LOGGED BY JPH

CORE DIA.

BOREHOLE NO. CM-3-89
STARTED M 19
FINISHED M 19
ELEVATIONS: DATUM

SAMPLE NO.	HNu ppm TYPE	DEPTH	BLOWS "N"	RECOVERY %	MOISTURE TIN NO.	SAMPLE DESCRIPTION: Color, Texture Classification, Compactness/Consistency, Moisture Condition, Weathering/Fracturing, Inclusions, Odor, Etc.	NOTES: Boring, Testing and Sampling Procedures, Water Loss and Gain Drilling and Testing Equipment, Etc.
25	0	48	13	1.2/2.0		.8 Lt Brown fine SAND w/ 2-3mm Reddish clay clasts sharp contact w/	
			25				
		49	45			.4 Till Reddish-Gray Silt and vf SAND matrix w/ little fine Gravel	Red Till coloration grades to Gray color - Moist
			72				
26	0	50	32	1.0/2.0		1.0 Till Gray-brown vf SAND w/ some fine Gravel, very sandy Till matrix	Moist
			40				
		51	48				
			40				
27	0	52	4	1.1/1.2		.3 Till A/A, sharp contact w/	
			44			.8 Bedrock, Brown dolostone, minor indication of weathering, extensive fracturing along horizontal bedding component, no apparent vertical fractures, calcite as fracture fill, brittle	
		53	100				100 count / .2'
		54					

Sheet No. 4 of 4

MALCOLM PIRNIE

FIELD BOREHOLE LOG

CLIENT Columbus McKinnon
PROJECT Columbus McKinnon site
LOCATION Tonawanda, NY
CONTRACTOR
METHOD OF BORING: SOIL HNu calibrated 10/30 span 5.28, 10/31 span 5.87
ROCK NX core

JOB NO. 1332-01-1
LOGGED BY J.P. Hilton
CORE DIA. NX (10')

BOREHOLE NO. CM-4-89
STARTED 10 AM 10/30 19 89
FINISHED 11[30] AM 10/31 19 89
ELEVATIONS: DATUM

SAMPLE NO.	HNu ppm TYPE	DEPTH	BLOWS 'N'	RECOVERY %	MOISTURE TIN NO.	SAMPLE DESCRIPTION: Color, Texture Classification, Compactness/Consistency, Moisture Condition, Weathering/Fracturing, Inclusions, Odor, Etc.	NOTES: Boring, Testing and Sampling Procedures, Water Loss and Gain Drilling and Testing Equipment, Etc.
1	0	0 1	12 13 11 10	.2/2.0		.2 Fill Concrete, wood and plastic	Dry Fill to 2.6
2	0	2 3	2 2 1 1	1.3/2.0		.6 Fill Black slag, sand, concrete .7 Lt Brown Silt w/trace clay, rootlets	Dry Oxidized silts and Moist sands to 11.1
3	0	4 5	2 7 6 10	1.5/2.0		1.5 Lt. Brown Mottled Silt w/trace clay, vf sand, rootlets	Moist
4	0	6 7	3 4 5 3	2.0/2.0		2.0 Brown Silt A/A with little vf sand	Moist
5	0	8 9	3 4 4 5	2.0/2.0		2.0 Brown mottled vf sand w/trace silt and clay interbeds	Moist
6	0	10 11	3 2 2 3	2.0/2.0		1.1 Brown Mottled Sand A/A .9 Gray vf sand and silt, slight mottling	Saturated Gray, Saturated Silts and Sand to Red Till at 31.4'
7	0	12 13	2 1 2 2	.8/2.0		.8 Gray vf sand, trace silt, trace mottling	
8	0	14 15	WOH 2 3 3	1.8/2.0		1.8 Gray vf-fine sand w/lt Gray silt interbeds 5-7mm	

Sheet No. 1 of 5

MALCOLM PIRNIE

CLIENT Columbus McKinnon

PROJECT

LOCATION

CONTRACTOR

METHOD OF BORING: SOIL

ROCK

JOB NO. 1332-01-1

LOGGED BY JPH

CORE DIA.

FIELD BOREHOLE LOG

BOREHOLE NO. CM-4-89

STARTED ____ M ____ 19 ____

FINISHED ____ M ____ 19 ____

ELEVATIONS: DATUM

SAMPLE NO.	HNu ppm TYPE	DEPTH	BLOWS 'N'	RECOVERY %	MOISTURE TIN NO.	SAMPLE DESCRIPTION: Color, Texture Classification, Compactness/Consistency, Moisture Condition, Weathering/Fracturing, Inclusions, Odor, Etc.	NOTES: Boring, Testing and Sampling Procedures, Water Loss and Gain Drilling and Testing Equipment, Etc.
9	0	16 17	2 3 3 7	2.0/2.0		1.4 Gray vf-fine Sand .6 Sand A/A w/little Silt	Saturated
10	0	18 19	3 6 8 5	2.0/2.0		2.0 Gray vf-f Sand w/Silt interbeds and laminae 2-3 mm	
11	0	20 21	1 2 3 7	2.0/2.0		2.0 Gray Sand A/A w/trace Clay and Silt as interbeds <10 mm	
12	0	22 23	1 2 4 4	2.0/2.0		2.0 Sand A/A	
13	0	24 25	2 2 5 5	2.0/2.0		2.0 Gray vf-f Sand w/little Silt	
14	0	26 27	6 11 8 10	2.0/2.0		1.4 Lt Gray vf-f Sand w/interbedded Silt laminae .6 Dark Gray f-Medium Sand	
15	0	28 29	3 3 14 7	2.0/2.0		2.0 Gray f Sand w/trace Silt	
16	0	30 31	5 5 8 11	2.0/2.0		1.4 Gray Sand A/A sharp contact w/ .6 Till, Clayey w/trace silt and fine Gravel	Red, Moist Till to 42.0'

MALCOLM

CLIENT Columbus McKinnon

JOB NO. 1332-01-1

FIELD BOREHOLE LOG

PROJECT

LOCATION

BOREHOLE NO. CM-4-89

CONTRACTOR

LOGGED BY JPH

STARTED ____ M ____ 19 ____

METHOD OF BORING: SOIL

ROCK

FINISHED ____ M ____ 19 ____

CORE DIA.

ELEVATIONS: DATUM

SAMPLE NO.	HNu ppm TYPE	DEPTH	BLOWS 'N'	RECOVERY %	MOISTURE TIN NO.	SAMPLE DESCRIPTION: Color, Texture Classification, Compactness/Consistency, Moisture Condition, Weathering/Fracturing, Inclusions, Odor, Etc.	NOTES: Boring, Testing and Sampling Procedures, Water Loss and Gain Drilling and Testing Equipment, Etc.
17	0	32 33	6 12 15 19	.8/2.0		.8 Till Red, Silt w/trace Clay, Fine Gravel	Moist
18	0	34 35	9 17 18 24	1.4/2.0		1.4 Till Red Silt A/A	
19	0	36 37	14 27 30 41	1.2/2.0		1.2 Till Red Silt w/little vf Sand, f Gravel	
20	0	38 39	22 34 35 40	1.6/2.0		1.6 Till Red-Brown Silt w/little vf Sand, f-Crs Gravel	
21	0	40 41	16 20 30 32	1.6/2.0		1.6 Till A/A	
22	0	42 43	2 5 7 12	2.0/2.0		1.6 Clay Red w/Gray interbeds 5-10mm, soft very plastic, easily molded with finger pressure .4 Till Gray-Brown vf Sand w/Fine Gravel	Lacustrine Clay 42.0-43.6 Gray-Brown Till, Moist to 46.2
23	0	44 45	11 10 11 13	1.7/2.0		1.7 Till Brown-Gray vf-f Sand w/trace Silt, little Fine Gravel	
24	0	46 47	7 11 18 31	2.0/2.0		.2 Till very Sandy .8 Brown Gray vf-f Sand 1.0 Till Brown Silt w/trace vf Sand, Fine Gravel	Saturated Moist Till to weathered Bedrock at 54.9

Sheet No. 3 of 5

MALCOLM

FIELD BOREHOLE LOG

CLIENT Columbus McKinnon
PROJECT
LOCATION
CONTRACTOR
METHOD OF BORING: SOIL
ROCK

JOB NO. 1332-01-1
LOGGED BY JPH
CORE DIA. NX Core

BOREHOLE NO. CM-4-89
STARTED ____ M ____ 19 ____
FINISHED ____ M ____ 19 ____
ELEVATIONS: DATUM

SAMPLE NO.	HNu ppm TYPE	DEPTH	BLOWS 'N'	RECOVERY %	MOISTURE TIN NO.	SAMPLE DESCRIPTION: Color, Texture Classification, Compactness/Consistency, Moisture Condition, Weathering/Fracturing, Inclusions, Odor, Etc.	NOTES: Boring, Testing and Sampling Procedures, Water Loss and Gain Drilling and Testing Equipment, Etc.
25	0	48 49	12 43 52 48	1.4/2.0		1.4 Till Gray Silt w/trace vf Sand, clay, little fine Gravel	
26	0	50 51	21 27 59 77	1.5/2.0		1.5 Till Gray, very dense A/A	Moist - Dry
27	0	52 53	24 57 100	1.4/1.4		1.4 Till Gray A/A very - extremely dense	100 blows/.4'
28	0	54 55	34 17 100	1.1/1.3		.6 Till A/A .3 Till w/Med-Crs Sand .2 Weathered dolostone bedrock, extremely fractured w/gypsum filling	Saturated
						Augered to 55.2 started NX Core	started @ 10:30 stopped @ 11:30 cored 10.0' Recovered 8.0'
						55.2-55.7 Dark Gray shaley Dolostone unweathered, fractured and broken along horizontal planes	
						55.7-57.3 Dark Gray Dolostone, w/irregular bedding planes Minute Gypsum filled fractures w/Gypsum and shale clasts grading to	
						57.3-57.7 Very Dark Gray - Lt Tan Dolostone w/pronounced Gypsum laminae to 2mm in micritic dolostone	

Sheet No. 4 of 5

MALCOLM

CLIENT Columbus McKinnon

PROJECT

LOCATION

CONTRACTOR

METHOD OF BORING: SOIL

ROCK

JOB NO. 1332-01-1

LOGGED BY JPH

CORE DIA.

FIELD BOREHOLE LOG

BOREHOLE NO. CM-4-89

STARTED ____ M ____ 19 ____

FINISHED ____ M ____ 19 ____

ELEVATIONS: DATUM

SAMPLE NO.	TYPE	DEPTH	BLOWS 'N'	RECOVERY %	MOISTURE TIN NO.	SAMPLE DESCRIPTION: Color, Texture Classification, Compactness/Consistency, Moisture Condition, Weathering/Fracturing, Inclusions, Odor, Etc.	NOTES: Boring, Testing and Sampling Procedures, Water Loss and Gain Drilling and Testing Equipment, Etc.
						NX Core Continued	
						57.7-59.8 Brown-Gray Dolostone, coarsening upward sequence from silt and vf sand matrix at 60.7 to silty micritic dolostone at 58.6, Gypsum filled fractures and laminae throughout	
						59.8-60.3 Brown-Gray Dolostone, shaley	
						60.3-60.5 Gray-Brown Dolostone w/ irregular bedding, shale and Gypsum filled clasts	
						60.5-61.7 Gray to Dark Gray Dolostone, shaley, minor evidence of vertical to sub-vertical Gypsum filled fractures	
						61.7-63.2 Dark Brown-Gray Dolostone, shaley w/ numerous gypsum filled fractures in horizontal plane, minor vertical fractures	

Sheet No. 5 of 5

MALCOLM

FIELD BOREHOLE LOG

CLIENT: Columbus McKinnon
JOB NO. 1332-01-1
PROJECT: Columbus McKinnon site
LOCATION: Tonawanda, NY
BOREHOLE NO. CM-5-89
CONTRACTOR:
LOGGED BY: J.P. Hilton
STARTED: 9 AM 11/1 1989
METHOD OF BORING: SOIL: HNu span @5.7 / 56 ppm
FINISHED: 2:30 PM 11/1 1989
ROCK:
CORE DIA.:
ELEVATIONS: DATUM:

SAMPLE NO.	HNu ppm TYPE	DEPTH	BLOWS "N"	RECOVERY %	MOISTURE TIN NO.	SAMPLE DESCRIPTION: Color, Texture Classification, Compactness/Consistency, Moisture Condition, Weathering/Fracturing, Inclusions, Odor, Etc.	NOTES: Boring, Testing and Sampling Procedures, Water Loss and Gain, Drilling and Testing Equipment, Etc.
1	0	0	1	1.3/2.0		.3 Brown Silty organic topsoil	Moist
			3			1.0 Lt Brown-Orange vf Sand w/trace Silt	
		1	2				Moist oxidized Sand & Silt
			3				to 7.7
2	0	2	2	1.4/2.0		1.4 Brown-Orange mottled vf Sand w/trace Silt, rootlets	
			3				
		3	3				
			7				
3	0	4	4	1.5/2.0		1.5 vf Sand A/A	
			4				
		5	5				
			5				
4	0	6	2	1.7/2.0		1.0 Lt Brown vf Sand, trace Silt	
			2			.7 Dark Brown vf Sand, mottled	Wet - capillary fringe
		7	2				to 10.9
			2				
5	0	8	2	2.0/2.0		1.3 Orange brown mottled vf Sand, trace Silt	
			3			.7 Lt Gray-brown vf-f Sand, trace Silt	
		9	3				
			2				
6	0	10	1	2.0/2.0		.9 Gray-Brown Sand A/A	
			1			1.1 Gray Silt and vf Sand	Saturated
		11	1				
			2				
7	0	12	1	2.0/2.0		.4 Gray-brown Silt and vf Sand	Saturated conditions
			1			1.6 Gray-Dark Gray vf-f Sand w/silt laminae	in Sands & Silts to
		13	1			and interbeds	top of till *1
			2				
8	0	14	1	1.6/2.0		1.6 Gray vf Sand, little Silt as interbeds	
			1				
		15	2				
			3				

MALCOLM PIRNIE

FIELD BOREHOLE LOG

CLIENT Columbus McKinnon
JOB NO. 1332-01-1
PROJECT
LOCATION
BOREHOLE NO. CM-5-89
CONTRACTOR
LOGGED BY JPH
STARTED ____ M ____ 19 ____
METHOD OF BORING: SOIL
FINISHED ____ M ____ 19 ____
ROCK
CORE DIA.
ELEVATIONS: DATUM

SAMPLE NO.	HNu ppm TYPE	DEPTH	BLOWS 'N'	RECOVERY %	MOISTURE TIN NO.	SAMPLE DESCRIPTION: Color, Texture Classification, Compactness/Consistency, Moisture Condition, Weathering/Fracturing, Inclusions, Odor, Etc.	NOTES: Boring, Testing and Sampling Procedures, Water Loss and Gain Drilling and Testing Equipment, Etc.
9	0	16 17	WOH 2 2 1	2.0 / 2.0		2.0 Gray Silt and vf Sand w/ Silt laminae and interbeds	Saturated
10	0	18 19	3 2 3 7	2.0 / 2.0		2.0 Gray vf Sand w/ little Silt and Silt interbeds to .1'	
11	0	20 21	1 5 5 5	2.0 / 2.0		2.0 Gray vf Sand w/ Silt A/A	
12	0	22 23	2 3 3 5	2.0 / 2.0		2.0 Gray - Dark Gray Sand A/A	
13	0	24 25	4 3 6 6	2.0 / 2.0		2.0 Gray - Dark Gray f Sand w/ trace Silt as laminae to 3 mm	
14	0	26 27	2 1 4 8	2.0 / 2.0		1.8 Sand A/A .2 Very Dark Gray Fine Sand	
15	0	28 29	3 6 7 40	2.0 / 2.0		1.1 Sand A/A .9 Till Red Silt w/ Some Clay, trace fine Gravel	Moist
16	0	30 31	24 38 33 59	2.0 / 2.0		.5 Till Red-brown Silt w/ trace vf Sand, Clay, little fine Gravel .8 Till Red Silt w/ trace Clay, Gravel is absent .7 Till Red Silt w/ fine Gravel	Moist conditions to Saturated Gravel & Sand @ 37.1

Sheet No. 2 of 4

MALCOLM PIRNIE

FIELD BOREHOLE LOG

CLIENT Columbus McKinnon
PROJECT
LOCATION
CONTRACTOR
METHOD OF BORING: SOIL
ROCK

JOB NO. 1332-01-1
LOGGED BY JPH
CORE DIA.

BOREHOLE NO. CM-5-89
STARTED ____ M ____ 19 ____
FINISHED ____ M ____ 19 ____
ELEVATIONS: DATUM

SAMPLE NO.	HNu ppm TYPE	DEPTH	BLOWS 'N'	RECOVERY %	MOISTURE TIN NO.	SAMPLE DESCRIPTION: Color, Texture Classification, Compactness/Consistency, Moisture Condition, Weathering/Fracturing, Inclusions, Odor, Etc.	NOTES: Boring, Testing and Sampling Procedures, Water Loss and Gain Drilling and Testing Equipment, Etc.
17	0	32 33	8 20 23 28	1.3/2.0		1.3 Till Red-brown Silt w/ little f Gravel, trace vf Sand	Moist
18	0	34 35	19 31 23 22	1.4/2.0		1.2 Till Red-brown Silt w/ fine Gravel A/A .2 Clay Red-Gray Soft, good plasticity, molded w/ some finger pressure, pliable	Clay interbed found in CM-1, 2 4 4
19	0	36 37	3 11 25 20	2.0/2.0		* 1.1 Clay A/A sharp contact w/ ** .9 Gravel f-Crs rnd-subrnd, distinct sulfur odor, iron sulfide, no staining evident	Moist Saturated / Drained
20	0	38 39	6 13 17 15	1.6/2.0		.5 Gray f-Med Sand .4 Gray Crs rnded Sand w/ trace f Gravel .3 Gray f-Med Sand w/ small Till interbed .4 Gray Till vf Sand and fine Gravel	Saturated Sands to Next Till Moist
21	0	40 41	6 10 15 22	1.4/2.0		1.4 Till Gray-brown w/ little vf Sand, f Gravel	Moist continues to lower Sand @ 48.9
22	0	42 43	12 18 40 50	.4/2.0		.2 Crs Gravel .2 Till Gray Silt w/ little fine Gravel	
23	0	44 45	24 41 53 70	1.7/2.0		1.7 Till Gray-brown Silt w/ little vf Sand some fine Gravel	
24	0	46 47	16 55 50	1.5/2.0		1.5 Till Gray-brown vf Sand w/ little Silt some fine Gravel	

Sheet No. 3 of 4

MALCOLM PIRNIE

FIELD BOREHOLE LOG

CLIENT Columbus McKinnon
JOB NO. 1332-01-1
PROJECT
LOCATION
BOREHOLE NO. CM-5-89
CONTRACTOR
LOGGED BY JPH
STARTED ______ M ______ 19 ______
METHOD OF BORING: SOIL
FINISHED ______ M ______ 19 ______
ROCK
CORE DIA.
ELEVATIONS: DATUM

SAMPLE NO.	HNu ppm TYPE	DEPTH	BLOWS 'N'	RECOVERY %	MOISTURE TIN NO.	SAMPLE DESCRIPTION: Color, Texture Classification, Compactness/Consistency, Moisture Condition, Weathering/Fracturing, Inclusions, Odor, Etc.	NOTES: Boring, Testing and Sampling Procedures, Water Loss and Gain Drilling and Testing Equipment, Etc.
25	0	48	8	1.95/1.95		.9 Till Brown-Gray Silt w/some Clay, trace	
			47			vf-Crs Sand	
		49	28			1.05 Lt Brown vf-f Sand	Saturated
			100				100 blows/.45'
26	0	50	WOR	1.3/2.0		1.3 Till Silt and vf Sand w/trace to little	Moist
			15			fine Gravel	
		51	23				
			50				
27	0	52	16	1.6/2.0		.4 Lt Brown vf Sand w/some Silt	Saturated
			65			.6 Till Brown-Gray Silt and f Gravel	Moist
		53	53			.6 Bedrock Dark Gray to Lt tan weathered	
			75			dolostone, extremely fractured	
		54					

Sheet No. 4 of 4

MALCOLM PIRNIE

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APPENDIX B2

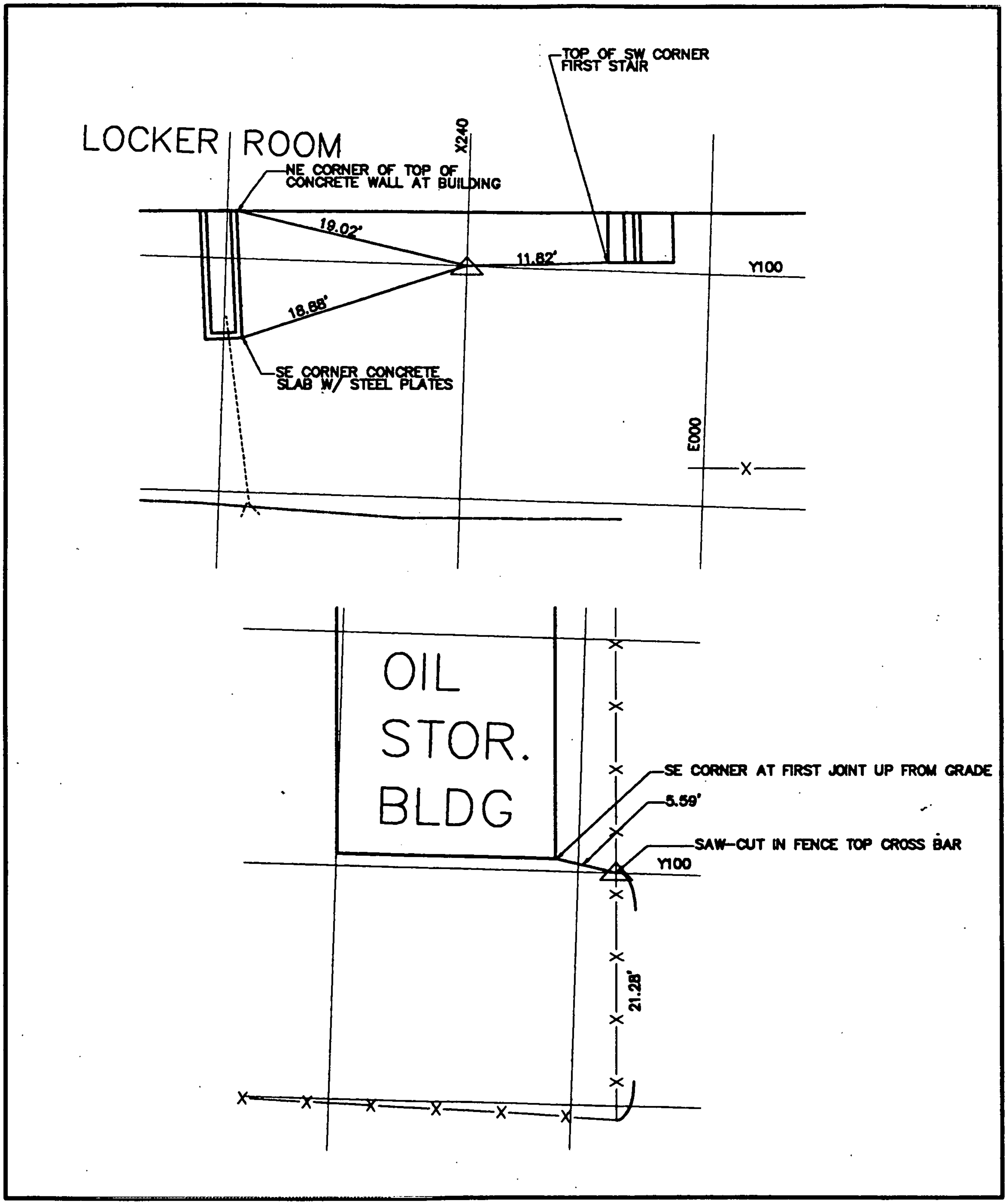
LOCATION OF HORIZONTAL GRID CONTROL POINTS

APPENDIX B2

Survey control was carried to site from USGA monument No. N55 (elevation 576.836 Ft. SL) located southside Sweeney Street at Oliver Street on the prolonged center of east face, north abutment of the NYCRR bridge over the Erie Canal. The bench mark established on site is 1st floor of facility building inside the double doors that open out to the concrete pad on the southeast corner of the building.

Horizontal control for this site was set up for field surveys and was based on an arbitrary coordinate system on X and Y coordinates, with no tie in to NYS coordinate system. The baseline for the sampling grid is shown on Figure B2-1

FIGURE 2-1



MALCOLM PIRNIE

COL-01-F21

LOCATION OF HORIZONTAL GRID CONTROL POINTS

COLUMBUS McKINNON CORPORATION DEC. 1990

MALCOLM PIRNIE

APPENDIX B3

SOIL SAMPLING BORING LOGS

BOREHOLE LOG SB90-1 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 4/10/90
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 569 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)

SB90-1 (0-2) Sample Submitted for Laboratory Analyses

x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	GRAPHIC LOG	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	'N'-VALUE (0–100)	COMMENTS
0–2	569–567	FILL Brown silty sand with cement fragments, damp.		1 SS	2 9 13 7	0.9	22		SB90-1 (0-2)
2–4	567–565	Brown silty sand with some angular gravel, damp. LACUSTRINE DEPOSITS Gray and brown (mottled) silty sand with some clay, damp.		2 SS	12 6 5 4	1.0	11		
4–6	565–563	Gray and brown (mottled) silty fine sand, moist.		3 SS	3 4 5 5	1.2	9		SB90-1 (4-6)
6–8	563–561	Gray silty fine sand, wet.		4 SS	WOH 2 1 1	1.6	3		SB90-1 (6-8) Saturated conditions at 6.2 ft.
8	561	BOREHOLE COMPLETED TO 8.0 FT. BGS.							

Depth scale (ft BGS) / Elevation (ft AMSL): 1–568, 2–567, 3–566, 4–565, 5–564, 6–563, 7–562, 8–561, 9–560, 10–559, 11–558, 12–557, 13–556, 14–555, 15–554

BOREHOLE LOG SB90-2 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 4/10/90
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 569 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)

SB90-2 (0-2) Sample Submitted for Laboratory Analyses

x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	GRAPHIC LOG	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	'N'-VALUE (0–100)	COMMENTS
0–2	569–567	FILL Brown silty sand with some angular gravel, damp.	Fill	1 SS	2 7 8 12	0.8	15	x	SB90-2 (0-2)
2–4	567–565	Brown silty sand with some angular gravel and brick, damp.	Fill	2 SS	5 4 3 2	0.1	7	x	
4–6	565–563	LACUSTRINE DEPOSITS Gray silty fine sand, moist.	Silty sand	3 SS	1 4 3 3	1.8	7	x	SB90-2 (4-6)
6–8	563–561	Gray silty fine sand, wet.	Silty sand	4 SS	1 2 1 1	1.4	3	x	SB90-2 (6-8) Saturated at 6.2 ft.
8	561	BOREHOLE COMPLETED TO 8.0 FT. BGS.							

Depth scale: 1–568, 2–567, 3–566, 4–565, 5–564, 6–563, 7–562, 8–561, 9–560, 10–559, 11–558, 12–557, 13–556, 14–555, 15–554

MALCOLM PIRNIE, INC.

BOREHOLE LOG SB90-3 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 4/10/90
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 569 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)

SB90-3 (0-2) Sample Submitted for Laboratory Analyses

x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	GRAPHIC LOG	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	'N'-VALUE (0–100)	COMMENTS
0–1	569–568	FILL Brown silty sand with some angular gravel, damp.							
1–2	568–567	Brown sandy silt, damp.		1 SS	2 4 3 11	1.5	72	x	
2–4	567–565	Cement fragments, damp. Brown sandy silt, moist. Dark brown silt with angular gravel, damp.		2 SS	9 5 5 6	0.5	10	x	
4–6	565–563	LACUSTRINE DEPOSITS Gray and brown (mottled) silty sand with clay, moist. Gray silty sand, very moist.		3 SS	3 6 7 10	1.4	13	x	SB90-3 (4-6)
6–8	563–561	Gray silty sand, wet.		4 SS	1 2 1 1	1.5	3	x	SB90-3 (6-8) Saturated at 6.2 ft.
8	561	BOREHOLE COMPLETED TO 8.0 FT. BGS.							
9	560								
10	559								
11	558								
12	557								
13	556								
14	555								
15	554								

MALCOLM PIRNIE, INC.

BOREHOLE LOG SB90-4 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 4/10/90
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 569 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)

SB90-4 (0-2) Sample Submitted for Laboratory Analyses

x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	GRAPHIC LOG	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	'N'-VALUE (0–100)	COMMENTS
		FILL Cement and angular gravel, damp.							SB90-4 (0-2)
1	568	Dark brown sand with angular gravel, damp		1 SS	3 6 8 7	1.0	14	x	
2	567	Dark brown sand with angular gravel, damp							
3	566	Reddish brown silt with roots, damp		2 SS	6 5 8 8	0.7	13	x	
4	565	Reddish brown silt with roots.							
		LACUSTRINE DEPOSITS							SB90-4 (4-6)
5	564	Gray and brown (mottled) silty sand with clay, very moist.		3 SS	WOR 2 3 8	1.7	5	x	
6	563	Gray silty fine sand, wet.							SB90-4 (6-8)
7	562			4 SS	WOH 3 3 2	1.8	6	x	Saturated at 6.2 ft.
8	561	BOREHOLE COMPLETED TO 8.0 FT. BGS.							
9	560								
10	559								
11	558								
12	557								
13	556								
14	555								
15	554								

BOREHOLE LOG SB90-5 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 4/10/90
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 572 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)

SB90-5 (0-2) Sample Submitted for Laboratory Analyses

x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	GRAPHIC LOG	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	COMMENTS
0–1	572–571	FILL Dark brown silt with angular gravel, damp. Yellowish brown silty fine sand, damp.	Fill	1 SS	1 2 1 5	0.8	3	SB90-5 (0-2)
2	570	Yellowish brown silty fine sand, damp.	Fill					
3	569	LACUSTRINE DEPOSITS Light brown silty fine sand, damp.	Lacustrine	2 SS	8 10 5 6	0.8	15	
4	568	Brown and gray (mottled) silty fine sand, damp.	Lacustrine					SB90-5 (4-6)
5	567	Gray silty fine sand, very moist.	Lacustrine	3 SS	3 3 4 6	1.8	7	
6	566	Gray silty sand, very moist. Gray sandy silt, wet.	Lacustrine					SB90-5 (6-8)
7	565		Lacustrine	4 SS	3 3 2 1	1.8	5	Saturated conditions at 6.5 ft.
8	564	BOREHOLE COMPLETED TO 8.0 FT. BGS.						
9	563							
10	562							
11	561							
12	560							
13	559							
14	558							
15	557							

'N'-VALUE scale: 0 – 100

BOREHOLE LOG SB90-6 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 4/11/90
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 569 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)

SB90-5 (0-2) Sample Submitted for Laboratory Analyses

x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	GRAPHIC LOG	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	'N'-VALUE (0–100)	COMMENTS
0–1	569–568	FILL Dark brown silt with some sand and angular gravel, damp. Brown coarse sand with angular gravel, moist.	Fill	1 SS	5 7 4 9	1.0	11	x	SB90-6 (0-2)
2–3	567–566	Brown sand with angular gravel and brick fragments, moist.	Fill	2 SS	4 6 4 1	0.4	10	x	
4–6	565–563	Wood LACUSTRINE DEPOSITS Dark brown silt with some fine sand, wet.	Fill / Silt	3 SS	1 2 2 44	0.8	4	x	SB90-6 (4-6) Saturated conditions at 5.0 ft.
6	563	BOREHOLE COMPLETED TO 6.0 FT. BGS.							
7	562								
8	561								
9	560								
10	559								
11	558								
12	557								
13	556								
14	555								
15	554								

BOREHOLE LOG SB90-7 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 4/11/90
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 571 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

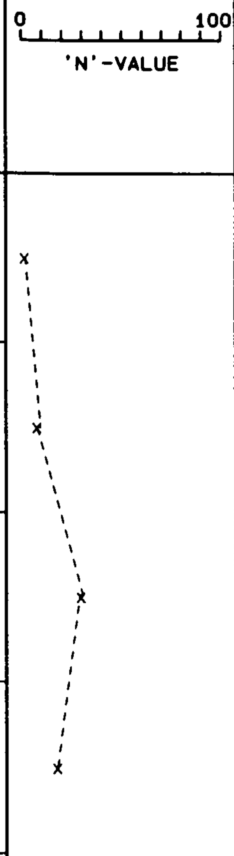
HS Total VOC Detected in the Sample Jar Head Space (ppm)

SB90-7 (0-2) Sample Submitted for Laboratory Analyses

x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	COMMENTS
0–2	571–569	FILL Reddish brown sandy silt with angular gravel, moist. LACUSTRINE DEPOSITS Brown and dark brown silty sand, damp.	1 SS	1 1 1 2	1.0	2	SB90-1 (0-2)
2–4	569–567		2 SS	3 1 7 4	0.9	8	
4–6	567–565	Wood	3 SS	42 15 15 11	NR	30	
6–8	565–563	Gray fine silt, wet.	4 SS	3 3 15 5	0.2	18	SB90-1 (6-8) Saturated at 6.5 ft.
8	563	BOREHOLE COMPLETED TO 8.0 FT. BGS.					

Depth scale: 1–570, 2–569, 3–568, 4–567, 5–566, 6–565, 7–564, 8–563, 9–562, 10–561, 11–560, 12–559, 13–558, 14–557, 15–556



BOREHOLE LOG SB90-8 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 4/11/90
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 569 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)

SB90-8 (4-6) Sample Submitted for Laboratory Analyses

x---x Penetration Resistance.('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	GRAPHIC LOG	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	'N'-VALUE (0–100)	COMMENTS
0–1	569–568	FILL Brown silty sand with gravel, wet. Light brown sand with angular gravel, damp.		1 SS	5 8 7 13	0.9	15	x	
2–3	567–566	Brown sand with angular gravel, moist.		2 SS	5 5 8 9	0.3	13	x	
4–6	565–563	Dark brown sandy silt with some cobbles, wet.		3 SS	7 2 3 2	1.0	5	x	SB90-8 (4-6) Saturated at 5 ft.
6	563	BOREHOLE COMPLETED TO 6.0 FT. BGS.							
7	562								
8	561								
9	560								
10	559								
11	558								
12	557								
13	556								
14	555								
15	554								

BOREHOLE LOG SB90-9 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 4/11/90
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 571 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)

SB90-9 (4-6) Sample Submitted for Laboratory Analyses

x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	GRAPHIC LOG	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	'N'-VALUE (0–100)	COMMENTS
0–2	571–569	FILL Dark brown sandy silt, very moist. Brown coarse sand with gravel, damp. Dark brown sand with gravel, moist.		1 SS	3 4 7 1	0.8	11	x	
2–4	569–567	LACUSTRINE DEPOSITS Light brown silty sand with some clay, moist. Gray and brown (mottled) silty fine sand, moist.		2 SS	2 1 3 2	1.4	4	x	SB90-9 (4-6)
4–6	567–565			3 SS	2 2 2 2	1.9	4	x	
6–8	565–563	Gray silty fine sand, wet.		4 SS	2 2 3 2	1.7	5	x	Saturated at 6.2 ft.
8	563	BOREHOLE COMPLETED TO 8.0 FT. BGS.							

Depth scale: 1–570, 2–569, 3–568, 4–567, 5–566, 6–565, 7–564, 8–563, 9–562, 10–561, 11–560, 12–559, 13–558, 14–557, 15–556

BOREHOLE LOG SB90-10 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 4/11/90
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 569 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)

SB90-10 (0-2) Sample Submitted for Laboratory Analyses

x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	GRAPHIC LOG	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	COMMENTS
0–2	569–567	FILL Dark brown silt with some sand, very moist. (1) Coarse gravel with some brown coarse sand, damp. (2) Brown coarse sand with some gravel, damp.		1 SS	4 8 7 12	0.8	15	SB90-10 (0-2)
2–4	567–565			2 SS	5 3 10 24	0.5	13	
4–6	565–563	(4) Brown coarse sand with some gravel, wet.		3 SS	1 3 12 3	0.3	15	
6–8	563–561	LACUSTRINE DEPOSITS Black silt, oil-like sheen, odor, wet.		4 SS	WOH 5 1 1	1.0	6	SB90-10 (6-8) HS=2.0
8–10	561–559	(8) Black silt, oil-like sheen, odor, wet.		5 SS	WOH WOH 1 3	1.5	1	HS=2.5
10–12	559–557	(10) Dark gray fine sand with some clay, wet. (11) Light gray silty fine sand, wet.		6 SS	1 WOH 1 1	1.9	1	HS=2.0
12–14	557–555	(12) Gray silty fine sand, wet. Light gray silty fine sand, wet.		7 SS	WOR WOR WOR WOR	1.95	0	SB90-10 (12-14) Saturated at 4.5 ft.
14–15	555–554	BOREHOLE COMPLETED TO 14.0 FT. BGS.						

BOREHOLE LOG SB90-11 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 4/11/90
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 571.5 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)

SB90-11 (0-2) Sample Submitted for Laboratory Analyses

x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	GRAPHIC LOG	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	'N'-VALUE (0–100)	COMMENTS
		FILL Dark brown silt with clay and sand, wet.							SB90-11 (0-2)
1	570.5	Gravel, damp.		1 SS	3 10 5 5	0.6	15	x	
2	569.5	Brown coarse sand with gravel and some brick fragments, moist.							
3	568.5			2 SS	WOH 8 6 6	0.5	14	x	
4	567.5	Brown coarse sand with brick fragments, wet.							SB90-10 (4-6)
5	566.5			3 SS	WOH 4 2 8	0.4	6	x	Saturated at 5.0 ft.
6	565.5	BOREHOLE COMPLETED TO 6.0 FT. BGS.							
7	564.5								
8	563.5								
9	562.5								
10	561.5								
11	560.5								
12	559.5								
13	558.5								
14	557.5								
15	556.5								

BOREHOLE LOG SB90-12 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 4/12/90
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 570 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)

SB90-12 (0-2) Sample Submitted for Laboratory Analyses

x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	GRAPHIC LOG	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	'N'-VALUE (0–100)	COMMENTS
0–2	570–568	FILL Brown coarse sand with some gravel, damp.		1 SS	4 8 8 8	0.3	16	x	SB90-12 (0-2)
2–4	568–566	Brown coarse sand with some silt and some gravel, moist.		2 SS	3 2 2 1	0.4	4	x	
4–6	566–564	Brown coarse sand with some gravel, wet.		3 SS	5 4 3 2	0.3	7	x	SB90-12 (4-6)
6–8	564–562	Brown coarse sand with some gravel, wet.		4 SS	2 2 2 2	0.3	4	x	Saturated at 5.0 ft.
8	562	BOREHOLE COMPLETED TO 8.0 FT. BGS.							

Depth scale: 1–569, 2–568, 3–567, 4–566, 5–565, 6–564, 7–563, 8–562, 9–561, 10–560, 11–559, 12–558, 13–557, 14–556, 15–555

BOREHOLE LOG SB90-13 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 4/12/90
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 572 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)

SB90-13 (0-2) Sample Submitted for Laboratory Analyses

x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	GRAPHIC LOG	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	'N'-VALUE (0–100)	COMMENTS
0–2	572–570	FILL Dark brown sand with some coarse sand and gravel and wood and brick fragments, damp.		1 SS	4 26 11 6	0.7	37	x	SB90-13 (0-2)
2–4	570–568	Dark brown silt with sand, damp. Light brown coarse sand with gravel, dry.		2 SS	13 1 4 3	0.6	5	x	
4–6	568–566	Brown coarse sand with gravel, odor, sheen, wet.		3 SS	5 4 13 10	0.5	17	x	SB90-13 (4-6) HS=2.5 Saturated at 5.5 ft.
6–8	566–564	Brown coarse sand with some gravel, some white matter, wet.		4 SS	WOH 7 2 29	0.5	9	x	
8–10	564–562	LACUSTRINE DEPOSITS Gray fine sand, wet. Black silt, very moist.		5 SS		1.0			SB90-13 (8-10) Black silt
10	562	BOREHOLE COMPLETED TO 10.0 FT. BGS.							

Depth scale: 1–15 ft BGS; elevation scale: 571–557 ft AMSL.

MALCOLM PIRNIE, INC.

BOREHOLE LOG SB90-14 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 4/12/90
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 570 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)

SB90-14 (4-6) Sample Submitted for Laboratory Analyses

x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	GRAPHIC LOG	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	COMMENTS
0–2	570–568	FILL Dark brown sand with some gravel, damp. Gravel, damp. Reddish sand with some gravel, moist.		1 SS	2 8 3 4	0.7	11	
2–4	568–566	Brown coarse sand with some angular and subangular gravel, moist.		2 SS	2 2 3 2	0.25	5	
4–6	566–564	Brown coarse sand with angular gravel, wet.		3 SS	WOH 2 17 4	0.5	19	SB90-14 (4-6) Saturated at 5.0 ft.
6–8	564–562	Brown coarse sand with angular gravel, sheen, wet.		4 SS	2 2 1 WOH	0.3	3	
8–10	562–560	Brown coarse sand with angular gravel, wet. LACUSTRINE DEPOSITS Dark gray silt with some fine sand and some clay.		5 SS	1 1 2 2	1.3	3	SB90-14 (8-10) Dark grey silt
10–12	560–558	Grayish brown silt with some clay and sand grading to Grayish brown silty fine sand, sheen, wet.		6 SS	1 1 2 1	1.7	3	
12–14	558–556	Gray silty fine sand with some clay, wet.		7 SS	WOR WOR WOR 2	1.0	0	
14–16	556–554	Gray med.-coarse sand, wet.		8 SS	WOR WOR WOR WOR	0.3	0	SB90-14 (14-16) Running sand
16	554	BOREHOLE COMPLETED TO 16.0 FT. BGS.						

BOREHOLE LOG SB90-15 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 4/12/90
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 572 ft.AMSL

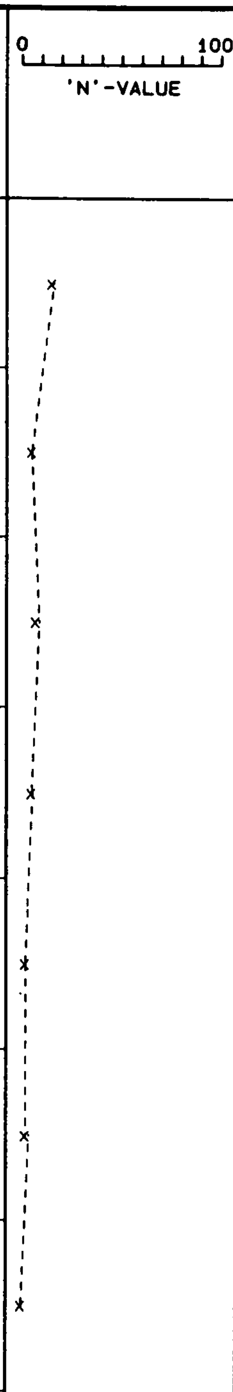
SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)
SB90-15 (4-6) Sample Submitted for Laboratory Analyses

DUST Total Dust Detected in the Work Zone (mg/m3)
x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	GRAPHIC LOG	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	COMMENTS
0–2	572–570 (1 – 571)	FILL Brown silt, wet. Brown coarse sand with angular gravel, damp. Reddish brown sand with gravel, damp.		1 SS	6 7 8 14	0.9	15	
2–4	570–568 (3 – 569)			2 SS	1 4 1 3	NR	5	No Sample Recovery
4–6	568–566 (5 – 567)	Brown sand and gravel, sheen, wet. Brown sand and gravel, wet.		3 SS	2 3 4 4	0.3	7	SB90-15 (4-6) Saturated at 5.0 ft.
6–8	566–564 (7 – 565)	LACUSTRINE DEPOSITS Black silt with some clay, odor, moist.		4 SS	7 1 4 6	0.4	5	HS=2.0
8–10	564–562 (9 – 563)	Black silty fine sand, odor, moist.		5 SS	1 1 1 3	1.4	2	SB90-15 (8-10)
10–12	562–560 (11 – 561)	Black silty fine sand, moist, grading to Gray clayey silt with trace fine sand, wet.		6 SS	WOH 1 1 2	1.9	2	
12–14	560–558 (13 – 559)	Gray fine sand, wet. Gray silt with fine sand, wet.		7 SS	WOR WOR WOR 1	1.9	0	SB90-15 (12-14) DUST=0.01 Blind Duplicate: SB90-15 (20-22)
14–15	558–557	BOREHOLE COMPLETED TO 14.0 FT. BGS.						



MALCOLM PIRNIE, INC.

BOREHOLE LOG SB90-16 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 4/13/90
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 573.5 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)

SB90-16 (4-6) Sample Submitted for Laboratory Analyses

DUST Total Dust Detected in the Work Zone (mg/m3)

x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	GRAPHIC LOG	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	0 100 'N'-VALUE	COMMENTS
1	572.5	FILL Brown sand with some silt and some gravel, damp.	▨	1 SS	1 1 2 2	0.8	3	x	
2	571.5								
3	570.5	LACUSTRINE DEPOSITS Dark brown silty sand, damp. Light brown sand with some silt, damp.		2 SS	1 1 2 3	1.7	3	x	
4	569.5	Light brown clayey silt with some fine sand, damp.							SB90-16 (4-6) HS=2.5
5	568.5	Light brown sandy silt, moist.		3 SS	2 3 5 5	1.6	8	x	
6	567.5	Gray and brown (mottled) sandy silt with clay, moist.							SB90-16 (6-8) HS=0.5
7	566.5	Gray and brown silty sand, wet.		4 SS	1 1 1 4	1.8	2	x	Saturated at 7.0 ft.
8	565.5	BOREHOLE COMPLETED TO 8.0 FT. BGS.							
9	564.5								
10	563.5								
11	562.5								
12	561.5								
13	560.5								
14	559.5								
15	558.5								

BOREHOLE LOG SB90-17 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 4/13/90
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 574.5 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)

SB90-17 (4-6) Sample Submitted for Laboratory Analyses

DUST Total Dust Detected in the Work Zone (mg/m3)

x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	GRAPHIC LOG	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	0 100 'N'-VALUE	COMMENTS
		FILL Brown silty sand, damp.							
1	573.5	LACUSTRINE DEPOSITS Light brown silty fine sand with clay, damp.		1 SS	1 1 1 1	1.3	2	x	
2	572.5	Brown and reddish brown (mottled) silty fine sand, moist.							
3	571.5	Brown and reddish brown (mottled) clayey silt with some fine sand, damp.		2 SS	1 1 3 8	1.4	4	x	
4	570.5	Brown and reddish brown (mottled) clayey silt with some fine sand, damp.							SB90-17 (4-6) Blind Duplicate: SB90-17 (20-22)
5	569.5			3 SS	2 5 5 7	1.5	10	x	
6	568.5	Reddish brown and gray (mottled) silty fine sand, wet.							SB90-17 (6-8)
7	567.5			4 SS	2 3 1 2	1.5	4	x	Saturated at 7.6 ft.
8	566.5	BOREHOLE COMPLETED TO 8.0 FT. BGS.							
9	565.5								
10	564.5								
11	563.5								
12	562.5								
13	561.5								
14	560.5								
15	559.5								

BOREHOLE LOG SB90-18 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 4/13/90
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 574 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NA No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)
SB90-18 (4-6) Sample Submitted for Laboratory Analyses

DUST Total Dust Detected in the Work Zone (mg/m3)
x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	COMMENTS
0–0.8	574	FILL Brown sandy silt, damp.					
0.8–2	573	LACUSTRINE DEPOSITS Light brown silty fine sand, damp.	1 SS	1 1 1 2	0.8	2	
2–4	572–571	Brown and gray (mottled) silty fine sand, moist. Light brown clayey silt, damp.	2 SS	WOH 1 7 10	1.6	8	
4–6	570–569	Brown and grey (mottled) silty fine sand with clay, damp. Brown and gray (mottled) sand, moist.	3 SS	2 2 4 5	1.8	6	SB90-18 (4-6)
6–8	568–567	Reddish brown and gray (mottled) fine silty sand with lenses of clay, wet.	4 SS	1 2 1 1	1.7	3	SB90-18 (6-8) Saturated at 7.5 ft.
8	566	BOREHOLE COMPLETED TO 8.0 FT. BGS.					

'N'-VALUE scale: 0 to 100

Depth scale: 1–573, 2–572, 3–571, 4–570, 5–569, 6–568, 7–567, 8–566, 9–565, 10–564, 11–563, 12–562, 13–561, 14–560, 15–559

BOREHOLE LOG SB90-19 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 4/13/90
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 573.2 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)

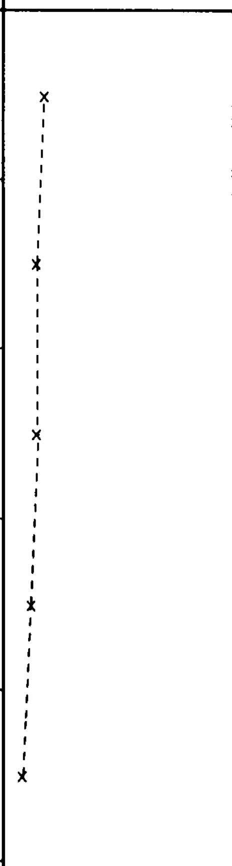
SB90-19 (4-6) Sample Submitted for Laboratory Analyses

DUST Total Dust Detected in the Work Zone (mg/m3)

x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	GRAPHIC LOG	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	'N'-VALUE (0–100)	COMMENTS
0–2	573.2–571.2	FILL Dark brown silty coarse sand, damp.		1 SS	3 10 3 4	0.6	2		
2–4	571.2–569.2	LACUSTRINE DEPOSITS Brown and gray (mottled) silty fine sand, moist. Brown and gray (mottled) clayey silt, damp. Brown and gray (mottled) silty sand, damp.		2 SS	1 2 7 8	1.3	8		
4–6	569.2–567.2	Reddish brown and gray (mottled) clayey silt with fine sand, damp. Reddish brown and gray (mottled) silty fine sand, moist.		3 SS	3 4 5 5	1.4	6		SB90-19 (4-6)
6–8	567.2–565.2	Reddish brown and gray (mottled) silty sand, moist. Reddish brown and gray clayey silt, moist. Reddish brown silty fine sand, wet.		4 SS	1 2 4 3	1.5	3		
8–10	565.2–563.2	Reddish brown silty fine sand, wet.		5 SS	3 1 1 2	2.0	2		SB90-19 (8-10) Saturated at 8.0 ft. DUST=0.01
10	563.2	BOREHOLE COMPLETED TO 10.0 FT. B.G.S.							

Depth scale: 1 – 572.2; 2 – 571.2; 3 – 570.2; 4 – 569.2; 5 – 568.2; 6 – 567.2; 7 – 566.2; 8 – 565.2; 9 – 564.2; 10 – 563.2; 11 – 562.2; 12 – 561.2; 13 – 560.2; 14 – 559.2; 15 – 558.2



BOREHOLE LOG SB90-20 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 4/16/90
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 571.8 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)

SB90-20 (6-8) Sample Submitted for Laboratory Analyses

DUST Total Dust Detected in the Work Zone (mg/m3)

x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	COMMENTS
0–2	571.8–569.8	FILL Reddish brown sandy silt with some gravel and wood, damp. Black and gray cinder and sand, some gravel, damp.	1 SS	6 3 11 3	1.2	14	
2–4	569.8–567.8	Brown coarse sand with some gravel and wood, damp.	2 SS	3 2 1 2	0.8	3	
4–6	567.8–565.8		3 SS	1 1 1 1	NR	2	
6–8	565.8–563.8	LACUSTRINE DEPOSITS Reddish brown silty sand and gravel, oily sheen, odor, wet.	4 SS	1 WOH 3 2	0.8	3	SB90-20 (6-8) Saturated at 6 ft.
8–10	563.8–561.8	Gray silty fine sand, sheen, wet. Gray clayey silt, sheen, wet.	5 SS	1 1 1 2	1.5	2	
10–12	561.8–559.8	Gray clayey silt, (sheen present at 10.0-10.3 ft.), wet.	6 SS	WOH 1 1 1	1.7	2	SB90-20 (10-12)
12–14	559.8–557.8	Light gray silty fine sand, wet.	7 SS	WOH 1 WOH 1	1.1	1	SB90-20 (12-14)
14–15	557.8–556.8	BOREHOLE COMPLETED TO 14.0 FT. B.G.S.					

MALCOLM PIRNIE, INC.

BOREHOLE LOG SB90-21 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 4/16/90
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 570.2 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)
SB90-21 (6-8) Sample Submitted for Laboratory Analyses

DUST Total Dust Detected in the Work Zone (mg/m3)
x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	COMMENTS
		FILL Brown sand and gravel, damp.					
1	569.2		1 SS	3 3 1 4	0.7	4	
2	568.2	Reddish brown coarse sand and gravel, damp.					
3	567.2		2 SS	6 8 2 2	0.6	10	
4	566.2						No Sample Recovery
5	565.2		3 SS	2 1 3 2	NR	4	
6	564.2	Brown coarse sand with some gravel, sheen, wet.					SB90-21 (6-8) Saturated at 7 ft.
7	563.2		4 SS	18 85 57 9	0.5	142	
8	562.2	LACUSTRINE DEPOSITS Black silt with some clay and some fine sand, sheen, wet.					
9	561.2		5 SS	1 2 1 1	1.1	3	
10	560.2	Gray silty sand, sheen, wet. Gray clayey silt, wet.					HS=2
11	559.2		6 SS	1 2 1 1	2.0	3	
12	558.2	Gray silt with some clay, some fine sand, wet.					
13	557.2		7 SS	WOH 1 1 1	1.8	2	
14	556.2	Gray and brown fine silt, runny, wet. Gray and brown fine sand with silt and clay, wet.					SB90-21 (14-16)
15	555.2		8 SS	WOH 1 1 2	1.9	2	
16	554.2	BOREHOLE COMPLETED TO 16.0 FT. B.G.S.					
17	553.2						

MALCOLM PIRNIE, INC.

BOREHOLE LOG SB90-22 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 4/16/90
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 572 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)

SB90-22 (6-8) Sample Submitted for Laboratory Analyses

DUST Total Dust Detected in the Work Zone (mg/m3)

x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	GRAPHIC LOG	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	'N'-VALUE (0–100)	COMMENTS
0–2	572–570	FILL Reddish brown coarse sand with some gravel, damp.		1 SS	2 2 5 7	1.1	7	x	SB90-22 (0-2)
2–4	570–568	Brown coarse sand with some gravel, damp.		2 SS	17 7 5 2	0.3	12	x	
4–6	568–566			3 SS	1 2 2 2	NR	4	x	No Sample Recovery
6–8	566–564	Brown silty sand with some gravel, wet. LACUSTRINE DEPOSITS Black silt, odor, wet.		4 SS	WOH 2 1 2	0.3	3	x	SB90-22 (6-8) Saturated at 7 ft.
8–10	564–562	Gray silty fine sand, wet.		5 SS	3 2 1 2	1.4	3	x	
10–12	562–560	Gray clayey silt, wet.		5 SS	WOH WOH WOH 1	1.3	0	x	SB90-22 (10-12)
12–15	560–557	BOREHOLE COMPLETED TO 12.0 FT. BGS.							

BOREHOLE LOG SB90-23 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 4/16/90
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 572.7 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery
HS Total VOC Detected in the Sample Jar Head Space (ppm)
SB90-23 (4-6) Sample Submitted for Laboratory Analyses
DUST Total Dust Detected in the Work Zone (mg/m3)
x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	GRAPHIC LOG	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	'N'-VALUE (0–100)	COMMENTS
0–2		FILL Brown silty coarse sand, dry.		1 SS	5 4 2 2	0.3	6	x	HS=0.5
1	571.7								
2	570.7	LACUSTRINE DEPOSITS Light brown clayey silt, damp.		2 SS	1 2 3 4	0.8	5	x	
3	569.7								
4	568.7	Reddish brown and brown clayey silt with some fine sand, damp.		3 SS	3 4 3 4	1.9	7	x	SB90-23 (4-6) HS=1.5
5	567.7								
6	566.7	Reddish brown and brown silty fine sand, damp.		4 SS	1 2 3 1	1.8	5	x	
7	565.7								
8	564.7	Reddish brown silty sand, moist.		5 SS	2 2 3 1	1.9	5	x	
9	563.7	Reddish brown clayey silt, moist. Gray silty fine sand, moist.							
10	562.7	Gray silty fine sand grading to-		6 SS	1 1 2 2	1.4	3	x	SB90-23 (10-12) Saturated at 10 ft.
11	561.7	Gray silty sand, damp.							
12	560.7	BOREHOLE COMPLETED TO 12.0 FT. B.G.S.							
13	559.7								
14	558.7								
15	557.7								

BOREHOLE LOG SB90-24 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 4/16/90
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 573.6 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)

SB90-24 (4-6) Sample Submitted for Laboratory Analyses

DUST Total Dust Detected in the Work Zone (mg/m3)

x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	GRAPHIC LOG	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	'N'-VALUE (0–100)	COMMENTS
		FILL Dark brown sandy silt, damp.							
1	572.6	LACUSTRINE DEPOSITS Reddish brown silty fine sand with some clay, damp.		1 SS	1 1 1 2	0.9	2		
2	571.6	Reddish brown silty sand, damp.							HS=1.0
3	570.6	Reddish brown and gray (mottled) silty clay, damp.		2 SS	1 2 8 10	1.6	10		
4	569.6	Reddish brown and gray (mottled) silty clay with some fine sand, damp.							SB90-24 (4-6)
5	568.6			3 SS	3 4 5 4	1.9	9		
6	567.6	Brown silty fine sand, very moist.							
7	566.6			4 SS	1 2 3 2	2.0	5		
8	565.6	Reddish brown and brown (mottled) silty fine sand, moist.							
9	564.6			5 SS	2 2 3 2	1.6	5		
10	563.6	Reddish brown and brown (mottled) silty fine sand, moist.							SB90-24 (10-12) Saturated at 12 ft. DUST=0.01
11	562.6	Gray silty fine sand with some clay, wet.		6 SS	1 2 1 2	1.8	3		
12	561.6	BOREHOLE COMPLETED TO 12.0 FT. B.G.S.							
13	560.6								
14	559.6								
15	558.6								

BOREHOLE LOG SB90-25 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 4/17/90
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 574.1 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)

SB90-38 (4-6) Sample Submitted for Laboratory Analyses

DUST Total Dust Detected in the Work Zone (mg/m3)

x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	GRAPHIC LOG	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	'N'-VALUE (0–100)	COMMENTS
		FILL Brown silt with some clay and fine sand, dry.							SB90-25 (0-2)
1	573.1			1 SS	1 3 2 3	1.1	5	x	
2	572.1	LACUSTRINE DEPOSITS Brown sandy silt, damp.							
3	571.1	Brown clayey silt, damp.		2 SS	2 2 10 10	1.3	12	x	
4	570.1	Reddish brown and brown (mottled) clayey silt, damp.							SB90-25 (4-6)
5	569.1			3 SS	3 3 4 3	1.9	7	x	
		Reddish brown and brown (mottled) silt with fine sand, moist.							
6	568.1	Brown and gray (mottled) clayey silt, damp Brown and gray (mottled) silty sand, moist.							
7	567.1			4 SS	2 1 4 3	1.7	5	x	
8	566.1	Reddish brown and gray (mottled) silty sand with some clay, wet.							SB90-25 (8-10) Saturated at 9 ft.
9	565.1			5 SS	1 3 2 3	1.4	5	x	
10	564.1	BOREHOLE COMPLETED TO 10.0 FT. B.G.S.							
11	563.1								
12	562.1								
13	561.1								
14	560.1								
15	559.1								

BOREHOLE LOG SB90-26 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 4/17/90
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 572.8 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)

SB90-26 (4-6) Sample Submitted for Laboratory Analyses

DUST Total Dust Detected in the Work Zone (mg/m3)

x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	GRAPHIC LOG	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	COMMENTS
0–2 (1: 571.8)	572.8–570.8	FILL Brown coarse sand with some gravel, damp. Brown coarse sand with some gravel, damp.		1 SS	2 5 4 3	1.1	9	SB90-26 (0-2)
2–4 (3: 569.8)	570.8–568.8	LACUSTRINE DEPOSITS Reddish brown and brown (mottled) clayey silt with some sand, damp.		2 SS	1 2 3 4	1.2	5	
4–6 (5: 567.8)	568.8–566.8	Reddish brown gray silty fine sand with clay; staining, odor, moist.		3 SS	2 3 2 3	1.7	5	SB90-26 (4-6) HS=20
6–8 (7: 565.8)	566.8–564.8	Gray and brown clayey silt, moist. Gray silty sand, moist.		4 SS	2 2 4 2	1.9	6	
8–10 (9: 563.8)	564.8–562.8	Gray and brown (mottled) silty sand, very moist.		5 SS	2 2 5 4	1.1	7	
10–12 (11: 561.8)	562.8–560.8	Gray and brown silty fine sand, moist. Gray silty sand, wet.		6 SS	WOH 1 1 2	2.0	2	SB90-26 (10-12) Saturated at 11 ft.
12	560.8	BOREHOLE COMPLETED TO 12.0 FT. B.G.S.						
13	559.8							
14	558.8							
15	557.8							

MALCOLM PIRNIE, INC.

BOREHOLE LOG SB90-21 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 4/16/90
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 570.2 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)

SB90-21 (6-8) Sample Submitted for Laboratory Analyses

DUST Total Dust Detected in the Work Zone (mg/m3)

x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft. BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	GRAPHIC LOG	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	COMMENTS
1	569.2	FILL Brown sand and gravel, damp.		1 SS	3 3 1 4	0.7	4	
2 3	568.2 567.2	Reddish brown coarse sand and gravel, damp.		2 SS	6 8 2 2	0.6	10	
4 5	566.2 565.2			3 SS	2 1 3 2	NR	4	No Sample Recovery
6 7	564.2 563.2	Brown coarse sand with some gravel, sheen, wet.		4 SS	18 85 57 9	0.5	142	SB90-21 (6-8) Saturated at 7 ft.
8 9	562.2 561.2	LACUSTRINE DEPOSITS Black silt with some clay and some fine sand, sheen, wet.		5 SS	1 2 1 1	1.1	3	
10 11	560.2 559.2	Gray silty sand, sheen, wet. Gray clayey silt, wet.		6 SS	1 2 1 1	2.0	3	HS=2
12 13	558.2 557.2	Gray silt with some clay, some fine sand, wet.		7 SS	WOH 1 1 1	1.8	2	
14 15	556.2 555.2	Gray and brown fine silt, runny, wet. Gray and brown fine sand with silt and clay, wet.		8 SS	WOH 1 1 2	1.9	2	SB90-21 (14-16)
16 17	554.2 553.2	BOREHOLE COMPLETED TO 16.0 FT. B.G.S.						

'N'-VALUE scale: 0 – 100

BOREHOLE LOG SB90-22 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 4/16/90
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 572 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)

SB90-22 (6-8) Sample Submitted for Laboratory Analyses

DUST Total Dust Detected in the Work Zone (mg/m3)

x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	GRAPHIC LOG	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	'N'-VALUE (0–100)	COMMENTS
0	572	FILL Reddish brown coarse sand with some gravel, damp.							SB90-22 (0-2)
1	571			1 SS	2 2 5 7	1.1	7	x	
2	570	Brown coarse sand with some gravel, damp.							
3	569			2 SS	17 7 5 2	0.3	12	x	
4	568								No Sample Recovery
5	567			3 SS	1 2 2 2	NR	4	x	
6	566	Brown silty sand with some gravel, wet. LACUSTRINE DEPOSITS							SB90-22 (6-8) Saturated at 7 ft.
7	565	Black silt, odor, wet.		4 SS	WOH 2 1 2	0.3	3	x	
8	564	Gray silty fine sand, wet.							
9	563			5 SS	3 2 1 2	1.4	3	x	
10	562	Gray clayey silt, wet.							SB90-22 (10-12)
11	561			5 SS	WOH WOH WOH 1	1.3	0	x	
12	560	BOREHOLE COMPLETED TO 12.0 FT. BGS.							
13	559								
14	558								
15	557								

BOREHOLE LOG SB90-23 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 4/16/90 -
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 572.7 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)

SB90-23 (4-6) Sample Submitted for Laboratory Analyses

DUST Total Dust Detected in the Work Zone (mg/m3)

x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	GRAPHIC LOG	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	0 – 100 'N'-VALUE	COMMENTS
0–2		FILL Brown silty coarse sand, dry.		1 SS	5 4 2 2	0.3	6	x	HS=0.5
1	571.7								
2	570.7	LACUSTRINE DEPOSITS Light brown clayey silt, damp.		2 SS	1 2 3 4	0.8	5	x	
3	569.7								
4	568.7	Reddish brown and brown clayey silt with some fine sand, damp.		3 SS	3 4 3 4	1.9	7	x	SB90-23 (4-6) HS=1.5
5	567.7								
6	566.7	Reddish brown and brown silty fine sand, damp.		4 SS	1 2 3 1	1.8	5	x	
7	565.7								
8	564.7	Reddish brown silty sand, moist.		5 SS	2 2 3 1	1.9	5	x	
9	563.7	Reddish brown clayey silt, moist. Gray silty fine sand, moist.							
10	562.7	Gray silty fine sand grading to-		6 SS	1 1 2 2	1.4	3	x	SB90-23 (10-12) Saturated at 10 ft.
11	561.7	Gray silty sand, damp.							
12	560.7	BOREHOLE COMPLETED TO 12.0 FT. B.G.S.							
13	559.7								
14	558.7								
15	557.7								

BOREHOLE LOG SB90-24 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 4/16/90
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 573.6 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)

SB90-24 (4-6) Sample Submitted for Laboratory Analyses

DUST Total Dust Detected in the Work Zone (mg/m3)

x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	COMMENTS
0	573.6	FILL Dark brown sandy silt, damp. LACUSTRINE DEPOSITS					
1	572.6	Reddish brown silty fine sand with some clay, damp.	1 SS	1 1 1 2	0.9	2	
2	571.6	Reddish brown silty sand, damp.					HS=1.0
3	570.6	Reddish brown and gray (mottled) silty clay, damp.	2 SS	1 2 8 10	1.6	10	
4	569.6	Reddish brown and gray (mottled) silty clay with some fine sand, damp.					SB90-24 (4-6)
5	568.6		3 SS	3 4 5 4	1.9	9	
6	567.6	Brown silty fine sand, very moist.					
7	566.6		4 SS	1 2 3 2	2.0	5	
8	565.6	Reddish brown and brown (mottled) silty fine sand, moist.					
9	564.6		5 SS	2 2 3 2	1.6	5	
10	563.6	Reddish brown and brown (mottled) silty fine sand, moist.					SB90-24 (10-12) Saturated at 12 ft. DUST=0.01
11	562.6	Gray silty fine sand with some clay, wet.	6 SS	1 2 1 2	1.8	3	
12	561.6	BOREHOLE COMPLETED TO 12.0 FT. B.G.S.					
13	560.6						
14	559.6						
15	558.6						

BOREHOLE LOG SB90-25 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 4/17/90
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 574.1 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)
SB90-38 (4-6) Sample Submitted for Laboratory Analyses

DUST Total Dust Detected in the Work Zone (mg/m3)
x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	GRAPHIC LOG	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	'N'-VALUE (0–100)	COMMENTS
		FILL Brown silt with some clay and fine sand, dry.							SB90-25 (0-2)
1	573.1			1 SS	1 3 2 3	1.1	5	x	
2	572.1	LACUSTRINE DEPOSITS Brown sandy silt, damp.							
3	571.1	Brown clayey silt, damp.		2 SS	2 2 10 10	1.3	12	x	
4	570.1	Reddish brown and brown (mottled) clayey silt, damp.							SB90-25 (4-6)
5	569.1	Reddish brown and brown (mottled) silt with fine sand, moist.		3 SS	3 3 4 3	1.9	7	x	
6	568.1	Brown and gray (mottled) clayey silt, damp. Brown and gray (mottled) silty sand, moist.							
7	567.1			4 SS	2 1 4 3	1.7	5	x	
8	566.1	Reddish brown and gray (mottled) silty sand with some clay, wet.							SB90-25 (8-10) Saturated at 9 ft.
9	565.1			5 SS	1 3 2 3	1.4	5	x	
10	564.1	BOREHOLE COMPLETED TO 10.0 FT. B.G.S.							
11	563.1								
12	562.1								
13	561.1								
14	560.1								
15	559.1								

BOREHOLE LOG SB90-26 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 4/17/90
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 572.8 ft.AMSL

SYMBOLS AND DEFINITIONS

- SS Split Spoon (2 in. ID)
- WOH Weight of Hammer
- WOR Weight of Rods
- NR No Recovery
- HS Total VOC Detected in the Sample Jar Head Space (ppm)
- SB90-26 (4-6) Sample Submitted for Laboratory Analyses
- DUST Total Dust Detected in the Work Zone (mg/m3)
- x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	GRAPHIC LOG	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	COMMENTS
0–1		FILL Brown coarse sand with some gravel, damp.						SB90-26 (0-2)
1	571.8			1 SS	2 5 4 3	1.1	9	
2	570.8	Brown coarse sand with some gravel, damp.						
2–3		LACUSTRINE DEPOSITS Reddish brown and brown (mottled) clayey silt with some sand, damp.						
3	569.8			2 SS	1 2 3 4	1.2	5	
4	568.8	Reddish brown gray silty fine sand with clay; staining, odor, moist.						SB90-26 (4-6) HS=20
5	567.8			3 SS	2 3 2 3	1.7	5	
6	566.8	Gray and brown clayey silt, moist.						
7	565.8	Gray silty sand, moist.		4 SS	2 2 4 2	1.9	6	
8	564.8	Gray and brown (mottled) silty sand, very moist.						
9	563.8			5 SS	2 2 5 4	1.1	7	
10	562.8	Gray and brown silty fine sand, moist.						SB90-26 (10-12) Saturated at 11 ft.
11	561.8	Gray silty sand, wet.		6 SS	WOH 1 1 2	2.0	2	
12	560.8	BOREHOLE COMPLETED TO 12.0 FT. B.G.S.						
13	559.8							
14	558.8							
15	557.8							

BOREHOLE LOG SB90-27 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 4/17/90
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 571.8 ft.AMSL

SYMBOLS AND DEFINITIONS

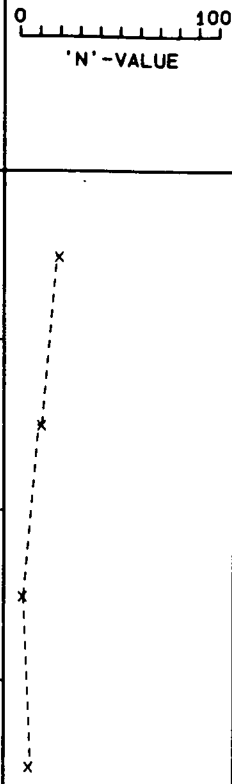
SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)
SB90-38 (4-6) Sample Submitted for Laboratory Analyses

DUST Total Dust Detected in the Work Zone (mg/m3)
x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	GRAPHIC LOG	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	COMMENTS
0–2		FILL Dark brown and reddish brown coarse sand and gravel, damp.		1 SS	1 8 12 7	0.5	20	SB90-27 (0-2)
1	570.8							
2	569.8	Dark brown and reddish brown coarse sand and gravel with some cement fragments, damp.		2 SS	1 7 4 3	0.2	11	
3	568.8							
4	567.8	Dark brown and reddish brown coarse sand and gravel with some cement fragments, moist.		3 SS	2 1 1 4	0.1	2	Poor recovery
5	566.8							
6	565.8	Reddish brown coarse sand with gravel, moist. LACUSTRINE DEPOSITS Gray clayey silt with some fine sand, wet.		4 SS	13 4 1 2	0.9	5	SB90-27 (6-8) Saturated at 7 ft.
7	564.8							
8	563.8	BOREHOLE COMPLETED TO 8.0 FT. B.G.S.						
9	562.8							
10	561.8							
11	560.8							
12	559.8							
13	558.8							
14	557.8							
15	556.8							

'N'-VALUE (0–100)



MALCOLM PIRNIE, INC.

BOREHOLE LOG SB90-28 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 4/17/90
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 570.8 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

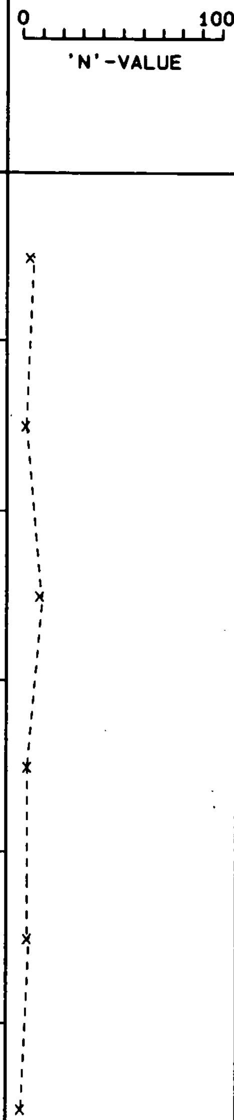
HS Total VOC Detected in the Sample Jar Head Space (ppm)

SB90-28 (4-6) Sample Submitted for Laboratory Analyses

DUST Total Dust Detected in the Work Zone (mg/m3)

x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	GRAPHIC LOG	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	COMMENTS
		FILL Dark brown sand with some gravel, damp.						SB90-28 (0-2)
1	569.8			1 SS	1 1 3 2	0.5	4	
2	568.8	Dark brown coarse sand with some gravel, damp.						
3	567.8			2 SS	0 1 1 2	0.2	2	
4	566.8	Dark brown coarse sand with gravel and brick fragments, damp.						SB90-28 (4-6)
5	565.8			3 SS	1 6 3 10	0.6	9	
6	564.8	Brown coarse sand with gravel, sheen, wet						
7	563.8			4 SS	1 2 1 1	0.4	3	Saturated at 7 ft.
8	562.8	Brown coarse sand and gravel, wet.						
		LACUSTRINE DEPOSITS Gray clayey silt, wet.						
9	561.8	Gray silty sand, wet.		5 SS	1 1 2 1	1.9	3	
10	560.8	Gray clayey silt, wet.						SB90-28 (10-12)
11	559.8	Gray silty sand, wet.		6 SS	WOH WOH WOH 1	1.9	0	
12	558.8	BOREHOLE COMPLETED TO 12.0 FT. B.G.S.						
13	557.8							
14	556.8							
15	555.8							



BOREHOLE LOG SB90-29 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 4/17/90
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 571.1 ft.AMSL

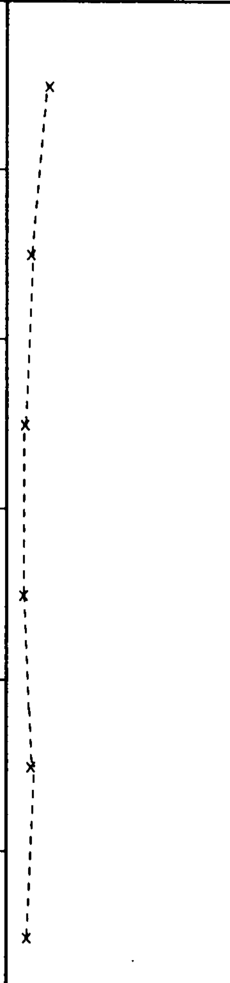
SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)
SB90-29 (4-6) Sample Submitted for Laboratory Analyses

DUST Total Dust Detected in the Work Zone (mg/m3)
x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	GRAPHIC LOG	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	'N'-VALUE (0–100)	COMMENTS
		FILL Reddish brown coarse sand with some black cinders, slag, and gravel, damp.							
1	570.1			1 SS	12 7 7 7	1.1	14		
2	569.1	Reddish brown coarse sand with some gravel, moist.							
3	568.1			2 SS	3 3 2 1	0.4	5		
4	567.1	Reddish brown coarse sand, wet.							SB90-29 (4-6)
5	566.1			3 SS	1 1 1 1	0.4	2		Saturated at 5 ft.
6	565.1	LACUSTRINE DEPOSITS Black silty fine sand, odor, wet.							SB90-29 (6-8)
7	564.1			4 SS	1 1 WOH 3	1.3	1		
8	563.1	Gray silty fine sand, wet.							SB90-29 (8-10)
9	562.1			5 SS	1 3 2 1	1.7	5		
10	561.1	Gray silt, some clay, some fine sand, wet							SB90-29 (10-12) DUST=0.01 mg/m3
11	560.1			6 SS	WOH 1 2 1	1.8	3		
12	559.1	BOREHOLE COMPLETED TO 12.0 FT. B.G.S.							
13	558.1								
14	557.1								
15	556.1								



BOREHOLE LOG SB90-30 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 4/17/90
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 572.2 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)

SB90-30 (4-6) Sample Submitted for Laboratory Analyses

DUST Total Dust Detected in the Work Zone (mg/m3)

x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	GRAPHIC LOG	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	'N'-VALUE (0–100)	COMMENTS
0–1	571.2	FILL Reddish brown coarse sand with some gravel, damp.		1 SS	2 2 3 2	1.2	5	x	
2–3	570.2 569.2	Reddish brown coarse sand with some gravel, damp.		2 SS	1 1 WOH 1	0.15	1	x	
4–5	568.2 567.2	LACUSTRINE DEPOSITS Dark brown silty clay, damp. Brown clayey silt, damp.		3 SS	2 1 1 2	1.4	2	x	SB90-30 (4-6)
6–7	566.2 565.2	Gray and brown clayey silt, some black staining, damp.		4 SS	1 1 1 1	1.7	2	x	SB90-30 (6-8)
8–9	564.2 563.2	Gray clayey silt grading to- Gray silty sand, damp.		5 SS	1 1 2 3	0.8	3	x	
10–11	562.2 561.2	Gray clayey silt with some fine sand, wet		6 SS	1 1 1 1	1.6	2	x	SB90-32 (10-12) Saturated at 10 ft.
12	560.2	BOREHOLE COMPLETED TO 12.0 FT. B.G.S.							
13	559.2								
14	558.2								
15	557.2								

BOREHOLE LOG SB90-31 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 4/17/90
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 573.4 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)
SB90-31 (4-6) Sample Submitted for Laboratory Analyses

DUST Total Dust Detected in the Work Zone (mg/m3)
x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	COMMENTS
0–2	573.4–571.4	FILL Brown coarse sand with some gravel, damp.	1 SS	4 7 3 3	0.4	10	
2–4	571.4–569.4	Brown coarse sand with some gravel, metal and ceramics present, damp. LACUSTRINE DEPOSITS Light brown and reddish brown clayey silt, damp.	2 SS	1 2 1 5	0.9	3	
4–6	569.4–567.4	Reddish brown clayey silt, damp. Gray silty fine sand, damp.	3 SS	4 4 3 5	1.8	7	SB90-31 (4-6)
6–8	567.4–565.4	Gray and brown (mottled) clayey silt with fine sand, moist.	4 SS	1 2 3 3	2.0	5	
8–10	565.4–563.4	Gray and brown (mottled) fine sand, wet.	5 SS	2 2 4 2	1.4	6	SB90-31 (8-10) Saturated at 9.5 ft.
10	563.4	BOREHOLE COMPLETED TO 10.0 FT. B.G.S.					

Depth / elevation scale: 1 – 572.4; 2 – 571.4; 3 – 570.4; 4 – 569.4; 5 – 568.4; 6 – 567.4; 7 – 566.4; 8 – 565.4; 9 – 564.4; 10 – 563.4; 11 – 562.4; 12 – 561.4; 13 – 560.4; 14 – 559.4; 15 – 558.4

'N'-VALUE scale: 0 – 100

BOREHOLE LOG SB90-32 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 4/17/90
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 574.2 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)

SB90-32 (4-6) Sample Submitted for Laboratory Analyses

DUST Total Dust Detected in the Work Zone (mg/m3)

x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	GRAPHIC LOG	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	0 100 'N'-VALUE	COMMENTS
		LACUSTRINE DEPOSITS Brown sandy silt, damp.							
1	573.2			1 SS	1 1 1 1	0.3	2		
2	572.2	Brown sand, damp. Light brown clayey silt with some fine sand, damp.							
3	571.2			2 SS	2 11 11 9	1.4	22		
4	570.2	Light brown clayey silt with sand, damp.							SB90-32 (4-6) HS=20
5	569.2	Gray silt with clay, staining, damp.		3 SS	2 4 3 3	2.0	7		
6	568.2	Gray and brown (mottled) silty fine sand with some clay, damp.							
7	567.2			4 SS	1 3 4 4	2.0	7		
8	566.2	Brown and gray (mottled) silty fine sand, very moist.							
9	565.2			5 SS	1 4 3 4	1.5	7		
10	564.2	Light brown and gray (mottled) silty sand, wet.							SB90-32 (10-12) Saturated at 10 ft.
11	563.2	Gray clayey sand, wet.		6 SS	1 2 2 1	2.0	4		
12	562.2	BOREHOLE COMPLETED TO 12.0 FT. B.G.S.							
13	561.2								
14	560.2								
15	559.2								

BOREHOLE LOG SB90-33 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 4/18/90
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 574.6 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)

SB90-33 (4-6) Sample Submitted for Laboratory Analyses

DUST Total Dust Detected in the Work Zone (mg/m3)

x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	GRAPHIC LOG	SAMPLE NO. & SAMPLE TYPE	BLOWS / .5 ft	RECOVERY (ft)	'N'-VALUE	COMMENTS
0–1		FILL Black cinders and sand, damp.						
1	573.6			1 SS	2 1 1 1	0.9	2	
2	572.6	Brown coarse sand with some angular gravel, moist.						
3	571.6			2 SS	3 4 3 7	0.4	7	
4	570.6	LACUSTRINE DEPOSITS Gray and brown (mottled) silty clay, odor, moist.						SB90-33 (4-6) HS=25-30
5	569.6			3 SS	1 5 4 5	1.8	9	
6	568.6	Gray and brown (mottled) silty clay, odor, moist.						SB90-33 (6-8) HS=45
7	567.6			4 SS	1 1 1 2	1.6	2	
8	566.6	Gray and brown (mottled) silty fine sand, odor, moist.						HS=4
9	565.6			5 SS	2 1 1 3	1.8	2	
10	564.6	Brown clayey silt, wet. Gray silt with fine sand, odor, wet.						HS=25 Saturated at 10 ft.
11	563.6			6 SS	1 2 1 1	2.0	3	
12	562.6	Gray fine sand with silt and clay, wet.						HS=5
13	561.6			7 SS	WOH 1 2 1	1.7	3	
14	560.6	Gray silty fine sand, wet.						HS=12
15	559.6			8 SS	WOH WOH WOH WOH	1.2	0	
16	558.6	Gray silty fine sand, wet.						HS=12
				9 SS		1.3	1	
17	557.6							

BOREHOLE LOG SB90-33 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 4/18/90
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 574.6 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)
SB90-33 (4-6) Sample Submitted for Laboratory Analyses

DUST Total Dust Detected in the Work Zone (mg/m3)
x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	GRAPHIC LOG	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	'N'-VALUE (0–100)	COMMENTS
				9 SS		1.3	1		
18	556.6	Dark gray coarse sand, wet.							HS=4
19	555.6			10 SS	WOH 1 1 2	0.9	2		
20	554.6	Gray coarse (running) sand, some silt, wet.							SB90-33 (20-22) HS=0
21	553.6			11 SS	WOH 1 2 2	0.9	3		
22	552.6	BOREHOLE COMPLETED TO 22.0 FT. B.G.S.							
23	551.6								
24	550.6								
25	549.6								
26	548.6								
27	547.6								
28	546.6								
29	545.6								
30	544.6								
31	543.6								
32	542.6								
33	541.6								
34	540.6								

BOREHOLE LOG SB90-34 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 4/19/90
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 574.2 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)
SB90-34 (4-6) Sample Submitted for Laboratory Analyses

DUST Total Dust Detected in the Work Zone (mg/m3)
x---x Penetration Resistance ('N' Blows/.5 ft.)

Depth (ft.BGS)	Elevation (ft AMSL)	Soil Description	Graphic Log	Sample No. & Sample Type	Blows /.5 ft	Recovery (ft)	'N'-Value	Comments
0–1	574.2–573.2	FILL Reddish brown silty sand with some gravel, damp.	Fill	1 SS	6 1 6 3	0.6	7	
2	572.2	Reddish brown silty sand with some gravel, damp. Red brick and other rock fragments, damp.	Fill					
3	571.2	LACUSTRINE DEPOSITS Brown silt with clay and fine sand, damp.	Lacustrine	2 SS	6 3 5 7	0.7	8	
4	570.2	Dark brown silty sand, damp. Brown and gray (mottled) clayey silt with some sand, damp.	Lacustrine					SB90-34 (4-6)
5	569.2			3 SS	3 3 4 6	1.5	7	
6	568.2	Gray and brown (mottled) silty fine sand with some clay, damp.						HS=35
7	567.2	Gray silty fine sand, moist.		4 SS	2 2 2 2	1.6	4	
8	566.2	Brown and gray (mottled) silt with some fine sand, odor, moist.						SB90-35 (8-10) HS=175
9	565.2			5 SS	1 2 3 2	1.6	5	
10	564.2	Gray and brown silty fine sand, wet.						SB90-35 (10-12) HS=8 Saturated at 10 ft.
11	563.2			6 SS	1 2 3 1	1.9	5	
12	562.2	Gray clayey silt grading to-						HS=12
13	561.2	gray silty clay, wet.		7 SS	1 WOH 2 1	1.4	2	
14	560.2	Gray sandy silt, wet.						HS=30
15	559.2			8 SS	WOH WOH WOH 1	1.4	0	

BOREHOLE LOG SB90-34 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 4/19/90
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 574.2 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)
SB90-34 (4-6) Sample Submitted for Laboratory Analyses

DUST Total Dust Detected in the Work Zone (mg/m3)
x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	GRAPHIC LOG	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	'N'-VALUE (0–100)	COMMENTS
				8 SS	WOH WOH WOH 1	1.4	0		
16	558.2	Gray (running) sand, wet. / Gray silty sand, wet.							HS<1 SB90-34 (16-18)
17	557.2			9 SS	WOH WOH 1 2	1.7	1		
18	556.2	BOREHOLE COMPLETED TO 18.0 FT. B.G.S.							
19	555.2								
20	554.2								
21	553.2								
22	552.2								
23	551.2								
24	550.2								
25	549.2								
26	548.2								
27	547.2								
28	546.2								
29	545.2								
30	544.2								

BOREHOLE LOG SB90-35 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 4/18/90
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 572.7 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)

SB90-35 (4-6) Sample Submitted for Laboratory Analyses

DUST Total Dust Detected in the Work Zone (mg/m3)

x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	GRAPHIC LOG	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	'N'-VALUE (0–100)	COMMENTS
		FILL Reddish brown coarse sand, damp.							
1	571.7	Black sand with some cinder and gravel, damp.		1 SS	1 3 1 1	0.9	4	x	
2	570.7	Reddish brown silt with some sand and wood, damp.							
3	569.7			2 SS	1 WOH 2 1	0.3	2	x	
4	568.7	Brown silty sand with gravel, dry.							SB90-35 (4-6)
5	567.7			3 SS	7 3 3 2	0.5	6	x	
6	566.7	Black silt with gravel, oily, very moist.							SB90-35 (6-8)
7	565.7			4 SS	2 3 4 2	0.4	7	x	
8	564.7	Brown sandy gravel with oily sheen, damp.							SB90-35 (8-10)
		LACUSTRINE DEPOSITS Brown silty fine sand, damp.							
9	563.7			5 SS	2 2 2 2	1.5	4	x	
10	562.7	Gray clayey silt with fine sand, very moist.							
11	561.7			6 SS	4 2 2 3	1.1	4	x	
12	560.7	Gray clayey silt with fine sand, wet.							Saturated at 12 ft. SB90-35 (12-14) Blind Duplicate: SB90 35 (20-22)
13	559.7			7 SS	WOH 1 2 1	0.8	3	x	
14	558.7	BOREHOLE COMPLETED TO 14.0 FT. B.G.S.							
15	557.7								

MALCOLM PIRNIE, INC.

BOREHOLE LOG SB90-36 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 4/18/90
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 572.5 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)

SB90-36 (4-6) Sample Submitted for Laboratory Analyses

DUST Total Dust Detected in the Work Zone (mg/m3)

x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	GRAPHIC LOG	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	'N'-VALUE (0–100)	COMMENTS
0–2 1	571.5	FILL Brown coarse sand, damp.		1 SS	1 3 5 4	0.5	8	x	
2–4 2 3	570.5 569.5	Reddish brown coarse sand, some (small) gravel, some cinder, "organic" odor, damp		2 SS	3 2 1 2	0.8	3	x	
4–6 4 5	568.5 567.5	Reddish brown coarse sand, "organic" odor, damp.		3 SS	6	0.9	18	x	SB90-36 (4-6)
6–8 6 7	566.5 565.5	Reddish brown coarse sand, damp. LACUSTRINE DEPOSITS Black silt, very moist. Gray clayey silt, dry.		4 SS	6 7 23 3	0.9	30	x	SB90-36 (6-8)
8–10 8 9	564.5 563.5	Black sandy silt, moist. Gray silty fine sand, sulfur-like odor, moist.		5 SS	1 2 2 2	1.4	4	x	HS=7
10–12 10 11	562.5 561.5	Gray and black clayey silt, moist. Gray silty fine sand with some clay, wet.		6 SS	1 2 1 2	1.7	3	x	SB90-36 (10-12) HS=1 Saturated at 11 ft.
12	560.5	BOREHOLE COMPLETED TO 12.0 FT. B.G.S.							
13	559.5								
14	558.5								
15	557.5								

MALCOLM PIRNIE, INC.

BOREHOLE LOG SB90-37 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 4/19/90
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 574.1 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)
SB90-34 (4-6) Sample Submitted for Laboratory Analyses

DUST Total Dust Detected in the Work Zone (mg/m3)
x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	GRAPHIC LOG	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	COMMENTS
1	573.1	FILL Black cinders, damp. Reddish brown coarse sand, damp. Black silt with some clay, dry. Brown silt with clay, dry.		1 SS	3 4 26 29	1.6	30	SB90-37 (0-2)
2	572.1	Dark brown coarse sand, dry.						
3	571.1			2 SS	4 1 1 1	0.35	2	
4	570.1	Red and brown coarse sand, very moist.						SB90-37 (4-6)
5	569.1			3 SS	2 1 1 4	1.6	2	
6	568.1	Red and brown coarse sand, moist.						
7	567.1	LACUSTRINE DEPOSITS Gray silt with clay, staining, moist.		4 SS	4 6 1 3	1.7	7	SB90-37 (6-8) HS=100 Blind Field Blank SB90-37 (26-28)
8	566.1	Gray sand, very moist. Brown and gray (mottled) clayey silt with fine sand, staining, very moist.						HS=70
9	565.1			5 SS	2 1 2 3	1.6	3	
10	564.1	Gray silt with some fine sand and clay, damp.						HS=7
11	563.1			6 SS	3 2 3 4	1.6	5	
12	562.1	Gray silt with some fine sand and clay, very moist.						HS=5 Saturated at 12 ft.
13	561.1			7 SS	1 1 1 1	1.7	2	
14	560.1	Gray fine sand with silt, wet.						SB90-37 (14-16) Blind Field Duplicate SB90-37 (20-22)
15	559.1			8 SS	WOH WOH WOH WOH	1.7	0	
16	558.1	BOREHOLE COMPLETED TO 16.0 FT. B.G.S.						
17	557.1							

'N'-VALUE scale: 0 – 100

MALCOLM PIRNIE, INC.

BOREHOLE LOG SB90-38 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 4/19/90
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 574.2 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)
SB90-38 (4-6) Sample Submitted for Laboratory Analyses

DUST Total Dust Detected in the Work Zone (mg/m3)
x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	GRAPHIC LOG	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	'N'-VALUE (0–100)	COMMENTS
		FILL Dark brown and black cinders and sand, dry.							SB90-38 (0-2)
1	573.2	Dark brown sand, dry.		1 SS	7 3 8 6	0.8	11	x	
2	572.2	Dark brown silty sand with some gravel, dry.							
3	571.2			2 SS	2 2 1 1	0.8	3	x	
4	570.2	Red coarse sand with gravel, very moist.							SB90-38 (4-6) Poor recovery
5	569.2			3 SS	6 8 7 3	0.3	15	x	
6	568.2	Red coarse sand and gravel, moist.							
7	567.2			4 SS	4 5 3 4	0.3	8	x	
8	566.2	LACUSTRINE DEPOSITS Dark reddish brown and dark brown (mottled) silty clay, moist.							
9	565.2	Light brown and reddish brown (mottled) clayey silt with fine sand, moist.		5 SS	3 5 4 4	1.9	9	x	
10	564.2	Reddish brown and dark brown (mottled) silty clay with some fine sand, damp.							SB90-38 (10-12) Saturated at 11 ft.
11	563.2	Gray silty fine sand, very moist.		6 SS	1 1 3 3	1.6	4	x	
12	562.2	BOREHOLE COMPLETED TO 12.0 FT. B.G.S.							
13	561.2								
14	560.2								
15	559.2								

BOREHOLE LOG SB90-39 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 8/23/90
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 575.2 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)

SB90-39 (4-6) Sample Submitted for Laboratory Analyses

DUST Total Dust Detected in the Work Zone (mg/m3)

x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	GRAPHIC LOG	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	'N'-VALUE (0–100)	COMMENTS
		FILL Brown silty sand with some gravel and slag, dry.							
1	574.2			1 SS	3 7 9 9	0.9	16		
2	573.2	Reddish brown silty sand with some gravel, dry.							HS=0.5
3	572.2			2 SS	3 8 4 2	0.6	12		
4	571.2	Reddish brown silty sand with some gravel, dry.							SB90-39 (4-6) Split sample with NYSDEC
5	570.2			3 SS	1 1 4 5	0.4	5		
6	569.2	LACUSTRINE DEPOSITS Dark brown clayey silt with sand, dry.							
7	568.2	Light brown silty fine sand, dry.		4 SS	2 4 5 6	1.6	9		
8	567.2	Light brown silty fine sand, v. moist.							
9	566.2			5 SS	3 4 5 5	1.5	9		
10	565.2	Light brown silty fine sand, wet.							SB90-39 (10-12) Saturated at 10 ft. DUST=.012 mg/m3
11	564.2			6 SS	2 3 4 5	1.8	7		
12	563.2	BOREHOLE COMPLETED TO 12.0 FT. BGS							
13	562.2								
14	561.2								
15	560.2								

BOREHOLE LOG SB90-40 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 8/22/90
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 574.5 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)

SB90-40 (4-6) Sample Submitted for Laboratory Analyses

DUST Total Dust Detected in the Work Zone (mg/m3)

x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	GRAPHIC LOG	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	'N'-VALUE (0–100)	COMMENTS
1	573.5	FILL Brown silt with sand and angular gravel, dry. Bright blue massive material of unknown composition, dry.		1 SS	3 9 5 6	0.9	14		HS=2
2 3	572.5 571.5	Gray silty sand with slag, glass and gravel, dry.		2 SS	2 2 2 3	1.1	4		HS=4
4 5	570.5 569.5	Brown silt with some clay and trace sand, dry.		3 SS	1 2 1 2	0.4	3		SB90-40 (4-6) HS=200 Split sample with NYSDEC
6 7	568.5 567.5	Black silt, dry. LACUSTRINE DEPOSITS Reddish brown and brown (mottled) clayey silt with sand, damp.		4 SS	4 5 9 13	1.1	14		HS=3.5
8 9	566.5 565.5	Light brown silty sand, damp. Gray silty clay with sand, damp.		5 SS	5 5 3 3	1.6	8		HS=6
10 11	564.5 563.5	Light brown silty sand, damp. Dark gray clayey silt with some sand, moist.		6 SS	2 3 4 5	1.1	7		HS=10
12 13	562.5 561.5	Gray silt with sand as laminae (.025' thick), wet.		7 SS	1 1 1 1	2.0	2		SB90-40 (12-14) HS<1 Saturated at 12 ft.
14 15	560.5 559.5	BOREHOLE COMPLETED TO 14.0 FT. BGS							

BOREHOLE LOG SB90-41 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 8/22/90
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 573.2 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

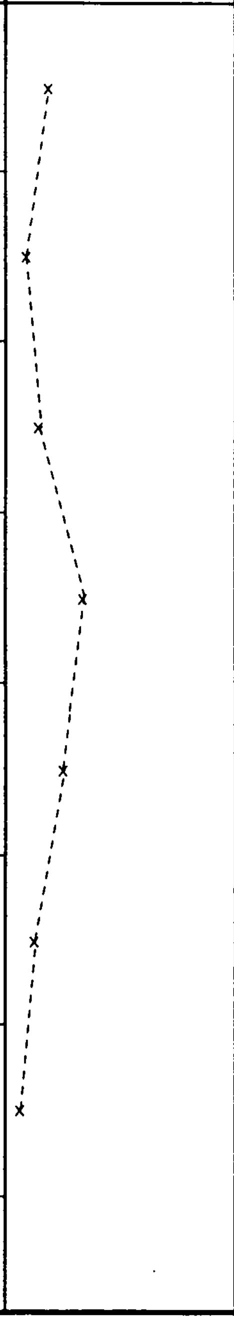
HS Total VOC Detected in the Sample Jar Head Space (ppm)

SB90-41 (4-6) Sample Submitted for Laboratory Analyses

DUST Total Dust Detected in the Work Zone (mg/m3)

x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	GRAPHIC LOG	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	'N'-VALUE (0–100)	COMMENTS
1	572.2	FILL Gray and brown silt, dry. Reddish brown silt with sand and slag, dry.		1 SS	4 10 4 3	0.7	14		
2 3	571.2 570.2	Gray and reddish brown silt with some clay, sand, cobbles, and glass, dry.		2 SS	2 1 2 3	0.4	3		
4 5	569.2 568.2	Gray and reddish brown silt with some clay, sand, cobbles, glass, and slag, dry.		3 SS	2 3 6 5	0.8	9		SB90-41 (4-6)
6 7	567.2 566.2	Brown silt with sand, dry. Gray and brown silt, dry. Yellow brick, dry.		4 SS	4 12 19 30	1.1	31		HS=50
8 9	565.2 564.2	LACUSTRINE DEPOSITS Black silt, dry. Black silt, solvent odor, wet.		5 SS	18 13 8 6	1.1	21		SB90-41 (8-10) HS=50-100
10 11	563.2 562.2	Black silt, solvent odor, wet.		6 SS	5 4 3 4	0.6	7		HS=200
12 13	561.2 560.2	Gray silt with clay and sand as laminae, no odor, wet.		7 SS	WOH WOH WOH WOH	1.5	0		SB90-41 (12-14) HS<1 DUST=.005 mg/m3 Saturated at 12 ft.
14 15	559.2 558.2	BOREHOLE COMPLETED TO 14.0 FT. BGS							



BOREHOLE LOG SB90-42 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 8/24/90
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 571.0 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)

SB90-42 (4-6) Sample Submitted for Laboratory Analyses

DUST Total Dust Detected in the Work Zone (mg/m3)

x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	GRAPHIC LOG	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	'N'-VALUE (0–100)	COMMENTS
0–2	571–569	FILL Brown silty sand and gravel, dry. Reddish brown sand with slag, damp.		1 SS	4 4 3 1	0.8	7	x	SB90-42 (0-2) Split with NYSDEC
2–4	569–567	Reddish brown silt sith slag, dry.		2 SS	2 2 3 1	0.7	5	x	
4–6	567–565	Reddish brown silt with slag, dry.		3 SS	2 2 3 2	0.8	5	x	SB90-42 (4-6) Blind Duplicate for VOCs: SB90-42 (20-22)
6–8	565–563	Reddish brown silty fine sand with metal filings, damp.		4 SS	3 3 2 3	0.8	5	x	
8–10	563–561	LACUSTRINE DEPOSITS Brown silty clay grading to light brown silty sand, damp.		5 SS	4 5 10 6	1.0	15	x	
10–12	561–559	Gray clayey silt grading to gray silty fine sand, wet.		6 SS	4 5 4 6	1.1	9	x	SB90-42 (10-12) DUST=.01 mg/m3 Saturated at 10 ft. Blind Duplicate also: SB90-42 (20-22)
12–15	559–556	BOREHOLE COMPLETED TO 12.0 FT. BGS							

MALCOLM PIRNIE, INC.

BOREHOLE LOG SB90-43 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 8/23/90
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 575.1 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)
SB90-43 (4-6) Sample Submitted for Laboratory Analyses

DUST Total Dust Detected in the Work Zone (mg/m3)
x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	GRAPHIC LOG	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	'N'-VALUE (0–100)	COMMENTS
		Organic matter, leaves, dry.							SB90-43 (0-2) HS=1
1	574.1	FILL Cement, dry. Reddish brown silty fine sand, dry.		1 SS	9 8 11 9	1.3	19	x	
2	573.1	Reddish brown and black silty sand with slag, glass, and gravel, dry.							
3	572.1			2 SS	4 9 5 4	1.0	14	x	
4	571.1	Reddish brown and black silty sand with gravel, slag, and metal filings, damp.							SB90-43 (4-6) Split with NYSDEC
5	570.1			3 SS	3 3 3 3	0.7	6	x	
6	569.1	Reddish brown and black silty sand with gravel, slag, and metal filings, damp.							
7	568.1			4 SS	2 3 13 10	0.6	16	x	
8	567.1	LACUSTRINE DEPOSITS Dark brown clayey silt, damp. Light brown and reddish brown silty fine sand, damp.							
9	566.1			5 SS	5 6 6 6	1.4	12	x	
10	565.1	Brown silty fine sand, moist.							
11	564.1			6 SS	3 4 4 4	0.8	8	x	
12	563.1	Gray clayey silt with sand, wet.							SB90-43 (12-14) Saturated at 12 ft.
13	562.1			7 SS	5 5 4 6	1.9	9	x	
14	561.1	BOREHOLE COMPLETED TO 14.0 FT. BGS							
15	560.1								

BOREHOLE LOG SB90-44 (Overburden)

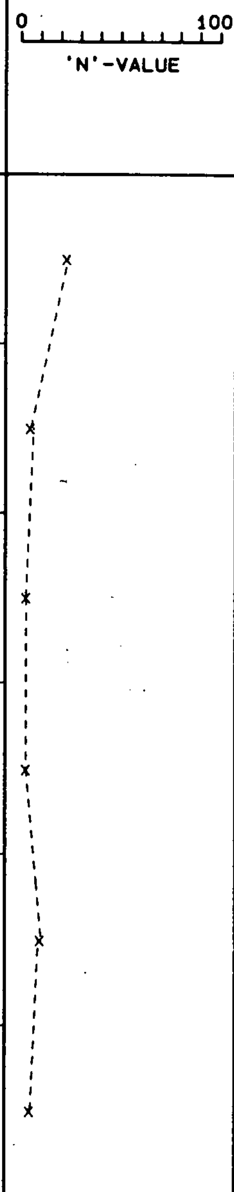
PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 8/23/90
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 575.5 ft.AMSL

SYMBOLS AND DEFINITIONS

- SS Split Spoon (2 in. ID)
- WOH Weight of Hammer
- WOR Weight of Rods
- NR No Recovery
- HS Total VOC Detected in the Sample Jar Head Space (ppm)
- SB90-44 (4-6) Sample Submitted for Laboratory Analyses
- DUST Total Dust Detected in the Work Zone (mg/m3)
- x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft. BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	GRAPHIC LOG	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	COMMENTS
0–2	575.5–573.5	FILL Reddish brown and black silty fine sand with slag, glass, and metal filings, dry.		1 SS	2 11 12 6	0.6	23	SB90-44 (0-2)
2–4	573.5–571.5	Reddish brown sandy silt, dry.		2 SS	3 2 3 1	1.8	5	HS=2
4–6	571.5–569.5	Reddish brown sandy silt, dry.		3 SS	1	0.4	3	SB90-44 (4-6) HS=1 Split with NYSDEC
6–8	569.5–567.5	LACUSTRINE DEPOSITS Reddish brown clayey silt with sand, dry. Gray and brown clayey silt with fine sand, tight, some roots present, damp.		4 SS	1 1 2 4	0.6	3	
8–10	567.5–565.5	Gray and reddish brown silty fine sand, some roots present, damp.		5 SS	3 4 6 7	1.2	10	
10–12	565.5–563.5	Gray silt with fine sand, moist. Gray and brown silty fine sand, wet.		6 SS	2 2 3 5	1.7	5	SB90-44 (10-12) Saturated at 10 ft.
12	563.5	BOREHOLE COMPLETED TO 12.0 FT. BGS						



BOREHOLE LOG SB90-45 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 8/23/90
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 575.8 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)

SB90-45 (4-6) Sample Submitted for Laboratory Analyses

DUST Total Dust Detected in the Work Zone (mg/m3)

x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	GRAPHIC LOG	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	COMMENTS
		FILL Black silt, dry. Reddish brown silty fine sand with gravel and glass, dry.						SB90-45 (0-2) Blind Duplicate: SB90-45 (20-22)
1	574.8			1 SS	2 3 3 5	0.6	6	
2	573.8	Reddish brown and black silty sand with metal filings, dry.						HS=2
3	572.8			2 SS	2 2 3 4	0.6	5	
4	571.8	Reddish brown and black silty sand with slag and metal filings, dry.						SB90-45 (4-6)
5	570.8			3 SS	2	1.1	4	
6	569.8	Reddish brown and black silty sand with slag and metal filings, dry.						HS=1
		LACUSTRINE DEPOSITS						
7	568.8	Gray clayey silt with fine sand, dry. Light brown silty sand, dry.		4 SS	6 5 7 9	1.2	12	
8	567.8	Brown and reddish brown gray clayey silt with fine sand, damp.						HS=1
9	566.8			5 SS	5 6 6 7	1.4	12	
10	565.8	Gray silty fine sand, moist.						
11	564.8	Gray clayey silt with some fine sand, moist.		6 SS	5 6 6 7	1.4	12	
12	563.8	Gray clayey silt with sand as laminae, wet.						SB90-45 (12-14) Saturated at 12 ft.
13	562.8			7 SS	4 3 3 4	1.6	6	
14	561.8	BOREHOLE COMPLETED TO 14.0 FT. BGS						
15	560.8							

BOREHOLE LOG SB90-46 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 8/23/90
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 575.3 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)

SB90-46 (4-6) Sample Submitted for Laboratory Analyses

DUST Total Dust Detected in the Work Zone (mg/m3)

x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	GRAPHIC LOG	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	COMMENTS
		FILL Black and reddish brown sandy silt with slag and gravel, dry.						SB90-46 (0-2)
1	574.3			1 SS	2 7 2 5	0.9	9	
2	573.3	Reddish brown and black silty sand with slag, gravel, wood, and red brick, dry.						
3	572.3			2 SS	5 10 13 6	1.0	23	
4	571.3	Reddish brown and black silty sand with slag, glass, wood, and red brick, dry.						SB90-46 (4-6) Split with NYSDEC
5	570.3			3 SS	2 3 1 1	0.7	4	
6	569.3	No Recovery						
7	568.3			4 SS	2 5 6 7	NR	11	
8	567.3	LACUSTRINE DEPOSITS Dark brown and reddish brown (mottled) silty clay with fine sand, roots, damp.						
9	566.3	Light brown silty fine sand, damp.		5 SS	2 7 10 9	1.7	17	
10	565.3	Gray and brown sandy silt with clay grading to light brown silty sand, moist. Red staining						
11	564.3			6 SS	5 5 4 3	1.4	9	
12	563.3	Gray silt with some very fine sand, wet.						SB90-46 (12-14) DUST=.009 mg/m3 Saturated at 12 ft.
13	562.3	Gray silt with sand as laminae, wet.		7 SS	3 4 4 4	1.7	8	
14	561.3	BOREHOLE COMPLETED TO 14.0 FT. BGS						
15	560.3							

BOREHOLE LOG SB90-47 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 8/24/90
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 575.3 ft.AMSL

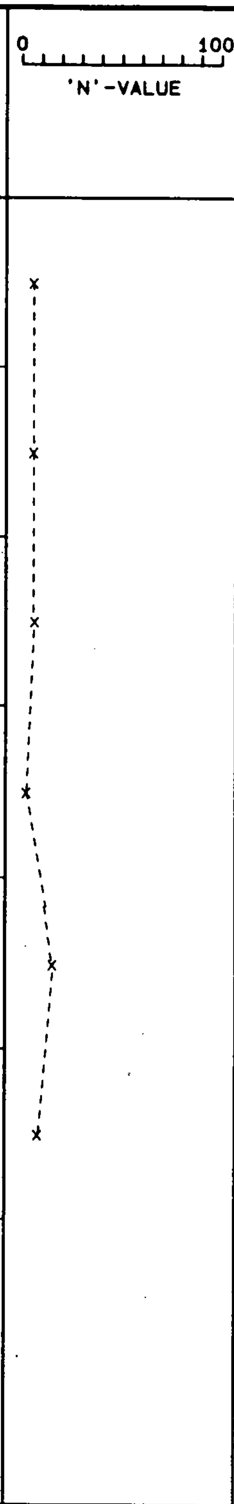
SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)
SB90-47 (4-6) Sample Submitted for Laboratory Analyses

DUST Total Dust Detected in the Work Zone (mg/m3)
x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	COMMENTS
0	575.3	FILL Brown silt with metal filings, leaves, and wood, dry.					SB90-47 (0-2)
1	574.3		1 SS	3 4 2 3	0.5	6	
2	573.3	Reddish brown silt with clay, sand, and organic matter, dry.					
3	572.3		2 SS	5 4 2 2	0.5	6	
4	571.3	Reddish brown silt with clay, sand, slag, gravel, and metal filings, dry.					SB90-47 (4-6)
5	570.3		3 SS	4	0.4	7	
6	569.3	Black weathered shale fragments, damp.					
7	568.3	LACUSTRINE DEPOSITS Orange and dark brown clayey silt, tight, damp.	4 SS	2 1 2 5	1.2	3	
8	567.3	Orange and dark brown clayey silt, tight, damp. Light brown and reddish brown silty sand, damp. Red staining					
9	566.3		5 SS	3 7 9 7	1.0	16	
10	565.3	Light brown silty fine sand with clay, wet.					SB90-47 (10-12) DUST=.009 mg/m3 Saturated at 10 ft.
11	564.3		6 SS	3 5 4 6	1.3	9	
12	563.3	BOREHOLE COMPLETED TO 14.0 FT. BGS					
13	562.3						
14	561.3						
15	560.3						



MALCOLM PIRNIE, INC.

BOREHOLE LOG SB90-48 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES:
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 8/24/90
DRILLING METHOD: 3.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 574.0 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)

SB90-48 (4-6) Sample Submitted for Laboratory Analyses

DUST Total Dust Detected in the Work Zone (mg/m3)

x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	GRAPHIC LOG	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	'N'-VALUE (0–100)	COMMENTS
0	574	FILL Brown silt with some sand, leaves, dry.							SB90-48 (0-2)
1	573			1 SS	2 2 1 1	0.4	3	x	
2	572	Reddish brown and light brown sand with glass and leaves, dry.							
3	571			2 SS	3 2 1 2	0.8	3	x	
4	570	Reddish brown and light brown sand with glass and leaves, dry. Black weathered shale fragments, damp.							SB90-48 (4-6)
5	569	LACUSTRINE DEPOSITS Light brown clayey silt, tight, damp.		3 SS	3 3 5 7	0.9	8	x	
6	568	Roots, damp. Light brown silty sand, dry.							
7	567	Brown silty fine sand with clay, damp.		4 SS	7 7 6 5	1.1	13	x	
8	566	Dark brown and reddish brown clayey silt, moist. Light brown silty sand, wet.							
9	565			5 SS	6 10 10 11	1.4	20	x	
10	564	BOREHOLE COMPLETED TO 10.0 FT. BGS							SB90-48 (8-10) Saturated at 9 ft.
11	563								
12	562								
13	561								
14	560								
15	559								

MALCOLM PIRNIE

APPENDIX B4

MONITORING WELL BORING LOGS

BOREHOLE LOG MW-1D (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES: 101.6N 74.435E
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 4/25/90-4/26/90
DRILLING METHOD: 4.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 572.23 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)

MW1D-(4-6) Sample Submitted for Laboratory Analyses

DUST Total Dust Detected in the Work Zone (mg/m3)

x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	GRAPHIC LOG	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	'N'-VALUE (0–100)	COMMENTS
0		FILL Brown coarse sand with angular gravel, damp.							MW1D-(0-2) HS=.5
1	571.23			1 SS	1 4 9 8	1.1	13	x	
2	570.23	Brick							Blows: 100/3" Drilled through to 4'
3	569.23			2 SS	100 - - -	NR			
4	568.23	Brown coarse sand with cement fragments, damp.							MW1D-(4-6) Blind duplicate: MW1D (36-38)
5	567.23			3 SS	3 4 4 5	0.3	8	x	
6	566.23	Brown sand and silt, wet. LACUSTRINE DEPOSITS Gray sandy silt, staining, wet.							MW1D-(6-8) Saturated at 6 ft.
7	565.23			4 SS	1 WOH 1 1	1.1	1	x	
8	564.23	Gray silty fine sand, wet. Gray silty fine sand with some clay, wet.							DUST=.032 mg/m3
9	563.23			5 SS	WOH WOH 3 1	1.4	3	x	
10	562.23	Gray sandy silt, wet.							
11	561.23	Gray silty sand, wet.		6 SS	WOH 2 3 2	1.6	5	x	
12	560.23	Gray clayey silt, wet. Gray silt with sand as interbedded laminae (.02-.05' thick), wet.							
13	559.23			7 SS	1 WOH 1 WOH	1.5	1	x	
14	558.23	Gray sandy silt with sand as interbedded laminae (.03-.05' thick), wet.							
15	557.23			8 SS	WOH WOH WOH WOH	2.0	0	x	
16	556.23								

BOREHOLE LOG MW-1D (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES: 101.6N 74.435E
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 4/25/90-4/26/90
DRILLING METHOD: 4.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 572.23 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)
MW1D-(4-6) Sample Submitted for Laboratory Analyses

DUST Total Dust Detected in the Work Zone (mg/m3)
x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	GRAPHIC LOG	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	'N'-VALUE (0–100)	COMMENTS
		Gray sand with some silt, wet.							DUST=.015 mg/m3
17	555.23			9 SS	WOH WOH 1 5	2.0	1		
18	554.23	Gray sand (coarsening with depth), wet.							MW1D-(18-20)
19	553.23			10 SS	1 2 4 9	1.9	6		
20	552.23	Gray (running) sand, wet.							
21	551.23			11 SS	4 2 1 6	2.0	3		
22	550.23	As above.							DUST=.016 mg/m3
23	549.23			12 SS	WOH 2 4 4	2.0	6		
24	548.23	As above.							
25	547.23			13 SS	2 2 4 3	0.8	6		
26	546.23	As above.							
27	545.23	Gray subangular gravel (.03-05' diameter) wet.		14 SS	1 19 10 7	2.0	29		
28	544.23	TILL Gray clayey silt with rounded gravel, damp.							
29	543.23	As above.		15 SS	6 8 8 6	1.4	16		
30	542.23	As above.							3" Split Spoon
31	541.23			16 SS	5 29 110 68	2.0	139		
32	540.23								

BOREHOLE LOG MW-2D (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES: 104.83N 194.265E
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 4/23/90-4/24/90
DRILLING METHOD: 4.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 574.57 ft.AMSL

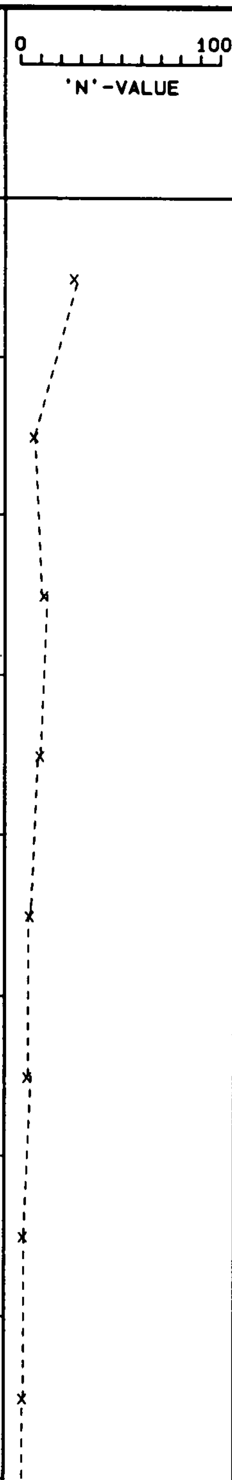
SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)
MW2D-(4-6) Sample Submitted for Laboratory Analyses

DUST Total Dust Detected in the Work Zone (mg/m3)
x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	GRAPHIC LOG	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	COMMENTS
1	573.57	FILL Reddish brown coarse sand, damp.		1 SS	2 10 17 12	0.6	27	MW2D-(0-2)
2 3	572.57 571.57	Black cinders with reddish brown silt and sand and fine gravel. Some metallic items (chains) present, damp.		2 SS	5 3 4 15	0.7	7	HS=1
4 5	570.57 569.57	Reddish brown coarse sand with silt, some gravel, some chains, damp.		3 SS	10 4 8 2	0.6	12	MW2D-(4-6) HS=1.5
6 7	568.57 567.57	Reddish brown coarse sand with silt, some gravel, some chains, damp. LACUSTRINE DEPOSITS Reddish brown silty clay, tight, dry.		4 SS	8 6 4 4	1.6	10	MW2D-(6-8) DUST=.029 mg/m3
8 9	566.57 565.57	Gray silty sand, moist, grading to- Gray sandy silt, damp.		5 SS	3 2 3 4	1.8	5	
10 11	564.57 563.57	Gray silty sand, moist. Gray silt with clay and sand asinter-bedded laminae.		6 SS	WOH WOH 4 4	1.7	4	
12 13	562.57 561.57	Gray sandy silt with sand as interbedded laminae (.05' thick), wet.		7 SS	1 1 1 1	2.0	2	Saturated at 12 ft.
14 15 16	560.57 559.57 558.57	Gray sandy silt with sand as interbedded laminae (.1-.15' thick), wet.		8 SS	2 1	2.0	2	DUST=.0238 mg/m3



BOREHOLE LOG MW-2D (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES: 104.83N 194.265E
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 4/23/90-4/24/90
DRILLING METHOD: 4.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 574.57 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery
HS Total VOC Detected in the Sample Jar Head Space (ppm)
MW2D-(4-6) Sample Submitted for Laboratory Analyses
DUST Total Dust Detected in the Work Zone (mg/m3)
x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	GRAPHIC LOG	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	'N'-VALUE (0–100)	COMMENTS
		Gray sandy silt with sand as interbedded laminae, (up to .2' thick), wet.							
17	557.57			9 SS	1 1 WOH 1	2.0	1	x	
18	556.57	As above.							DUST=.0237 mg/m3
19	555.57			10 SS	WOH WOH WOH WOH	2.0	0	x	
20	554.57	Gray silty sand, wet.							
21	553.57			11 SS	WOR 1 3 4	2.0	4	x	
22	552.57	Gray (running) sand, wet.							DUST=.023 mg/m3
23	551.57			12 SS	2 2 4 3	2.0	6	x	
24	550.57	As above.							
25	549.57			13 SS	1 2 5 3	2.0	7	x	
26	548.57	Gray (running) sand, with some small (.01-.02') gastropods (turriculate shape), wet.							DUST=.022 mg/m3
27	547.57			14 SS	3 7 6 6	2.0	13	x	
28	546.57	Gray (running) sand, sharp contact with small rounded gravel, damp.							
29	545.57			15 SS	1 8 9 11	1.8	17	x	
		TILL Brown clay with some rounded gravel, damp							
30	544.57	Reddish brown clayey silt with some small (.01') rounded gravel, damp.							
31	543.57			16 SS	1 3 9 13	1.3	12	x	
32	542.57								

BOREHOLE LOG MW-2D (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES: 104.83N 194.265E
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 4/23/90-4/24/90
DRILLING METHOD: 4.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 574.57 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)
MW2D-(4-6) Sample Submitted for Laboratory Analyses

DUST Total Dust Detected in the Work Zone (mg/m3)
x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	GRAPHIC LOG	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	'N'-VALUE (0–100)	COMMENTS
		As above.							
33	541.57			17 SS	3 6 10 12	2.0	16	x	
34	540.57	As above.							3" Split Spoon
35	539.57								
36	538.57	BOREHOLE COMPLETED TO 36.0 FT. B.G.S.							
37	537.57	REFER TO WELL CONSTRUCTION LOG FOR WELL INSTALLATION DETAILS							
38	536.57								
39	535.57								
40	534.57								
41	533.57								
42	532.57								
43	531.57								
44	530.57								
45	529.57								
46	528.57								
47	527.57								
48	526.57								

BOREHOLE LOG MW-3 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES: 451.465N -31.245E
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 4/30/90
DRILLING METHOD: 4.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 576.72 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)

MW2D-(4-6) Sample Submitted for Laboratory Analyses

DUST Total Dust Detected in the Work Zone (mg/m3)

x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	COMMENTS
		BLACKTOP					Augered through .5' blacktop-unable to collect split-spoon sample.
1	575.72	FILL Gravel, dry. Brown sand and gravel, dry.	1 SS	6	0.9	19	
2	574.72	Gravel, damp.					
3	573.72	LACUSTRINE DEPOSITS Brown and gray (mottled) sandy clay, damp Brown and gray (mottled) silty clay, damp	2 SS	3 2 1 3	1.7	3	
4	572.72	Brown and reddish brown (mottled) silty clay, damp. Brown and reddish brown (mottled) silty sand, damp.					MW3-(4-6)
5	571.72	Brown and reddish brown (mottled) clayey silt with fine sand, damp.	3 SS	2 5 3 5	1.6	8	Saturated at 5.5 ft.
6	570.72	Brown and reddish brown (mottled) silty fine sand, wet. Reddish brown silty fine sand, very moist.					
7	569.72		4 SS	6 7 6 5	1.4	13	
8	568.72	Reddish brown and light brownish gray (mottled) silty fine sand, wet.					
9	567.72	Reddish brown and light brownish gray (mottled) silty fine sand with clay, wet.	5 SS	3 4 4 4	1.6	8	
10	566.72	Reddish brown and light brown (mottled) silty fine sand, wet. Reddish brown and light brown (mottled) clayey fine sand, wet.					
11	565.72	Reddish brown and light brown (mottled) silty fine sand, wet.	6 SS	3 3 5 5	1.8	8	
12	564.72	Reddish brown and light brown (mottled) clayey fine sand, wet. Reddish brown silty fine sand, wet.					
13	563.72	Gray clayey silt with sand as inter-bedded laminae (.05-.1' thickness), wet.	7 SS	2 2 2 2	2.0	4	
14	562.72	As above.					
15	561.72		8 SS	WOH 2	1.9	3	
16	560.72						

'N'-VALUE scale: 0 – 100

MALCOLM PIRNIE, INC.

BOREHOLE LOG MW-3 (Overburden)

PROJECT: COLUMBUS McKINNON CORPORATION
PROJECT NO.: 1332-01-1
LOCATION: TONAWANDA, NEW YORK
SURVEY COORDINATES: 451.465N -31.245E
SURVEY DATUM:

CLIENT: COLUMBUS McKINNON CORPORATION
DRILLING DATES: 4/30/90
DRILLING METHOD: 4.25-inch ID HSA
LOGGED/CHECKED BY: JCS
SURFACE ELEVATION: 576.72 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2 in. ID)
WOH Weight of Hammer
WOR Weight of Rods
NR No Recovery

HS Total VOC Detected in the Sample Jar Head Space (ppm)
MW20-(4-6) Sample Submitted for Laboratory Analyses

DUST Total Dust Detected in the Work Zone (mg/m3)
x---x Penetration Resistance ('N' Blows/.5 ft.)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL DESCRIPTION	GRAPHIC LOG	SAMPLE NO. & SAMPLE TYPE	BLOWS /.5 ft	RECOVERY (ft)	'N'-VALUE	'N'-VALUE (0–100)	COMMENTS
		Gray clayey silt with many interbedded sand laminae (.05-1' thick), wet.							
17	559.72			9 SS	WOR WOH 1 3	2.0	1	x	
18	558.72	As above.							DUST=.008 mg/m3
19	557.72			10 SS	1 3 4 3	2.0	7	x	
		Gray (running) sand, wet.							
20	556.72	Gray (running) sand with silt as interbedded laminae (.005' thick), wet.							
21	555.72			11 SS	1 2 2 5	1.6	4	x	
22	554.72	As above.							
		Light reddish brown clayey silt, wet.							
23	553.72			12 SS	1 WOH 1 WOH	1.4	1	x	
24	552.72	Light reddish brown and gray (mottled) clay, some subrounded gravel, plastic, very moist.							
25	551.72			13 SS	WOH WOH 1 1	2.0	1	x	
26	550.72	As above.							
27	549.72			14 SS	WOH WOH 1 1	2.0	1	x	
28	548.72	As above.							
29	547.72			15 SS	WOH WOH WOH WOH	2.0	0	x	DUST=.013 mg/m3
30	546.72	BOREHOLE COMPLETED TO 30.0 FT. B.G.S.							
31	545.72	REFER TO WELL CONSTRUCTION LOG FOR WELL INSTALLATION DETAILS							
32	544.72								

FIELD BOREHOLE LOG

CLIENT Columbus McKinnon Corp.
PROJECT Columbus McKinnon Corp.
LOCATION Tonawanda, NY
CONTRACTOR Buffalo Drilling Co.
METHOD OF BORING: SOIL Hollow Stem Auger
ROCK
JOB NO. 1332011151
LOGGED BY JC Schiferle
CORE DIA.
BOREHOLE NO. MW-1S
STARTED 1^00 p M 4/27 19 90
FINISHED 2^20 p M 4/27 19 90
ELEVATIONS: DATUM

SAMPLE NO.	HNu (ppm) TYPE	DEPTH	BLOWS "N"	RECOVERY %	MOISTURE TIN NO.	SAMPLE DESCRIPTION: Color, Texture Classification, Compactness/Consistency, Moisture Condition, Weathering/Fracturing, Inclusions, Odor, Etc.	NOTES: Boring, Testing and Sampling Procedures, Water Loss and Gain Drilling and Testing Equipment, Etc.
						Refer to MW-1D Borehole Log for descriptions to 5 feet.	
	2	5 6	2 2 3 6	.5/2		Fill - .4 - Brown sands and angular gravels, damp .1 Red and Brown sands, wet	Saturated
	3	7 8	WOH 2 2 4	.8/2		.8 Grey silt, wet, stained, odor, sheen.	Dust = .027 mg/m³
	2	9 10	3 3 4 4	1.5/2		1.5 Grey clayey silt with some fine sand, wet, staining present to 10 ft.	Driller indicates that he in encountering a dense unit.
	1	11 12	3 2 2 2	1.4/2		1.4 Grey clayey silt with some fine sand, wet, staining present.	
	<1	13 14	1 2 3 3	1.4/2		1.4 As above, wet	Dust = .022 mg/m³
	0	15 16	WOH 1 2 6	1.4/2		1.4 Grey silt with sand interbeds (1 cm in thickness)	Augered to 16 ft.
						Refer to Well Construction Log for Well Installation Details.	

Sheet No.____of ____

MALCOLM PIRNIE

FIELD BOREHOLE LOG

CLIENT Columbus McKinnon Corp. JOB NO. 1332011.S1
PROJECT Columbus McKinnon Corp.
LOCATION Tonawanda, NY BOREHOLE NO. MW-1I
CONTRACTOR Buffalo Drilling Co. LOGGED BY JC Schiferle STARTED 2:20 p M 4/26 19 90
METHOD OF BORING: SOIL Hollow Stem Auger FINISHED 4:00 p M 4/26 19 90
ROCK ______ CORE DIA. ______ ELEVATIONS: DATUM ______

SAMPLE NO.	TYPE	DEPTH	BLOWS "N"	RECOVERY %	MOISTURE TIN NO.	SAMPLE DESCRIPTION: Color, Texture Classification, Compactness/Consistency, Moisture Condition, Weathering/Fracturing, Inclusions, Odor, Etc.	NOTES: Boring, Testing and Sampling Procedures, Water Loss and Gain, Drilling and Testing Equipment, Etc.
						Refer to MW-1D Borehole Log for descriptions to 20 feet.	Dust = .020 mg/m³
	O	20 21	2 4 4 7	1.8/2		1.3 Grey silt with sand interbeds of 1-2 cm in thickness, wet. .5 Grey (running) sand, wet	
	O	22 23	WOH 2 2 5	1.9/2		1.4 Grey silt, wet .5 Grey (running) sand, wet.	Dust = .017 mg/m³
	O	24 25	WOP 6 4 7	.5/2		.5 Grey (running) sand, wet.	
	O	26 27	14 7 8 9	1.2/2		.4 Grey (running) sand, wet. .1 Grey sand (compacted), wet. .7 Grey clayey silt with some small (.5-1.0 cm) rounded gravel, wet.	Dust = .016 mg/m³ TILL at 27.3 feet
						Refer to Well Construction Log for Well Installation details.	

Sheet No.____of ____

MALCOLM PIRNIE

FIELD BOREHOLE LOG

CLIENT Columbus McKinnon Corp.
JOB NO. 1332011151
PROJECT Columbus McKinnon Corp.
LOCATION Tonawanda, NY
BOREHOLE NO. MW-2S
CONTRACTOR Buffalo Drilling Co.
LOGGED BY JC Schiferle
STARTED 925A M 4/25 19 90
METHOD OF BORING: SOIL Hollow Stem Auger
FINISHED 1025A M 4/25 19 90
ROCK
CORE DIA.
ELEVATIONS: DATUM

SAMPLE NO.	HNu (ppm) TYPE	DEPTH	BLOWS "N"	RECOVERY %	MOISTURE TIN NO.	SAMPLE DESCRIPTION: Color, Texture Classification, Compactness/Consistency, Moisture Condition, Weathering/Fracturing, Inclusions, Odor, Etc.	NOTES: Boring, Testing and Sampling Procedures, Water Loss and Gain Drilling and Testing Equipment, Etc.
						Refer to Borehole Log (MW-2D) for descriptions to 5 feet.	
	3	5 6	2 2 2 2	1.4/2		Fill - 1.4 - Cinders, slag, gravel, coarse sand, moist	Saturated conditions at 6.9 feet.
	50	7 8	2 2 2 2	1.1/2		0.6 - Grey sandy silt with clay, v. moist. 0.5 - Grey clayey silt, tight, moist.	
	9	9 10	2 1 2 4	1.1/2		1.1 - Grey sandy silt, v. moist. some staining.	
	2	11 12	2 1 2 1	1.4/2		0.6 Grey sandy silt, wet. 0.8 Grey silt with interbeds of grey sand (.5 cm) in thickness wet.	
	1	13 14	1 WOH 1 1	1.1/2		1.1 - As above	
	0	15 16	WOH WOH 1 1	2/2		2.0 - As above	
						Refer to Well Construction Log for well installation details	Dust = .025 mg/m3 During well installation

Sheet No. ____ of ____

MALCOLM PIRNIE

2

CLIENT Columbus McKinnon Corp. **JOB NO.** 1332011151

FIELD BOREHOLE LOG

PROJECT Columbus McKinnon Corp.

LOCATION Tonawanda, NY

BOREHOLE NO. MW-2I

CONTRACTOR Buffalo Drilling Co. **LOGGED BY** JCSchiferle

STARTED 1:00 P M 4/24 19 90

FINISHED 3:20 P M 4/24 19 90

METHOD OF BORING: SOIL Hollow Stem Auger ROCK ______ **CORE DIA.** ______ **ELEVATIONS: DATUM** ______

SAMPLE NO.	TYPE (HNu ppm)	DEPTH	BLOWS "N"	RECOVERY %	MOISTURE TIN NO.	SAMPLE DESCRIPTION: Color, Texture Classification, Compactness/Consistency, Moisture Condition, Weathering/Fracturing, Inclusions, Odor, Etc.	NOTES: Boring, Testing and Sampling Procedures, Water Loss and Gain Drilling and Testing Equipment, Etc.
						Refer to MW-2D Borehole Log for descriptions to 24 feet.	Dust = .0236 mg/m3
	0	24–25	3, 3, 4, 4	2/2		1.1 - Grey sandy silt, wet. .9 - Grey sand (running), wet.	Dust = .0246 mg/m3
	0	26–27	2, 3, 6, 3	2/2		2.0 - Grey sand (running), wet.	
	0	28–30	7, 10, 12, 20	2/2		2.0 - Grey sand (running), wet	Top of till 29.4'
						Refer to well construction Log for well Installation Details.	Dust = .029 mg/m3 during well installation.

Sheet No. ____ of ____

MALCOLM PIRNIE

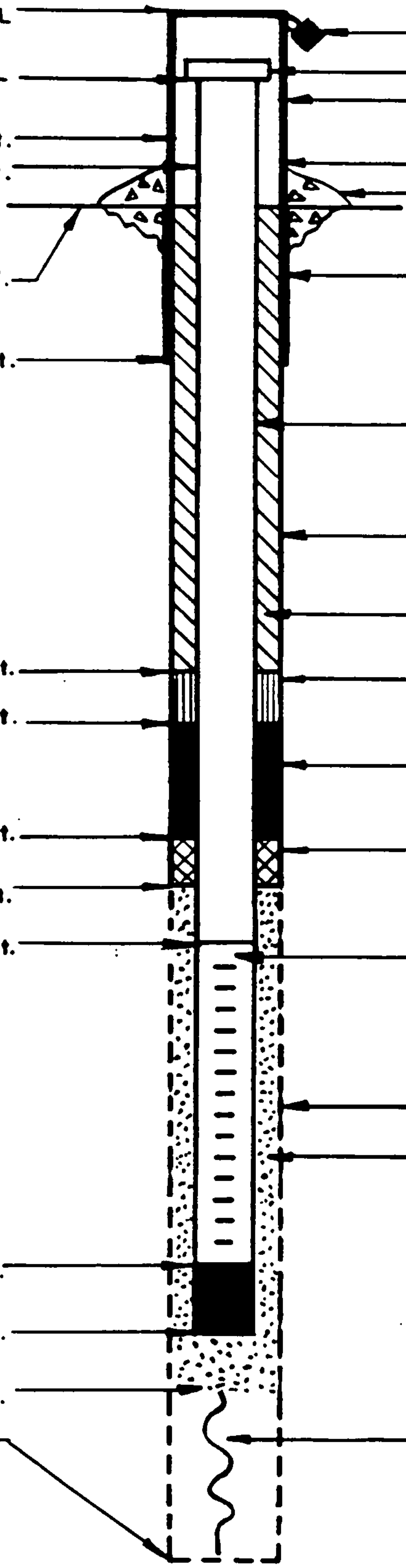
MALCOLM PIRNIE

APPENDIX B5

WELL CONSTRUCTION DIAGRAMS

MONITORING WELL CONSTRUCTION LOG

PROJECT: Columbus McKinnon
LOCATION: Tonawanda, NY
DRILLER: M. Gerstung
PROJECT NO.: 1332011
BORING: MW-1S
DRILLING METHOD: Hollow Stem Auger
GROUND ELEV.: 571.71
DATE: 4/27/90
DEVELOPMENT METHOD: Pumping + Bailing
FIELD GEOLOGIST: J. Schiferle



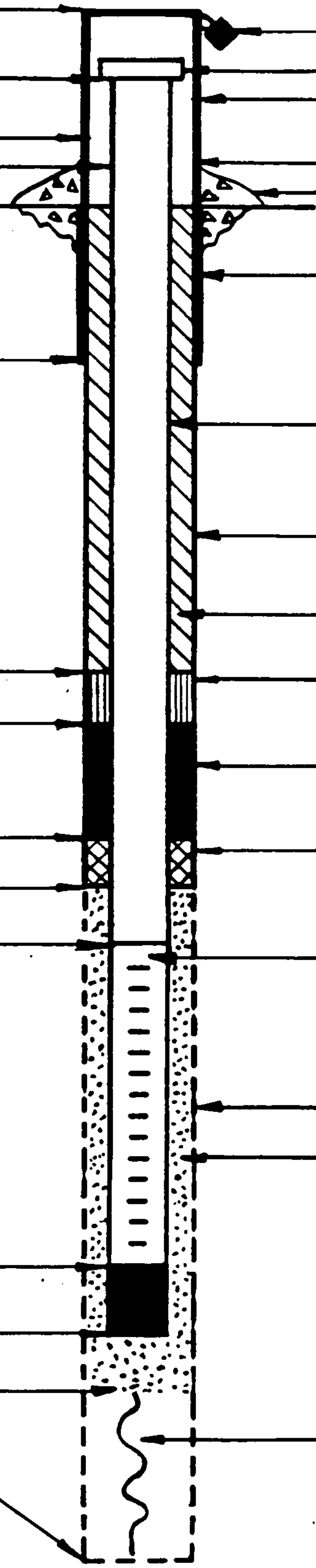
ELEV. OF TOP OF PROTECTIVE CASING: 573.77 ft. AMSL
ELEV. OF TOP OF RISER PIPE: 573.49 ft. AMSL
STICK-UP TOP OF PROTECTIVE CASING: 2.06 ft.
STICK-UP RISER PIPE: 1.78 ft.
GROUND SURFACE ELEV.
DEPTH BOTTOM OF SURFACE CASING: – ft.
DEPTH TOP OF GROUT INVASION BARRIER: – ft.
DEPTH TOP OF SEAL: 1 ft.
DEPTH TOP OF SECONDARY SAND PACK: – ft.
DEPTH TOP OF PRIMARY SAND PACK: 4 ft.
DEPTH TOP OF SCREEN 5.2 ft.
DEPTH BOTTOM OF SCREEN: 15.2 ft.
DEPTH BOTTOM OF SCREEN CAP: 15.5 ft.
DEPTH BOTTOM OF SAND PACK: 15.5 ft.
DEPTH OF HOLE: 16 ft.

LOCKING COVER
WELL CAP
I.D. x LENGTH OF PROTECTIVE CASING: 4-inch x 3 ft.
1/4" WEEP HOLE
TYPE OF SURFACE SEAL: Cement
I.D. OF SURFACE CASING: – ft.
TYPE OF SURFACE CASING:
RISER PIPE I.D. 0.16 ft.
TYPE OF RISER PIPE: stainless steel
BOREHOLE DIA.: ft.
TYPE OF BACKFILL: Cement and Bentonite Slurry
TYPE OF BARRIER: –
TYPE OF SEAL: Bentonite Pellets
TYPE OF SAND PACK: –
TYPE OF SCREEN: stainless steel
SLOT SIZE x LENGTH: .006 x 10 ft.
I.D. OF SCREEN: 0.16 ft.
BOREHOLE DIA.: 0.66 ft.
TYPE OF SAND PACK: #1 sand
TYPE OF BACKFILL BELOW OBSERVATION WELL: –

MALCOLM PIRNIE

MONITORING WELL CONSTRUCTION LOG

PROJECT: Columbus McKinnon
LOCATION: Tonawanda, NY
DRILLER: M. Gerstung
PROJECT NO.: 1332011
BORING: MW-1I
DRILLING METHOD: Hollow Stem Auger
GROUND ELEV.: 572.15
DATE: 4/26/90 - 4/27/90
FIELD GEOLOGIST: J. Schiferle
DEVELOPMENT METHOD: Pumping



ELEV. OF TOP OF PROTECTIVE CASING: 574.21 ft. AMSL

ELEV. OF TOP OF RISER PIPE: 574.07 ft. AMSL

STICK-UP TOP OF PROTECTIVE CASING: 2.06 ft.

STICK-UP RISER PIPE: 1.92 ft.

GROUND SURFACE ELEV.

DEPTH BOTTOM OF SURFACE CASING: – ft.

DEPTH TOP OF GROUT INVASION BARRIER: – ft.

DEPTH TOP OF SEAL: 16.7 ft.

DEPTH TOP OF SECONDARY SAND PACK: – ft.

DEPTH TOP OF PRIMARY SAND PACK: 19.7 ft.

DEPTH TOP OF SCREEN 21.7 ft.

DEPTH BOTTOM OF SCREEN: 26.7 ft.

DEPTH BOTTOM OF SCREEN CAP: 27 ft.

DEPTH BOTTOM OF SAND PACK: 27 ft.

DEPTH OF HOLE: 27 ft.

LOCKING COVER

WELL CAP

I.D. x LENGTH OF PROTECTIVE CASING: 4 inch x 5 ft.

1/4" WEEP HOLE

TYPE OF SURFACE SEAL: Cement

I.D. OF SURFACE CASING: – ft.

TYPE OF SURFACE CASING:

RISER PIPE I.D. 0.16 ft.

TYPE OF RISER PIPE:

BOREHOLE DIA.: 0.66 ft.

TYPE OF BACKFILL: Cement: Bentonite slurry

TYPE OF BARRIER: –

TYPE OF SEAL: Bentonite Pellets

TYPE OF SAND PACK: –

TYPE OF SCREEN: stainless steel

SLOT SIZE x LENGTH: .006 x 5 ft.

I.D. OF SCREEN: 0.16 ft.

BOREHOLE DIA.: 0.66 ft.

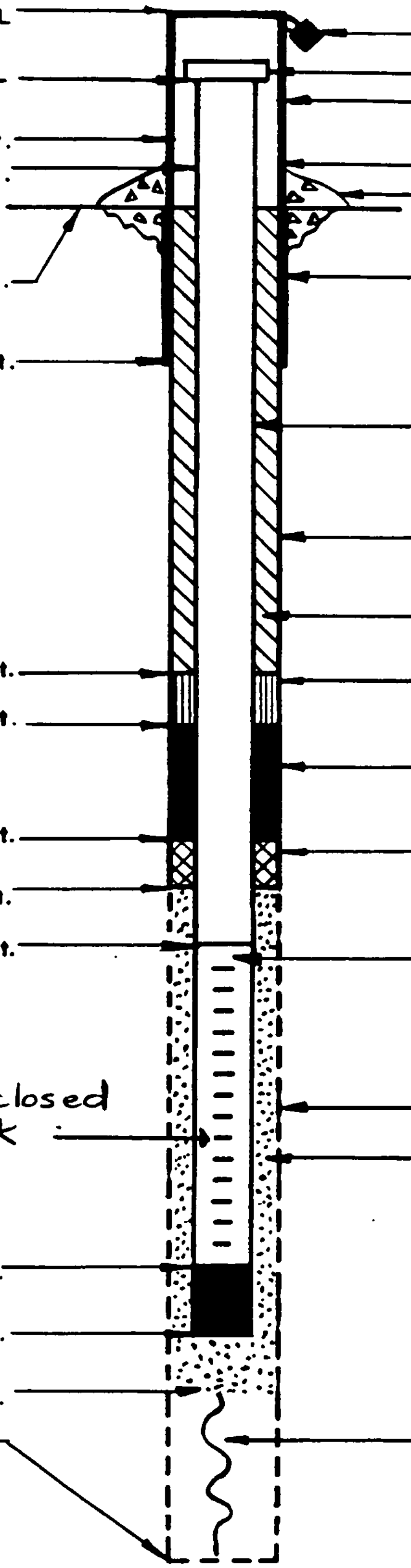
TYPE OF SAND PACK: #1 sand

TYPE OF BACKFILL BELOW OBSERVATION WELL: –

MALCOLM PIRNIE

MONITORING WELL CONSTRUCTION LOG

PROJECT: Columbus McKinnon
LOCATION: Tonawanda, NY
DRILLER: M. Gerstung
PROJECT NO.: 1332011
BORING: MW-1D
DRILLING METHOD: Hollow Stem Auger
GROUND ELEV.: 572.23
DATE: 4/25/90 - 4/26/90
FIELD GEOLOGIST: J. Schiferle
DEVELOPMENT METHOD: Bailing



ELEV. OF TOP OF PROTECTIVE CASING: 575.01 ft. AMSL
ELEV. OF TOP OF RISER PIPE: 574.80 ft. AMSL
STICK-UP TOP OF PROTECTIVE CASING: 2.78 ft.
STICK-UP RISER PIPE: 2.57 ft.
GROUND SURFACE ELEV.
DEPTH BOTTOM OF SURFACE CASING: – ft.
DEPTH TOP OF GROUT INVASION BARRIER: – ft.
DEPTH TOP OF SEAL: 26.7 ft.
DEPTH TOP OF SECONDARY SAND PACK: – ft.
DEPTH TOP OF PRIMARY SAND PACK: – ft.
DEPTH TOP OF SCREEN 29.7 ft.
Screen and cap enclosed in geotextile sock
DEPTH BOTTOM OF SCREEN: 31.7 ft.
DEPTH BOTTOM OF SCREEN CAP: 31.7 ft.
DEPTH BOTTOM OF SAND PACK: No sandpack ft.
DEPTH OF HOLE: 32 ft.

LOCKING COVER
WELL CAP
I.D. x LENGTH OF PROTECTIVE CASING: 4 inch x 5 ft.
1/4" WEEP HOLE
TYPE OF SURFACE SEAL: Cement
I.D. OF SURFACE CASING: – ft.
TYPE OF SURFACE CASING:
RISER PIPE I.D. 0.16 ft.
TYPE OF RISER PIPE: Sch. 40 PVC
BOREHOLE DIA.: 0.66 ft.
TYPE OF BACKFILL: Cement and bentonite slurry
TYPE OF BARRIER: –
TYPE OF SEAL: Bentonite Pellets
TYPE OF SAND PACK: –
TYPE OF SCREEN: PVC with geotextile sock
SLOT SIZE x LENGTH: .006 x 2 ft.
I.D. OF SCREEN: 0.16 ft.
BOREHOLE DIA.: 0.25 ft.
TYPE OF SAND PACK: None
TYPE OF BACKFILL BELOW OBSERVATION WELL: –

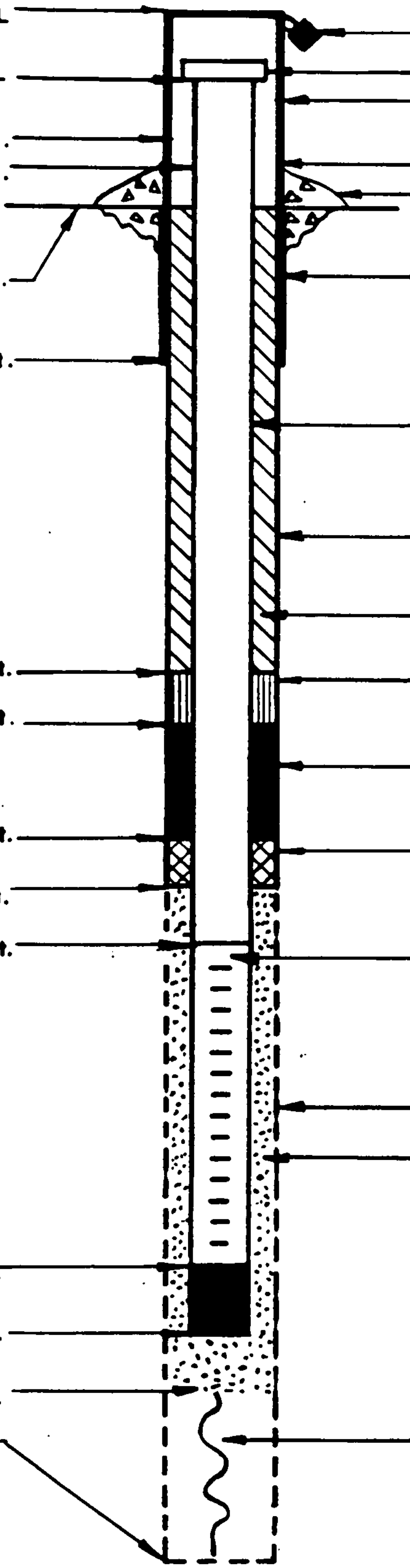
MALCOLM PIRNIE

MONITORING WELL CONSTRUCTION LOG

PROJECT: Columbus McKinnon
PROJECT NO.: 1332011
GROUND ELEV.: 574.35
FIELD GEOLOGIST: J. Schiferle

LOCATION: Tonawanda, NY
BORING: MW-2S
DATE: 4/25/90

DRILLER: M. Gerstung
DRILLING METHOD: Hollow Stem Auger
DEVELOPMENT METHOD: Pumping & Bailing



ELEV. OF TOP OF PROTECTIVE CASING: 576.27 ft. AMSL
ELEV. OF TOP OF RISER PIPE: 576.13 ft. AMSL
STICK-UP TOP OF PROTECTIVE CASING: 1.92 ft.
STICK-UP RISER PIPE: 1.78 ft.
GROUND SURFACE ELEV.
DEPTH BOTTOM OF SURFACE CASING: – ft.
DEPTH TOP OF GROUT INVASION BARRIER: – ft.
DEPTH TOP OF SEAL: 0.7 ft.
DEPTH TOP OF SECONDARY SAND PACK: – ft.
DEPTH TOP OF PRIMARY SAND PACK: 3.7 ft.
DEPTH TOP OF SCREEN 4.7 ft.
DEPTH BOTTOM OF SCREEN: 14.7 ft.
DEPTH BOTTOM OF SCREEN CAP: 15 ft.
DEPTH BOTTOM OF SAND PACK: 16 ft.
DEPTH OF HOLE: 16 ft.

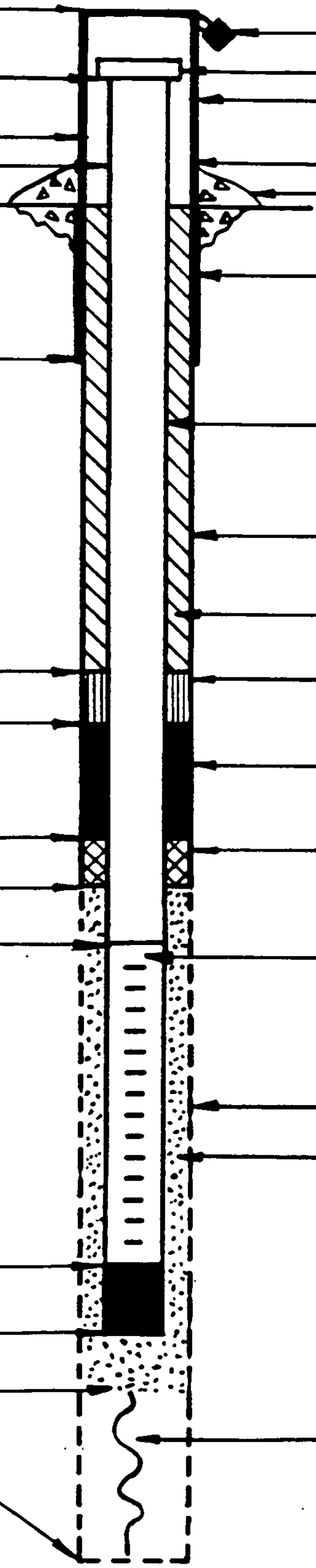
LOCKING COVER
WELL CAP
I.D. x LENGTH OF PROTECTIVE CASING: 4 inch x 3 ft.
1/4" WEEP HOLE
TYPE OF SURFACE SEAL: Cement
I.D. OF SURFACE CASING: – ft.
TYPE OF SURFACE CASING:
RISER PIPE I.D. 0.16 ft.
TYPE OF RISER PIPE: Stainless Steel
BOREHOLE DIA.: 0.16 ft.
TYPE OF BACKFILL: Cement and bentonite slurry
TYPE OF BARRIER: –
TYPE OF SEAL: Bentonite Pellets
TYPE OF SAND PACK: –
TYPE OF SCREEN: Stainless Steel
SLOT SIZE x LENGTH: .006 x 10 ft.
I.D. OF SCREEN: 0.16 ft.
BOREHOLE DIA.: 0.66 ft.
TYPE OF SAND PACK: #1 sand
TYPE OF BACKFILL BELOW OBSERVATION WELL: –

MALCOLM PIRNIE

MONITORING WELL CONSTRUCTION LOG

PROJECT: Columbus McKinnon LOCATION: Tonawanda, NY
PROJECT NO.: 1332011 BORING: MW-2I
GROUND ELEV.: 574.57 DATE: 4/24/90
FIELD GEOLOGIST: J. Schiferle

DRILLER: M. Gerstung
DRILLING METHOD: Hollow Stem Auger
DEVELOPMENT METHOD: Pumping



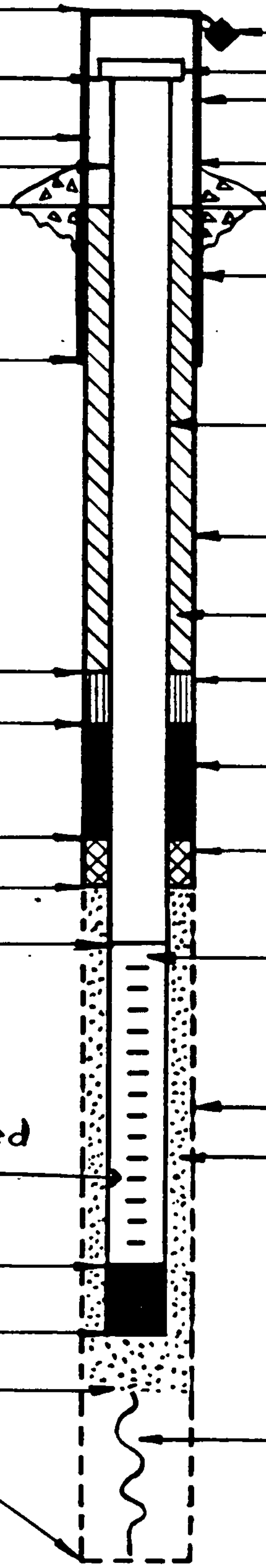
ELEV. OF TOP OF PROTECTIVE CASING: 576.51 ft. AMSL
ELEV. OF TOP OF RISER PIPE: 576.45 ft. AMSL
STICK-UP TOP OF PROTECTIVE CASING: 1.94 ft.
STICK-UP RISER PIPE: 1.88 ft.
GROUND SURFACE ELEV.
DEPTH BOTTOM OF SURFACE CASING: ______ ft.
DEPTH TOP OF GROUT INVASION BARRIER: – ft.
DEPTH TOP OF SEAL: 17.7 ft.
DEPTH TOP OF SECONDARY SAND PACK: – ft.
DEPTH TOP OF PRIMARY SAND PACK: 20.7 ft.
DEPTH TOP OF SCREEN 22.7 ft.
DEPTH BOTTOM OF SCREEN: 27.7 ft.
DEPTH BOTTOM OF SCREEN CAP: 28 ft.
DEPTH BOTTOM OF SAND PACK: 28 ft.
DEPTH OF HOLE: 28 ft.

LOCKING COVER
WELL CAP
I.D. x LENGTH OF PROTECTIVE CASING: 4 inch x 5 ft.
1/4" WEEP HOLE
TYPE OF SURFACE SEAL: Cement
I.D. OF SURFACE CASING: – ft.
TYPE OF SURFACE CASING: ______
RISER PIPE I.D. .16 ft.
TYPE OF RISER PIPE: Stainless Steel
BOREHOLE DIA.: ______ ft.
TYPE OF BACKFILL: Cement + Bentonite Slurry
TYPE OF BARRIER: –
TYPE OF SEAL: Bentonite Pellets
TYPE OF SAND PACK: –
TYPE OF SCREEN: Stainless Steel
SLOT SIZE x LENGTH: .006 x 5 ft.
I.D. OF SCREEN: 0.16 ft.
BOREHOLE DIA.: 0.66 ft.
TYPE OF SAND PACK: #1 sand
TYPE OF BACKFILL BELOW OBSERVATION WELL: –

MALCOLM PIRNIE

MONITORING WELL CONSTRUCTION LOG

PROJECT: Columbus McKinnon
LOCATION: Tonawanda, NY
DRILLER: M. Gerstung
PROJECT NO.: 1332011
BORING: MW-2D
DRILLING METHOD: Hollow Stem Auger
GROUND ELEV.: 574.57
DATE: 4/23/90 - 4/24/90
FIELD GEOLOGIST: J. Schiferle
DEVELOPMENT METHOD: Bailing



ELEV. OF TOP OF PROTECTIVE CASING 575.77 ft. AMSL

ELEV. OF TOP OF RISER PIPE: 575.69 ft. AMSL

STICK-UP TOP OF PROTECTIVE CASING: 1.2 ft.

STICK-UP RISER PIPE: 1.12 ft.

GROUND SURFACE ELEV.

DEPTH BOTTOM OF SURFACE CASING: – ft.

DEPTH TOP OF GROUT INVASION BARRIER: – ft.

DEPTH TOP OF SEAL: 30 ft.

DEPTH TOP OF SECONDARY SAND PACK: – ft.

DEPTH TOP OF PRIMARY SAND PACK: – ft.

DEPTH TOP OF SCREEN 33 ft.

Screen and cap enclosed in geotextile sock

DEPTH BOTTOM OF SCREEN: 35 ft.

DEPTH BOTTOM OF SCREEN CAP: 35 ft.

DEPTH BOTTOM OF SAND PACK: No sandpack ft.

DEPTH OF HOLE: 36 ft.

LOCKING COVER

WELL CAP

I.D. x LENGTH OF PROTECTIVE CASING: 4 inch x 5 ft.

1/4" WEEP HOLE

TYPE OF SURFACE SEAL: Cement

I.D. OF SURFACE CASING: – ft.

TYPE OF SURFACE CASING: –

RISER PIPE I.D. .16 ft.

TYPE OF RISER PIPE: Sch. 40 PVC

BOREHOLE DIA.: .66 ft.

TYPE OF BACKFILL: Cement and bentonite slurry

TYPE OF BARRIER: –

TYPE OF SEAL: Bentonite Pellets

TYPE OF SAND PACK: –

TYPE OF SCREEN: PVC with geotextile sock

SLOT SIZE x LENGTH: .006 x 2 ft.

I.D. OF SCREEN: 0.16 ft.

BOREHOLE DIA.: 0.25 ft.

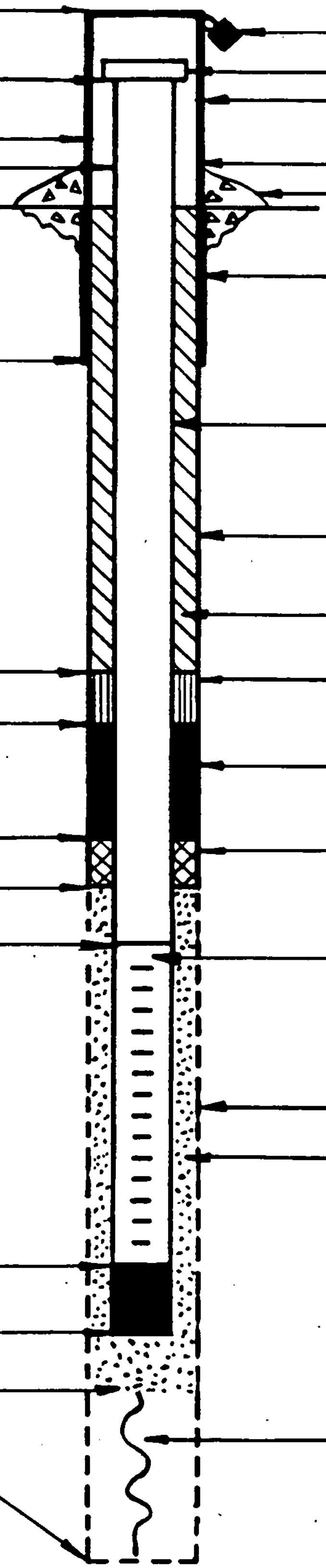
TYPE OF SAND PACK: None

TYPE OF BACKFILL BELOW OBSERVATION WELL: –

MALCOLM PIRNIE

MONITORING WELL CONSTRUCTION LOG

PROJECT: Columbus McKinnon LOCATION: Tonawanda, NY DRILLER: K. Huebert
PROJECT NO.: 1332011 BORING: MW-3 DRILLING
GROUND ELEV.: 576.72 DATE: 4/30/90 METHOD: Hollow Stem Auger
FIELD GEOLOGIST: J. Schiferle DEVELOPMENT METHOD: Pumping



ELEV. OF TOP OF PROTECTIVE CASING: 578.72 ft. AMSL
ELEV. OF TOP OF RISER PIPE: 578.56 ft. AMSL
STICK-UP TOP OF PROTECTIVE CASING: 2 ft.
STICK-UP RISER PIPE: 1.84 ft.
GROUND SURFACE ELEV.
DEPTH BOTTOM OF SURFACE CASING: – ft.
DEPTH TOP OF GROUT INVASION BARRIER: – ft.
DEPTH TOP OF SEAL: 0.7 ft.
DEPTH TOP OF SECONDARY SAND PACK: – ft.
DEPTH TOP OF PRIMARY SAND PACK: 3.7 ft.
DEPTH TOP OF SCREEN 5.7 ft.
DEPTH BOTTOM OF SCREEN: 20.7 ft.
DEPTH BOTTOM OF SCREEN CAP: 21 ft.
DEPTH BOTTOM OF SAND PACK: 21 ft.
DEPTH OF HOLE: 30 ft.

LOCKING COVER
WELL CAP
I.D. x LENGTH OF PROTECTIVE CASING: 4 inch x 3 ft.
1/4" WEEP HOLE
TYPE OF SURFACE SEAL: Cement
I.D. OF SURFACE CASING: – ft.
TYPE OF SURFACE CASING:
RISER PIPE I.D. 0.16 ft.
TYPE OF RISER PIPE: stainless steel
BOREHOLE DIA.: 0.66 ft.
TYPE OF BACKFILL: Cement and Bentonite slurry
TYPE OF BARRIER: –
TYPE OF SEAL: Bentonite Pellets
TYPE OF SAND PACK: –
TYPE OF SCREEN: stainless steel
SLOT SIZE x LENGTH: .006 x 15 ft.
I.D. OF SCREEN: 0.16 ft.
BOREHOLE DIA.: 0.66 ft.
TYPE OF SAND PACK: #1 sand
TYPE OF BACKFILL BELOW OBSERVATION WELL: #1 sand

MALCOLM PIRNIE

MALCOLM PIRNIE

APPENDIX B6

WELL DEVELOPMENT LOGS

WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: Columbus McKinnon Corp.

PROJECT NO.: 133201151

STAFF: JC Schiferle

DATE: 5/9/90

WELL NO.: MW-1S

① TOTAL CASING AND SCREEN LENGTH (FT.): 18

② CASING INTERNAL DIAMETER (in.): 2"

③ WATER LEVEL BELOW TOP OF CASING (FT.) 6.84

④ VOLUME OF WATER IN CASING (GAL.) 1.82

$V = 0.0408 (②)^2 \times (① - ③) =$ 1.82 GAL.

WELL I.D.	VOL. GAL./FT.
1"	0.04
(2")	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)										
	2	4	6								
pH ↕		840	700								
conductivity		8.1	8								
Temp °C.		11	11								

COMMENTS: Water did not completely clear during well development, unable to develop well completely due to slow recharge. Honda centrifugal pump and dedicated pvc 3/4" used for well evacuation.

MALCOLM PIRNIE

WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: Columbus McKinnon Corp.

PROJECT NO.: 1332011151

STAFF: JC Schiferle

DATE: 5/8/90

WELL NO.: MW-11

① TOTAL CASING AND SCREEN LENGTH (FT.): 29

② CASING INTERNAL DIAMETER (in.): 2"

③ WATER LEVEL BELOW TOP OF CASING (FT.) 6.38

④ VOLUME OF WATER IN CASING (GAL.) 3.68

V = 0.0408 (②)^2 x (① - ③) = 3.68 GAL.

WELL I.D.	VOL. GAL./FT.
1"	0.04
(2")	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)									
	15	20	25	30	35	40	45	50	55	60	
pH	7.0	7.0	6.9	7.1	7.0	7.0	7.2	7.1	7.0	7.1	
conductivity	1350	1270	1270	1260	1270	1260	1270	1280	1260	1270	
Temp.	12.5	12.5	12	12	12	12	12	12	12	12	

COMMENTS: Well was developed until water remained clear. Water cleared after pumping approx. 2 gal. Used Honda centrifugal pump and dedicated pvc (3/4") pipe for well evacuation.

MALCOLM PIRNIE

WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: Columbus McKinnon

PROJECT NO.: 1332.011.151

STAFF: J. Schiferle R. Dubisz

DATE: 5/15/90

WELL NO.: MW-1D

① TOTAL CASING AND SCREEN LENGTH (FT.): 34

② CASING INTERNAL DIAMETER (in.): 2"

③ WATER LEVEL BELOW TOP OF CASING (FT.) 7.28

④ VOLUME OF WATER IN CASING (GAL.) 4.02 gal

$V = 0.0408\,(②)^2 \times (① - ③) =$ 4.02 GAL.

WELL I.D.	VOL. GAL./FT.
1"	0.04
(2")	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)										
	1gal	4gal (Bailed dry)									
pH	11.66										
Conductivity	1042										
Temp.	12.7										

COMMENTS:

MALCOLM PIRNIE

WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: Columbus McKinnon Corp.

PROJECT NO.: 133201151

STAFF: JCSchiferle

DATE: May 8, 1990 and May 9, 1990

WELL NO.: MW 2-S

① TOTAL CASING AND SCREEN LENGTH (FT.): 18

② CASING INTERNAL DIAMETER (in.): 2"

③ WATER LEVEL BELOW TOP OF CASING (FT.) 9.10

④ VOLUME OF WATER IN CASING (GAL.) 1.45

$V = 0.0408 (②)^2 \times (① - ③) =$ 1.45 GAL.

WELL I.D.	VOL. GAL./FT.
1"	0.04
2"	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)										
	2	4	6	8	10	12	14				
pH	7.1	7.0	7.2	7.0	7.1	7.2	7.0				
conductivity	1295	1270	1485	1270	1400	1335	1310				
Temp	11.5	11.5	11.	11.	11.	11.	11.				

COMMENTS: Water did not completely clear during well dvpt. - however ~~the~~ upon completion of development ~~the~~ fines had been removed to the extent that all silt/sand was removed from the base of the well. Fines present in the purge water are likely a result of the glaciolacustrine sediments into which the screen is set.
Development was conducted with a Honda centrifugal pump and dedicated (3/4") pvc pipet bailing.

MALCOLM PIRNIE

WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: Columbus McKinnon

PROJECT NO.: 13320 11.151

STAFF: JC Schiferle

DATE: May 8, 1990

WELL NO.: MW-2I

① TOTAL CASING AND SCREEN LENGTH (FT.): 30

② CASING INTERNAL DIAMETER (in.): 2"

③ WATER LEVEL BELOW TOP OF CASING (FT.) 9.00'

④ VOLUME OF WATER IN CASING (GAL.) 3.57

$V = 0.0408 (②)^2 \times (① - ③) = \approx 3.57$ GAL.

WELL I.D.	VOL. GAL./FT.
1"	0.04
(2")	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)										
	5	10	15	20	25	30	35	40	45	50	55
pH	6.7	7.3	7.0	7.1	7.0	6.9	7.0	7.0	7.1	7.0	7.0
conductivity	830	970	1070	1210	1190	1220	1270	1270	1300	1345	1300
Temp.	12.5	12.5	12.5	12.	12.	12.	12.	12.	12.	12	12

COMMENTS: The well was developed until purged water was clear. Clear after approx 20 gals. Used Honda centrifugal pump and dedicated pvc pipe (3/4") for well evacuation.

MALCOLM PIRNIE

WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: Columbus McKinnon Corp.

PROJECT NO.: 1332011 151

STAFF: J. Schiferle R. Dubisz

DATE: 5/15/96

WELL NO.: MW-1 2D

		WELL I.D.	VOL. GAL./FT.
① TOTAL CASING AND SCREEN LENGTH (FT.):	38	1"	0.04
② CASING INTERNAL DIAMETER (in.):	2"	(2")	0.17
		3"	0.38
③ WATER LEVEL BELOW TOP OF CASING (FT.)	21.47	4"	0.66
		5"	1.04
④ VOLUME OF WATER IN CASING (GAL.)	2.36	6"	1.50
		8"	2.60

$V = 0.0408\,(②)^2 \times (① - ③) =$ 2.36 GAL.

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)										
	3										
pH	12.37										
Conductivity	5150										
temp.	13.9°										

COMMENTS: Unable to lift with centrifugal pump & unable to use surge block (ID too small). Used teflon bailer to purge. Bailed dry - slow recharge.

MALCOLM PIRNIE

WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: Columbus McKinnon Corp.

PROJECT NO.: 1332011 151

STAFF: JC Schiferle

DATE: 5/8/90 and 5/9/90

WELL NO.: MW-3

① TOTAL CASING AND SCREEN LENGTH (FT.): 23

② CASING INTERNAL DIAMETER (in.): 2"

③ WATER LEVEL BELOW TOP OF CASING (FT.) 7.02'

④ VOLUME OF WATER IN CASING (GAL.) 2.60

$V = 0.0408\,(②)^2 \times (① - ③)$ = 2.60 GAL.

WELL I.D.	VOL. GAL./FT.
1"	0.04
2" (circled)	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)									
	5	10	15	20	25	30	35	~~40~~	~~45~~		
pH	7.5	7.9	7.5	7.4	7.2	7.0	7.2				
conductivity	990	905	1000	1020	1070	1130	1060				
Temp. °C	10	10	10	9	9	9	9				

COMMENTS: ~~Water~~ Well was developed until water was consistently clear. Water cleared after pumping approx. 28 gals. Used a Honda centrifugal pump and dedicated pvc (3/4") pipe for well evacuation.

MALCOLM PIRNIE

MALCOLM PIRNIE

APPENDIX B7

GROUND WATER SAMPLING FIELD LOGS FOR THE MAY 1990 SAMPLING EVENT

WATER SAMPLING FIELD DATA SHEET

PROJECT: Columbus McKinnon
CLIENT: Columbus McKinnon
JOB NO.: 1332011151

TYPE OF SAMPLE: Groundwater
LOCATION NO.: MW-15
LAB SAMPLE NO.:

WELL DATA: DATE: 5/18/90 TIME: 1600

Casing Diameter (inches): 2-inch
Casing Material: Stainless Steel
Screened Interval (ft BGS): 5.2 - 15.2
Screen Material: Stainless Steel
Static Water Level Below TOR (ft): 6.50
Bottom Depth (ft): 15.5 ft.
Elevation Top of Well Riser:
Datum Ground Surface:

NO PRODUCT detected

PURGING DATA: DATE: 5/18/90 TIME: Start: 1125 Finish: 1420

Method: Teflon Bailer
Pumping Rate (gal/min): bailing
Well Volumes Purged ($V=\pi R^2 H/231$): 1.65
Was well purged dry? X Yes ___ No
Standing Volume (gal): 1.53
Was well purged below sand pack? X Yes ___ No
Volume Purged (gal): 2.5 gal

Well I.D. (inches)	Volume (gal/ft)
2	0.17
4	0.66
6	1.50

Is purging equipment dedicated to sample location? Yes ___ No X
Field Personnel: J. Schiferle - D. Malucci

SAMPLING DATA: DATE: 5/18/90 TIME: Start: 1420 Finish: 1430

Method: Bailing
Sampler(s): J. Schiferle - D. Malucci
Present Water Level (ft): 6.88
Air Temperature (°F): 52°
Depth of Sample (ft): Top of water column
Weather Conditions: Overcast, cool
Is sampling equipment dedicated to sample location? Yes ___ No X

PRESERVATION DATA: DATE: 5/18/90 TIME: Start: 1430 Finish: 1430

Filtered: ___ Yes X No
Cool to 4°C: Packed in ice until receipt at lab.
Preservative: ___ H_2SO_4 X HNO_3 ___ NaOH ___ Other
metals only

PHYSICAL AND CHEMICAL DATA:

Appearance: Clear: ___ Turbid: X Color: brown
Contains Sediment: silt Odor: ___ Other: some sheen noted
Temperature (°C): 11.3 pH: 7.27 Specific Conductivity (µmhos/cm): 565
Turbidity (NTU): 30 - Diluted 4ml to 50 ml w/ DI H_2O Other:

REMARKS: Split sample with NYDEC scientist, Kevin Glosser.

MALCOLM PIRNIE

WATER SAMPLING FIELD DATA SHEET

PROJECT: Columbus McKinnon Corp.
CLIENT: Columbus McKinnon Corp
JOB NO.: 1332011151
TYPE OF SAMPLE: Ground water
LOCATION NO.: MW-1I
LAB SAMPLE NO.: ____

WELL DATA: DATE: 5/18/90 TIME: 1000
Casing Diameter (inches): 2-inch
Casing Material: stainless steel
Screened Interval (ft BGS): 21.7 - 26.7
Screen Material: stainless steel
Static Water Level Below TOR (ft): 5.51
Bottom Depth (ft): 27
Elevation Top of Well Riser: ____
Datum Ground Surface: ____
NO PRODUCT detected

PURGING DATA: DATE: 5/18/90 TIME: Start: 14.30 Finish: 1500
Method: Teflon Bailer
Pumping Rate (gal/min): bailing
Well Volumes Purged ($V=\pi R^2H/231$): 3.28
Was well purged dry? ____ Yes X No
Standing Volume (gal): 3.65 gal
Was well purged below sand pack? ____ Yes X No
Volume Purged (gal): 12 gal

Well I.D. (inches)	Volume (gal/ft)
2	0.17
4	0.66
6	1.50

Is purging equipment dedicated to sample location? Yes ____ No X
Field Personnel: J. Schifferle, D. Malucci

SAMPLING DATA: DATE: 5/18/90 TIME: Start: 1500 Finish: 1520
Method: Bailing
Sampler: J. Schiferle / D. Malucci
Present Water Level (ft): 6.05
Air Temperature (°F): 52 °F
Depth of Sample (ft): Top of water column
Weather Conditions: Cloudy, cool
Is sampling equipment dedicated to sample location? Yes ____ No X

PRESERVATION DATA: DATE: 5/18/90 TIME: Start: 1520 Finish: 1526
Filtered: ____ Yes X No
Cool to 4°C: Packed on ice until receipt at lab
Preservative: ____ H_2SO_4 X HNO_3 (Metals only) ____ NaOH ____ Other

PHYSICAL AND CHEMICAL DATA:
Appearance: Clear: X Turbid: ____ Color: ____
Contains Sediment: ____ Odor: ____ Other: ____
Temperature (°C): 12.4 pH: 6.85 Specific Conductivity (µmhos/cm): 1300
Turbidity (NTU): 50 Other: ____

REMARKS: Collected ~~do~~ triplicate volume from this well. Used extra volume for MS/MSD and for blind field duplicate (MW-4). Collected Equipment blank (EB-7) from bailer used for purging + sampling of this well.
Split sample with NYDEC scientist, Kevin Glaser

MALCOLM PIRNIE

WATER SAMPLING FIELD DATA SHEET

PROJECT: Columbus McKinnon
CLIENT: Columbus McKinnon
JOB NO.: 1332011151

TYPE OF SAMPLE: Ground Water
LOCATION NO.: MW-25
LAB SAMPLE NO.:

WELL DATA: DATE: 5/18/90 TIME: 1100

Casing Diameter (inches): 2-inch
Casing Material: Stainless steel
Screened Interval (ft BGS): 4.7 - 14.7
Screen Material: Stainless Steel
Static Water Level Below TOR (ft): 8.41
Bottom Depth (ft): ~~14.7~~ 15
Elevation Top of Well Riser:
Datum Ground Surface:
NO PRODUCT detected

PURGING DATA: DATE: 5/18/90 TIME: Start: 1130 Finish: 1230

Method: Teflon Bailer
Pumping Rate (gal/min): bailing
Well Volumes Purged ($V=\pi R^2H/231$): 2.23
Was well purged dry? X Yes ___ No
Standing Volume (gal): 1.12
Was well purged below sand pack? X Yes ___ No
Volume Purged (gal): 2.5 gal

Well I.D. (inches)	Volume (gal/ft)
2	0.17
4	0.66
6	1.50

Is purging equipment dedicated to sample location?
Yes ___ No X
Field Personnel: J. Schiferle / D. Malucci

SAMPLING DATA: DATE: 5/18/90 TIME: Start: 1536 Finish: 1542

Method: bailing
Sampler: J. Schiferle / D. Malucci
Present Water Level (ft): 8.70'
Air Temperature (°F): 52°F
Depth of Sample (ft): top of water column
Weather Conditions: Cloudy, cool
Is sampling equipment dedicated to sample location? Yes ___ No X

PRESERVATION DATA: DATE: 5/18/90 TIME: Start: 1545 Finish: 1545

Filtered: ___ Yes X No
Cool to 4°C: Packed on ice until receipt at lab.
Preservative: ___ H_2SO_4 X HNO_3 ___ NaOH ___ Other
Metals only

PHYSICAL AND CHEMICAL DATA:

Appearance: Clear: ___ Turbid: X Color: ___
Contains Sediment: silt Odor: ___ Other: ___
Temperature (°C): 11.6 pH: 7.06 Specific Conductivity (umhos/cm): 1490
Turbidity (NTU): 37 - Diluted 2ml to 50ml w/DI H_2O Other:

REMARKS:

MALCOLM PIRNIE

WATER SAMPLING FIELD DATA SHEET

PROJECT: Columbus McKinnon
CLIENT: Columbus McKinnon
JOB NO.: 1332011151

TYPE OF SAMPLE: Ground Water
LOCATION NO.: MW-2I
LAB SAMPLE NO.:

WELL DATA: DATE: 5/18/90 TIME: 1100

Casing Diameter (inches): 2-inch
Casing Material: stainless steel
Screened Interval (ft BGS): 22.7 - 27.7
Screen Material: stainless steel
Static Water Level Below TOR (ft): 8.05
Bottom Depth (ft): 28
Elevation Top of Well Riser:
Datum Ground Surface:

No Product detected

PURGING DATA: DATE: 5/18/90 TIME: Start: 1145 Finish: 1230

Method: Teflon bailer
Pumping Rate (gal/min): bailing
Well Volumes Purged ($V = \pi R^2 H/231$): 3 + volumes
Was well purged dry? ____ Yes X No
Standing Volume (gal): ≈ 3.39
Was well purged below sand pack? ____ Yes X No
Volume Purged (gal): 11 +

Well I.D. (inches)	Volume (gal/ft)
2	0.17
4	0.66
6	1.50

Is purging equipment dedicated to sample location?
Yes ____ No X
Field Personnel: J. Schiferle / D. Malucci

SAMPLING DATA: DATE: 5/18/90 TIME: Start: 1230 Finish: 1240

Method: bailing
Sampler: J. Schiferle / D. Malucci
Present Water Level (ft): ≈ 8.5'
Air Temperature (°F): 52 °F
Depth of Sample (ft): top of water column
Weather Conditions: Cloudy, cool
Is sampling equipment dedicated to sample location? Yes ____ No X

PRESERVATION DATA: DATE: 5/18/90 TIME: Start: 1240 Finish: 1240

Filtered: ____ Yes X No
Cool to 4°C: Packed on ice until shipment to lab.
Preservative: ____ H_2SO_4 X HNO_3 ____ NaOH ____ Other
Metals ONLY

PHYSICAL AND CHEMICAL DATA:

Appearance: Clear: X Turbid: ____ Color: ____
Contains Sediment: ____ Odor: ____ Other: ____
Temperature (°C): 12 pH: 6.87 Specific Conductivity (µmhos/cm): 1275
Turbidity (NTU): 34 Other:

REMARKS:

MALCOLM PIRNIE

WATER SAMPLING FIELD DATA SHEET

PROJECT: Columbus McKinnon
CLIENT: Columbus McKinnon
JOB NO.: 1332011151

TYPE OF SAMPLE: Ground Water
LOCATION NO.: MW-3
LAB SAMPLE NO.:

WELL DATA: DATE: 5/18/90 TIME: 0855

Casing Diameter (inches): 2-inch
Casing Material: Stainless Steel
Screened Interval (ft BGS): 5.7 - 20.7
Screen Material: Stainless Steel
Static Water Level Below TOR (ft): 6.05
Bottom Depth (ft): 21
Elevation Top of Well Riser:
Datum Ground Surface:

no Product detected

PURGING DATA: DATE: 5/18/90 TIME: Start: 0855 Finish: 0945

Method: Teflon bailer
Pumping Rate (gal/min): bailing
Well Volumes Purged ($V=\pi R^2H/231$): 4.7
Was well purged dry? ___ Yes X No
Standing Volume (gal): 2.55
Was well purged below sand pack? X Yes ___ No
Volume Purged (gal): 12 gal

Well I.D. (inches)	Volume (gal/ft)
2	0.17
4	0.66
6	1.50

Is purging equipment dedicated to sample location?
Yes ___ No X

Field Personnel: J. Schiferle / D. Malucci

SAMPLING DATA: DATE: 5/18/90 TIME: Start: 0945 Finish: 0958

Method: Bailing
Sampler: J. Schiferle / D. Malucci
Present Water Level (ft): 7.05
Air Temperature (°F): 52° F
Depth of Sample (ft): Top of water column
Weather Conditions: Cloudy, cool
Is sampling equipment dedicated to sample location? Yes ___ No X

PRESERVATION DATA: DATE: 5/18/90 TIME: Start: 0958 Finish: 1000

Filtered: ___ Yes X No
Cool to 4°C: Packed on ice for shipment to lab.
Preservative: ___ H_2SO_4 X HNO_3 (Metals only) ___ NaOH ___ Other

PHYSICAL AND CHEMICAL DATA:

Appearance: Clear: ___ Turbid: slightly turbid Color: ___
Contains Sediment: silt Odor: ___ Other: ___
Temperature (°C): 9.6 pH: 7.07 Specific Conductivity (µmhos/cm): 1020
Turbidity (NTU): 15 - Diluted 2ml to 16 ml w/ DI water Other: ___

REMARKS: Split sample with NYDEC Scientist, Kevin Gleisser.

MALCOLM PIRNIE

MALCOLM PIRNIE

APPENDIX C

CALCULATIONS

C1 Hydraulic Conductivity Testing Data
C2 Soil Loss Calculations
C3 Contaminant Loading to Ellicott Creek via Soil Erosion and Ground Water

MALCOLM PIRNIE

APPENDIX C1

HYDRAULIC CONDUCTIVITY TESTING DATA

FIELD SLUG TEST LOG

PROJECT:

CLIENT: COLUMBUS MCKINNON — WELL/BOREHOLE NO.: MW-15

JOB NO.: 1332-01-1 — COMPLETED BY: JCS/RHO

WELL/BOREHOLE DETAILS:

Installation Date: — Ground Elevation: 571.71 ft. AMSL

Reference Point (RP): — RP Elevation: 573.49 ft. AMSL

Stratigraphic Unit Monitored: LACUSTRINE SAND AND SILT

Hydrostratigraphic Unit Monitored: SHALLOW WATER BEARING ZONE

Slug Test Method: BOWER AND RICE (1976)

Riser Length: 7.0 ft. Riser I.D.: .17 ft. Riser Material: STAINLESS

Screen Length: 10.0 ft. Screen I.D.: .17 ft. Screen Material: STAINLESS Slot: .006"

SATURATED L (Length of Sand Pack) 9.8 ft. r_s (Radius of Borehole at Screen) .333 ft. r_c (Radius of Screen) .083* ft.

Slug Dimensions or Volume: * SEE BELOW

TEST:

Start Date: 5/30/90 — Static Level (H): 7.17 ft. BRP

Start Time (To): 14:18 — Initial Pressure Head (Ho): 7.95 ft. BRP

Will Water Level Remain Above the Screen During the Test? (Yes) ____ (No) X

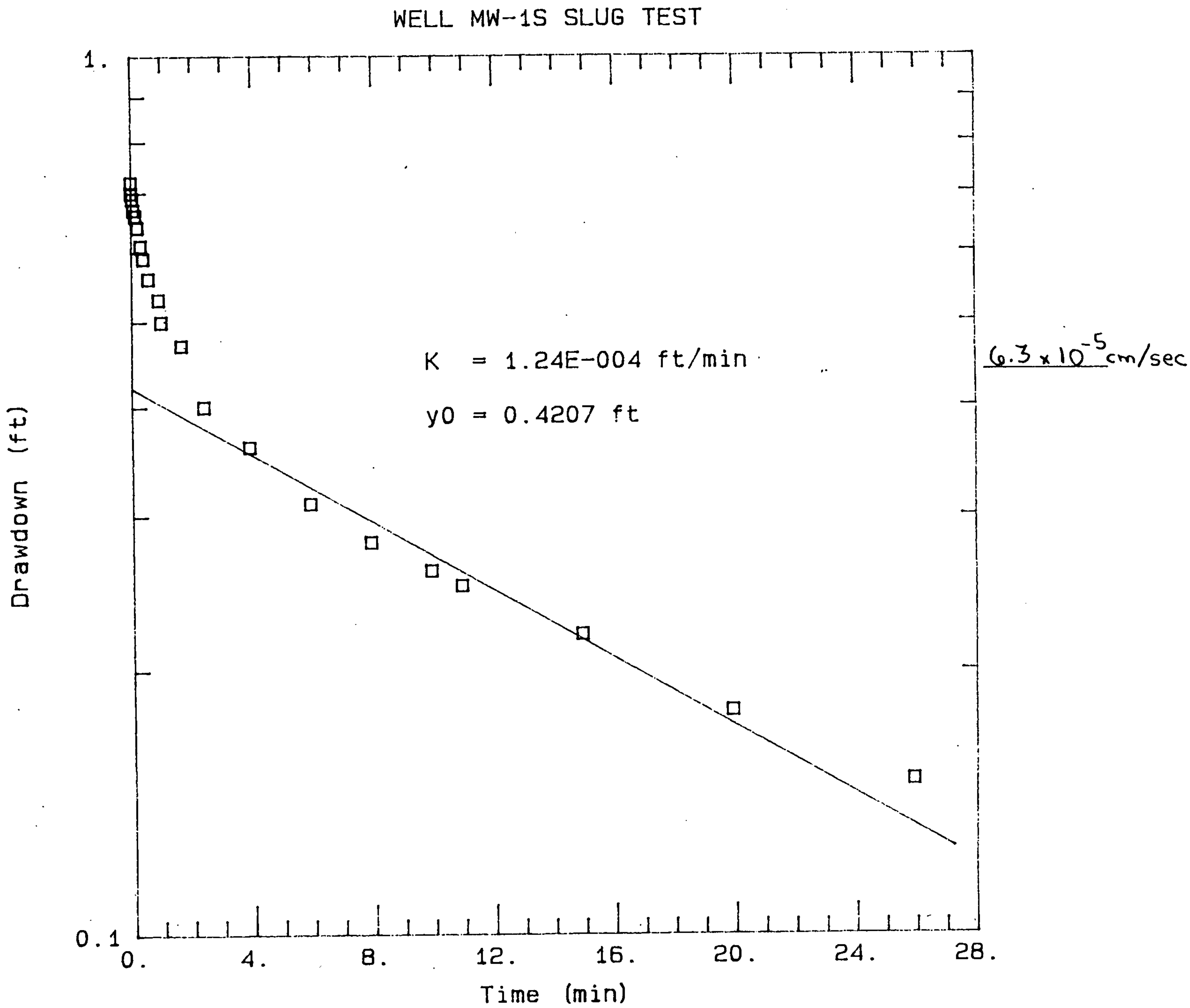
CLOCK TIME	ELAPSED TIME t(min)	DEPTH H(ft. BRP)	H-h (ft.)	H-h / H-Ho	CLOCK TIME	ELAPSED TIME t(min)	DEPTH h(ft. BRP)	H-h (ft.)	H-h / H-Ho
	.010	7.89				3.40	7.54		
	.017	7.87				4.40	7.51		
	.050	7.86				5.90	7.48		
	.083	7.84				6.90	7.46		
	.150	7.83				7.90	7.45		
	.217	7.81				10.90	7.42		
	.317	7.78				14.90	7.39		
	.483	7.75				19.90	7.35		
	.567	7.73				25.90	7.32		
	.733	7.72							
	.90	7.70							
	1.15	7.67							
	1.483	7.65							
	1.817	7.62							
	2.40	7.57							

COMMENTS: SAND PACK PARTIALLY SATURATED ∴ CALCULATE EFFECTIVE r_c (r_{eff})

$r_{eff} = r_c + n(r_s - r_c)$

$= .083' + (.30)(.333 - .083) = .158'$

MALCOLM PIRNIE



WELL MW-1S SLUG TEST
K = 1.24E-004 ft/min
y0 = 0.4207 ft
6.3 x 10^-5 cm/sec
Drawdown (ft)
Time (min)
1.
0.1
0.
4.
8.
12.
16.
20.
24.
28.

WEll MW-1S

SE1000B
Environmental Logger
05/30 16:41

Unit# 00554 Test# 3

INPUT 1: Level (F) TOC

Reference 7.17
Scale factor 49.82
Offset 0.00

Step# 0 05/29 14:18

Elapsed Time	Value
0.0000	7.17
0.0033	7.20
0.0066	7.21
0.0099	7.23
0.0133	7.23
0.0166	7.23
0.0200	7.23
0.0233	7.23
0.0266	7.23
0.0300	7.23
0.0333	7.24
0.0500	9.82
0.0666	7.20
0.0833	7.95
0.1000	7.89
0.1166	7.87
0.1333	7.87
0.1500	7.86
0.1666	7.86
0.1833	7.84
0.2000	7.84
0.2166	7.84
0.2333	7.84
0.2500	7.83
0.2666	7.83
0.2833	7.83
0.3000	7.83
0.3166	7.81
0.3333	7.81
0.4167	7.78
0.5000	7.76
0.5833	7.75
0.6667	7.73
0.7500	7.73
0.8333	7.72
0.9167	7.72
1.0000	7.70
1.0833	7.68
1.1667	7.68
1.2500	7.67
1.3333	7.67
1.4166	7.67
1.5000	7.67
1.5833	7.65
1.6667	7.65
1.7500	7.64
1.8333	7.64
1.9167	7.62
2.0000	7.64
2.5000	7.57
3.0000	7.56
3.5000	7.54
4.0000	7.53
4.5000	7.51
5.0000	7.50
5.5000	7.50
6.0000	7.48
6.5000	7.48
7.0000	7.46
7.5000	7.46
8.0000	7.45
8.5000	7.45
9.0000	7.45
9.5000	7.45
10.0000	7.43
11.0000	7.42
12.0000	7.42
13.0000	7.40
14.0000	7.40
15.0000	7.39
16.0000	7.39
17.0000	7.39
18.0000	7.37
19.0000	7.37
20.0000	7.35
21.0000	7.35
22.0000	7.34
23.0000	7.34
24.0000	7.35
25.0000	7.34
26.0000	7.32
27.0000	7.32
28.0000	7.32
29.0000	7.32
30.0000	7.31
31.0000	7.32
32.0000	7.31
33.0000	7.32
34.0000	7.32
35.0000	7.32
36.0000	7.32
37.0000	7.32
38.0000	7.31

END

FIELD SLUG TEST LOG

PROJECT:

CLIENT: COLUMBUS MCKINNON

WELL/BOREHOLE NO.: MW-25

JOB NO.: 1333-01-1

COMPLETED BY: JCS / RHO

WELL/BOREHOLE DETAILS:

Installation Date:

Ground Elevation: 574.35 ft. AMSL

Reference Point (RP):

RP Elevation: 576.13 ft. AMSL

Stratigraphic Unit Monitored: LACUSTRINE SILT AND SAND

Hydrostratigraphic Unit Monitored: SHALLOW WATER BEARING ZONE

Slug Test Method: BOUWER & RICE (1976)

Riser Length: 6.5 ft. Riser I.D.: .17 ft. Riser Material: STAINLESS

Screen Length: 10 ft. Screen I.D.: .17 ft. Screen Material: STAINLESS Slot: .006"

(SATURATED: 8.5 ft)

L (Length of Sand Pack) 12.3 ft. r_s (Radius of Borehole at Screen) .333 ft. r_c (Radius of Screen) * ft.

Slug Dimensions or Volume 2 ft Slug

TEST:

Start Date: 5/29/90

Static Level (H): 9.28 ft. BRP

Start Time (To): 11:58

Initial Pressure Head (Ho): 10.08 ft. BRP

Will Water Level Remain Above the Screen During the Test? (Yes) ______ (No) X

CLOCK TIME	ELAPSED TIME t(min)	DEPTH H(ft. BRP)	H-h (ft.)	H-h / H-Ho	CLOCK TIME	ELAPSED TIME t(min)	DEPTH h(ft. BRP)	H-h (ft.)	H-h / H-Ho
	.013	10.05	.77			3.90	9.76	.48	
	.067	10.03	.75			4.90	9.73	.45	
	.150	10.02	.74			5.90	9.70	.42	
	.233	10.00	.72			6.90	9.67	.39	
	.317	9.99	.71			8.40	9.64	.36	
	.483	9.97	.69			9.90	9.61	.33	
	.567	9.95	.67			11.90	9.57	.29	
	.817	9.94	.66			14.90	9.54	.26	
	.983	9.92	.64			17.90	9.51	.23	
	1.233	9.91	.63			19.90	9.50	.22	
	1.483	9.89	.61						
	1.733	9.87	.59						
	2.40	9.84	.56						
	2.90	9.81	.53						
	3.40	9.80	.52						

COMMENTS: * SAND PACK PARTIALLY SATURATED ∴ EFFECTIVE r_c (r_{eff})

$r_{eff} = r_c + n(r_s + r_c)$

$= .083' + .30(.333' - .083') = 0.158'$ where n = porosity

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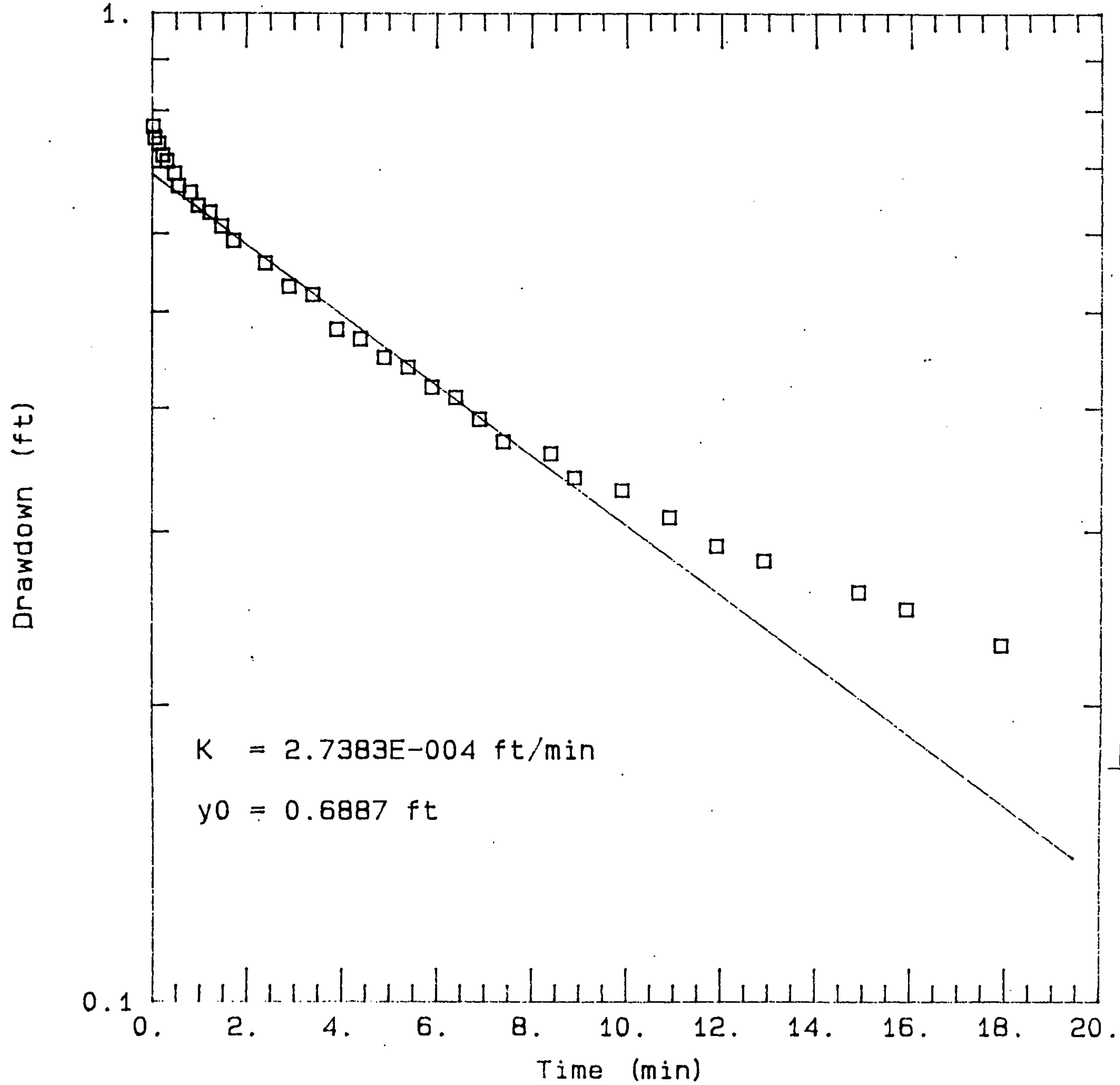
WELL MW-2S SLUG TEST



1.4 x 10^{-4} cm/sec

SE1000B
Environmental Logger
05/30 16:40

Unit# 00554 Test# 2

Well MW-2S

INPUT 1: Level (F) TOC

Reference 9.28
Scale factor 49.98
Offset 0.00

Step# 0 05/29 11:58

Elapsed Time	Value
0.0000	9.28
0.0033	9.28
0.0066	9.28
0.0099	9.28
0.0133	9.28
0.0166	9.28
0.0200	9.28
0.0233	9.29
0.0266	9.28
0.0300	9.28
0.0333	9.29
0.0500	9.31
0.0666	9.28
0.0833	9.28
0.1000	9.39
0.1166	10.08
0.1333	10.05
0.1500	10.05
0.1666	10.03
0.1833	10.03
0.2000	10.03
0.2166	10.03
0.2333	10.03
0.2500	10.02
0.2666	10.02
0.2833	10.02
0.3000	10.02
0.3166	10.02
0.3333	10.00
0.4167	9.99
0.5000	9.99
0.5833	9.97
0.6667	9.95
0.7500	9.95
0.8333	9.95
0.9167	9.94
1.0000	9.94
1.0833	9.92
1.1667	9.92
1.2500	9.92
1.3333	9.91
1.4166	9.91
1.5000	9.91
1.5833	9.89
1.6667	9.89
1.7500	9.89
1.8333	9.87
1.9167	9.87
2.0000	9.87
2.5000	9.84
3.0000	9.81
3.5000	9.80
4.0000	9.76
4.5000	9.75
5.0000	9.73
5.5000	9.72
6.0000	9.70
6.5000	9.69
7.0000	9.67
7.5000	9.65
8.0000	9.65
8.5000	9.64
9.0000	9.62
9.5000	9.64
10.0000	9.61
11.0000	9.59
12.0000	9.57
13.0000	9.56
14.0000	9.56
15.0000	9.54
16.0000	9.53
17.0000	9.53
18.0000	9.51
19.0000	9.51
20.0000	9.50

END

FIELD SLUG TEST LOG

PROJECT:
CLIENT: COLUMBUS MCKINNON
WELL/BOREHOLE NO.: MW-3
JOB NO.: 1332-01-1
COMPLETED BY: JCS/RHO

WELL/BOREHOLE DETAILS:

Installation Date:
Ground Elevation: 576.72 ft. AMSL
Reference Point (RP): TOP OF RISER
RP Elevation: 578.56 ft. AMSL
Stratigraphic Unit Monitored: LACUSTRINE SAND AND SILT
Hydrostratigraphic Unit Monitored: SHALLOW WATER BEARING ZONE
Slug Test Method: BOUWER + RICE (1976)
Riser Length: 7.5 ft. Riser I.D.: .17 ft. Riser Material: STAINLESS
Screen Length: 15 ft. Screen I.D.: .17 ft. Screen Material: STAINLESS Slot: .006
L (Length of Sand Pack) 15.6 ft. r_s (Radius of Borehole at Screen) .333 ft. r_c (Radius of Screen) .083 ft. *
Slug Dimensions or Volume * SEE BELOW

TEST:

Start Date: 5/30/90
Static Level (H): 6.90 ft. BRP
Start Time (To): 15:56
Initial Pressure Head (Ho): 8.76 ft. BRP
Will Water Level Remain Above the Screen During the Test? (Yes) ___ (No) X

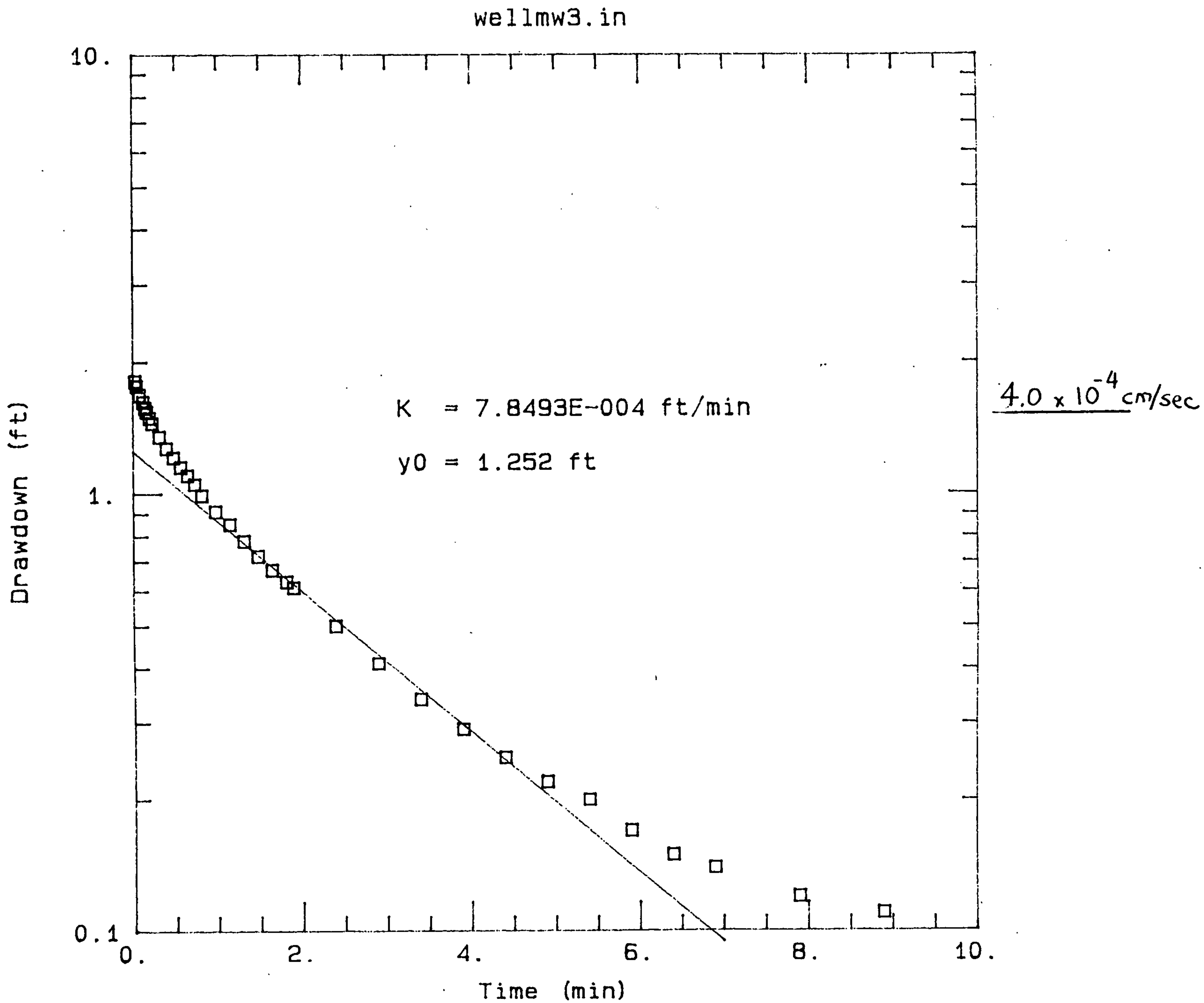
CLOCK TIME	ELAPSED TIME t(h=m=s)	DEPTH H(ft. BRP)	H-h (ft.)	H-h / H-Ho	CLOCK TIME	ELAPSED TIME t(h=m=s)	DEPTH h(ft. BRP)	H-h (ft.)	H-h / H-Ho
	0.033		1.81			0.983		0.91	
	0.05		1.76			1.15		0.85	
	0.083		1.68			1.317		0.78	
	0.127		1.62			1.483		0.72	
	0.15		1.57			1.65		0.67	
	0.167		1.54			1.817		0.63	
	0.2		1.49			1.90		0.61	
	0.233		1.45			2.40		0.50	
	0.317		1.35			2.90		0.41	
	0.4		1.27			3.40		0.34	
	0.483		1.21			3.90		0.29	
	0.567		1.15			4.40		0.25	
	0.65		1.1			4.90		0.22	
	0.733		1.05			5.40		0.20	
	0.817		0.99			5.90		0.17	
						6.40		0.15	
						6.90		0.14	
						7.90		0.12	
						8.90		0.11	

COMMENTS. * SAND PACK PARTIALLY UNSATURATED
∴ CALCULATE EFFECTIVE r_c (r_{eff})

$r_{eff} = r_c + n(r_s - r_c) = .083' + (.30)(.333 - .083) = 0.158'$

n = porosity

MALCOLM PIRNIE



wellmw3.in
K = 7.8493E-004 ft/min
y0 = 1.252 ft
Drawdown (ft)
Time (min)
10.
1.
0.1
0.
2.
4.
6.
8.
10.
4.0 x 10^-4 cm/sec

SE1000B
Environmental Logger
05/30 16:44

Unit# 00554 Test# 4 Well MW-3

INPUT 1: Level (F) TOC

Reference 6.90
Scale factor 49.98
Offset 0.00

Step# 0 05/29 15:56

Elapsed Time	Value
0.0000	6.90
0.0033	6.90
0.0066	6.90
0.0099	6.90
0.0133	6.90
0.0166	6.90
0.0200	6.90
0.0233	6.90
0.0266	6.90
0.0300	6.91
0.0333	6.90
0.0500	7.51
0.0666	6.93
0.0833	7.40
0.1000	8.27
0.1166	8.76
0.1333	8.71
0.1500	8.66
0.1666	8.63
0.1833	8.58
0.2000	8.55
0.2166	8.52
0.2333	8.50
0.2500	8.47
0.2666	8.44
0.2833	8.43
0.3000	8.39
0.3166	8.38
0.3333	8.35
0.4167	8.25
0.5000	8.17
0.5833	8.11
0.6667	8.05
0.7500	8.00
0.8333	7.95
0.9167	7.89
1.0000	7.86
1.0833	7.81
[illegible]	[illegible]
1.1667	7.78
1.2500	7.75
1.3333	7.72
1.4166	7.68
1.5000	7.65
1.5833	7.62
1.6667	7.59
1.7500	7.57
1.8333	7.54
1.9167	7.53
2.0000	7.51
2.5000	7.40
3.0000	7.31
3.5000	7.24
4.0000	7.19
4.5000	7.15
5.0000	7.12
5.5000	7.10
6.0000	7.07
6.5000	7.05
7.0000	7.04
7.5000	7.04
8.0000	7.02
8.5000	7.02
9.0000	7.01

END

FIELD SLUG TEST LOG

PROJECT:

CLIENT: COLUMBUS MCKINNON

JOB NO.: 1332-01-1

WELL/BOREHOLE NO.: MW-2I

COMPLETED BY: JCS/RHO

WELL/BOREHOLE DETAILS:

Installation Date:

Ground Elevation: 574.57 ft. AMSL

Reference Point (RP): TOP OF RISER

RP Elevation: 576.45 ft. AMSL

Stratigraphic Unit Monitored: LACUSTRINE SAND AND SILT

Hydrostratigraphic Unit Monitored: SHALLOW WATER BEARING ZONE

Slug Test Method: COOPER et al. (1967)

Riser Length: 24.6 ft. Riser I.D.: .17 ft. Riser Material: STAINLESS

Screen Length: 5.0 ft. Screen I.D.: .17 ft. Screen Material: STAINLESS Slot: .006"

L (Length of Sand Pack) 7.3 ft. r_s (Radius of Borehole at Screen) .33 ft. r_c (Radius of Screen) .083 ft.

Slug Dimensions or Volume 5 ft SLUG

TEST:

Start Date: 5/29/90

Static Level (H): 9.26 ft. BRP

Start Time (To): 11:10

Initial Pressure Head (Ho): 11.08 ft. BRP

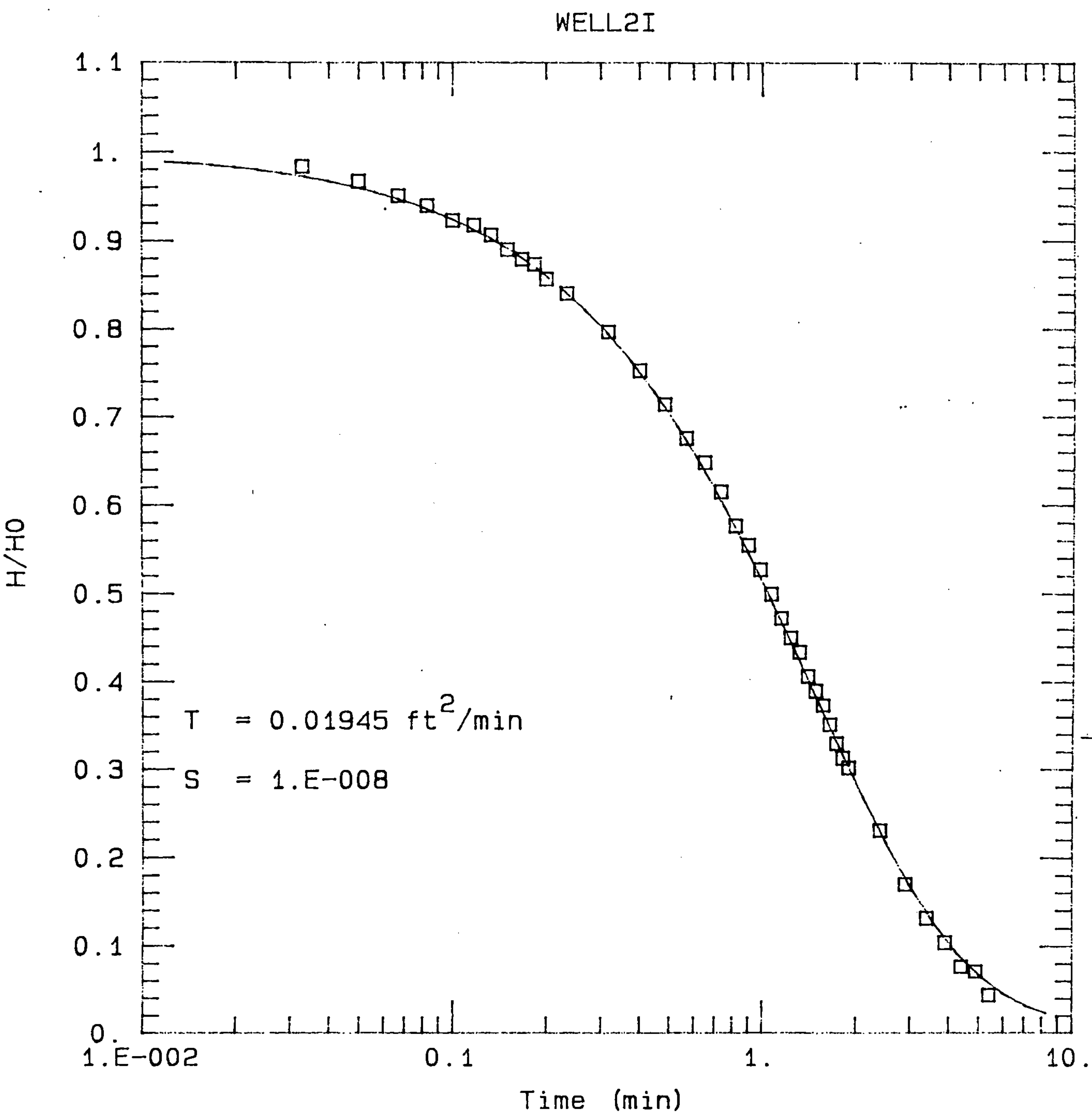
Will Water Level Remain Above the Screen During the Test? (Yes) ____ (No) ____

CLOCK TIME	ELAPSED TIME t(h-m-s)	DEPTH H(ft. BRP)	H-h (ft.)	H-h / H-Ho
	.033	11.05	1.79	
	.050	11.02	1.76	
	.067	10.99	1.73	
	.083	10.97	1.71	
	.100	10.94	1.68	
	.133	10.91	1.65	
	.167	10.86	1.60	
	.200	10.82	1.56	
	.133	10.79	1.53	
	.417	10.71	1.45	
	.40	10.63	1.37	
	.483	10.56	1.30	
	.567	10.49	1.23	
	.650	10.44	1.18	
	.733	10.38	1.12	

CLOCK TIME	ELAPSED TIME t(h-m-s)	DEPTH h(ft. BRP)	H-h (ft.)	H-h / H-Ho
	.817	10.31	1.05	
	.90	10.27	1.01	
	1.067	10.17	.91	
	1.233	10.08	.82	
	1.400	10.00	.74	
	1.567	9.94	.68	
	1.733	9.86	.60	
	1.900	9.81	.55	
	2.40	9.68	.42	
	2.90	9.57	.31	
	3.40	9.50	.24	
	3.90	9.45	.19	
	4.40	9.40	.14	
	4.90	9.39	.13	
	5.40	9.34	.08	

COMMENTS: TO CALC. HYD. COND
USE T = K/b
Where b = SATURATED THICK = LENGTH OF SAND PACK = 7.3 ft

MALCOLM PIRNIE



$K = T/b$

$= \frac{0.01945 \text{ ft}^2/\text{min}}{7.3 \text{ ft}}$

$= 2.66 \times 10^{-3}$ ft/min

$= 1.4 \times 10^{-3}$ cm/sec

SE1000B
Environmental Logger
05/30 16:36

Unit# 00554 Test# 0 Well MW-2I

INPUT 1: Level (F) TOC

Reference 9.28
Scale factor 49.82
Offset 0.00

Step# 0 05/29 11:10

Elapsed Time	Value
0.0000	9.26
0.0033	9.26
0.0066	9.26
0.0099	9.28
0.0133	9.26
0.0166	9.28
0.0200	9.28
0.0233	9.28
0.0266	9.28
0.0300	9.28
0.0333	9.28
0.0500	9.26
0.0666	9.28
0.0833	9.61
0.1000	11.05
0.1166	11.08
0.1333	11.05
0.1500	11.02
0.1666	10.99
0.1833	10.97
0.2000	10.94
0.2166	10.93
0.2333	10.91
0.2500	10.88
0.2666	10.86
0.2833	10.85
0.3000	10.82
0.3166	10.82
0.3333	10.79
0.4167	10.71
0.5000	10.63
0.5833	10.56
0.6667	10.49
0.7500	10.44
0.8333	10.38
0.9167	10.31
1.0000	10.27
1.0833	10.22
[illegible]	[illegible]
1.1667	10.17
1.2500	10.12
1.3333	10.08
1.4166	10.05
1.5000	10.00
1.5833	9.97
1.6667	9.94
1.7500	9.90
1.8333	9.86
1.9167	9.83
2.0000	9.81
2.5000	9.68
3.0000	9.57
3.5000	9.50
4.0000	9.45
4.5000	9.40
5.0000	9.39
5.5000	9.34
6.0000	9.35

END

FIELD SLUG TEST LOG

PROJECT:
CLIENT: COLUMBUS MCKINNON
JOB NO.: 1332-01-1
WELL/BOREHOLE NO.: MW-1I
COMPLETED BY: JCS / RHO

WELL/BOREHOLE DETAILS:

Installation Date:
Ground Elevation: 572.15 ft. AMSL
Reference Point (RP): TOP OF RISER
RP Elevation: 574.07 ft. AMSL
Stratigraphic Unit Monitored: LACUSTRINE SILT AND SAND
Hydrostratigraphic Unit Monitored: SHALLOW WATER BEARING ZONE
Slug Test Method: COOPER et al. (1967)
Riser Length: 23.6 ft. Riser I.D.: .17 ft. Riser Material: STAINLESS
Screen Length: 5.0 ft. Screen I.D.: .17 ft. Screen Material: STAINLESS Slot: .006"

L (Length of Sand Pack) 7.3 ft. r_s (Radius of Borehole at Screen) .33 ft. r_c (Radius of Screen) .083 ft.
Slug Dimensions or Volume

TEST:

Start Date: 5-29-90
Static Level (H): 6.64 ft. BRP
Start Time (To): 11:43:00
Initial Pressure Head (Ho): ft. BRP
Will Water Level Remain Above the Screen During the Test? (Yes) (No)

CLOCK TIME	ELAPSED TIME t(h-m-s)	DEPTH H(ft. BRP)	H-h (ft.)	H-h / H-Ho
	.117	8.44	1.8	
	.150	8.32	1.68	
	.167	8.27	1.63	
	.183	8.21	1.57	
	.20	8.16	1.52	
	.217	8.13	1.49	
	.233	8.07	1.43	
	.250	8.03	1.39	
	.267	8.00	1.36	
	.283	7.96	1.32	
	.300	7.92	1.28	
	.317	7.89	1.25	
	.333	7.86	1.22	
	.417	7.69	1.05	
	.50	7.56	.92	

CLOCK TIME	ELAPSED TIME t(h-m-s)	DEPTH h(ft. BRP)	H-h (ft.)	H-h / H-Ho
	.583	7.45	.81	
	.667	7.36	.72	
	.750	7.28	.64	
	.833	7.20	.56	
	.917	7.14	.50	
	1.0	7.09	.45	
	1.083	7.03	.39	
	1.17	7.00	.36	
	1.25	6.97	.33	
	1.417	6.90	.26	
	1.50	6.87	.23	
	1.67	6.84	.20	
	1.83	6.81	.17	
	1.917	6.79	.16	
	2.50	6.70	.06	

COMMENTS: TO CALC. HYD. COND.
USE T = K/b
WHERE b = SATURATED THICKNESS = LENGTH OF SAND PACK = 7.3 ft = 222.5 cm

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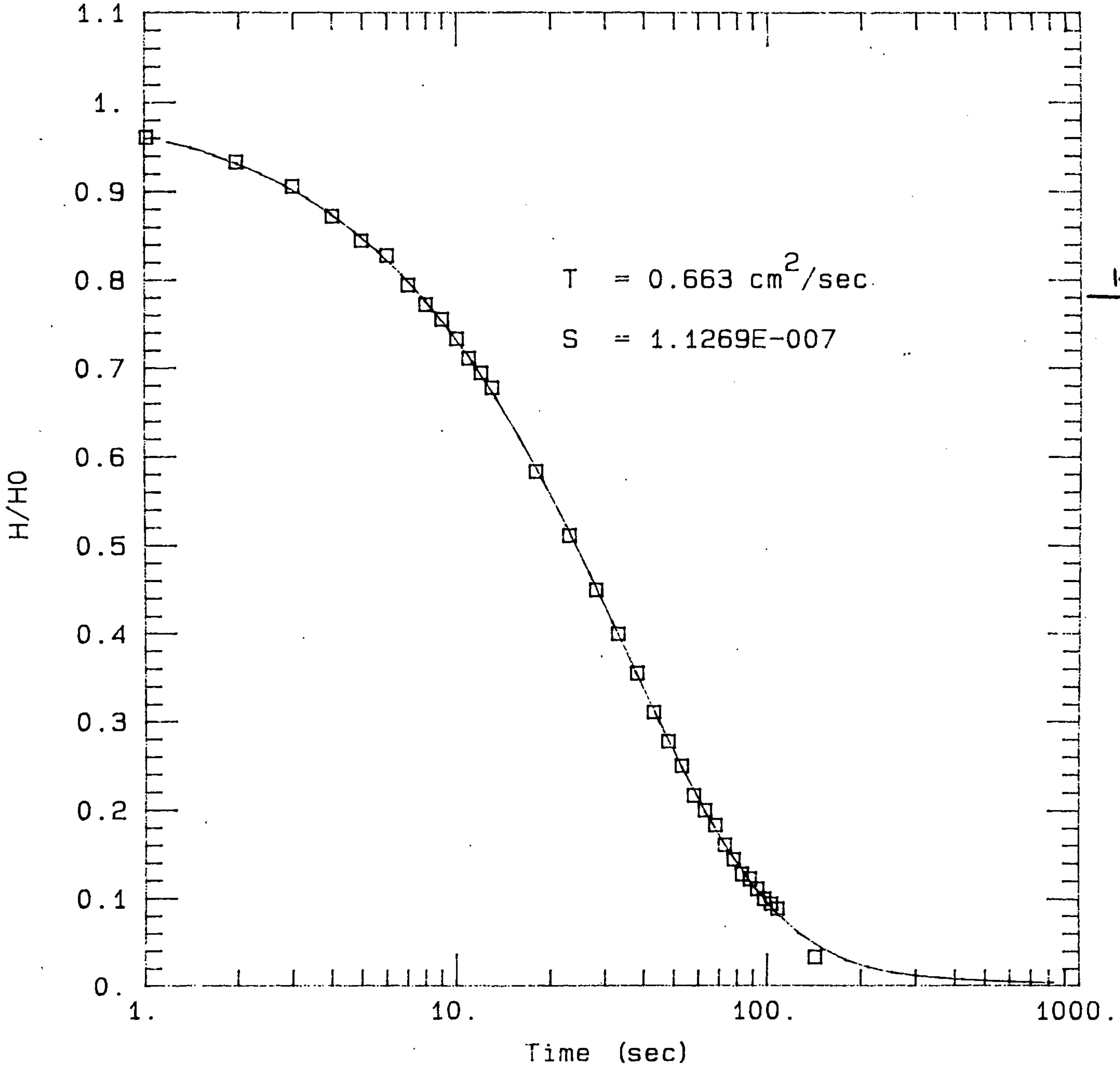
WELL MW-1I SLUG TEST



$K = T/b$

$= \frac{0.663\ cm^2/sec}{222.5\ cm}$

$= 3.0 \times 10^{-3}\ cm/sec$

SE1000B
Environmental Logger
05/30 16:38

Unit# 00554 Test# 1

INPUT 1: Level (F) TOC   Well MW-1 I

Reference 6.64
Scale factor 49.82
Offset 0.00

Step# 0 05/29 11:43

Elapsed Time	Value
0.0000	6.64
0.0033	6.67
0.0066	6.68
0.0099	6.70
0.0133	6.70
0.0166	6.70
0.0200	6.70
0.0233	6.70
0.0266	6.70
0.0300	6.70
0.0333	6.70
0.0500	6.70
0.0666	8.40
0.0833	7.17
0.1000	8.10
0.1166	8.44
0.1333	8.37
0.1500	8.32
0.1666	8.27
0.1833	8.21
0.2000	8.16
0.2166	8.13
0.2333	8.07
0.2500	8.03
0.2666	8.00
0.2833	7.96
0.3000	7.92
0.3166	7.89
0.3333	7.86
0.4167	7.69
0.5000	7.56
0.5833	7.45
0.6667	7.36
0.7500	7.28
0.8333	7.20
0.9167	7.14
1.0000	7.09
1.0833	7.03
1.1667	7.00
1.2500	6.97
1.3333	6.93
1.4166	6.90
1.5000	6.87
1.5833	6.86
1.6667	6.84
1.7500	6.82
1.8333	6.81
1.9167	6.79
2.0000	6.79
2.5000	6.70

END

FIELD SLUG TEST LOG

PROJECT:

CLIENT: COLUMBUS MCKINNON

WELL/BOREHOLE NO.: MW-1D

JOB NO.: 1332-01-1

COMPLETED BY:

WELL/BOREHOLE DETAILS:

Installation Date:

Ground Elevation: 572.23 ft. AMSL

Reference Point (RP): TOP OF RISER

RP Elevation: 574.80 ft. AMSL

Stratigraphic Unit Monitored: TILL

Hydrostratigraphic Unit Monitored: CONFINING LAYER

Slug Test Method: RECOVERY TEST – HVORSLEV (1951)

Riser Length: 32.27 ft. Riser I.D.: .083 ft. Riser Material: PVC

Screen Length: 2 ft. Screen I.D.: .083 ft. Screen Material: PVC Slot: .010

L (Length of Sand Pack) 2 ft. r_s (Radius of Borehole at Screen) .25 ft. r_c (Radius of Screen) .083 ft

Slug Dimensions or Volume NA

TEST:

Start Date: 5/18/90

Static Level (H): 8.45 ft. BRP

Start Time (To):

Initial Pressure Head (Ho): 27.41 ft. BRP

Will Water Level Remain Above the Screen During the Test? (Yes) YES (No)

h = Head Ratio :

CLOCK TIME	ELAPSED TIME t(h-m-s)	DEPTH H(ft. BRP)	H-h (ft.)	H-h / H-Ho
	DAYS			
5/18	0	27.41	18.96	1.0
5/25	7	18.51	10.06	.53
5/29	11	15.46	7.01	.37
6/1	14	13.88	5.43	.29
6/8	21	11.18	2.73	.14
6/15	28	9.68	1.23	.06
6/22	35	8.86	0.41	.02
6/29		8.45		0

CLOCK TIME	ELAPSED TIME t(h-m-s)	DEPTH h(ft. BRP)	H-h (ft.)	H-h / H-Ho

COMMENTS:

$$K = \frac{(r_c)^2 \ln(L/r_s) \ln(h_1/h_2)}{2(L)(t_2-t_1)} = \frac{(.083)^2 \ln(2/.25) \ln(.70/.37)}{2(2)(11-4 \text{ days})} = 1.2 \times 10^{-6} \frac{cm}{sec}$$

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FIELD SLUG TEST LOG

PROJECT:
CLIENT: COLUMBUS MCKINNON
JOB NO.: 1332-01-1
WELL/BOREHOLE NO.: MW-2D
COMPLETED BY:

WELL/BOREHOLE DETAILS:

Installation Date:
Reference Point (RP):
Ground Elevation: 574.57 ft. AMSL
RP Elevation: 575.69 ft. AMSL
Stratigraphic Unit Monitored: TILL
Hydrostratigraphic Unit Monitored: CONFINING LAYER
Slug Test Method: RECOVERY TEST - HVORSLEV (1951)
Riser Length: 29.58 ft. Riser I.D.: .083 ft. Riser Material: PVC
Screen Length: 2 ft. Screen I.D.: .083 ft. Screen Material: PVC Slot: .010

L (Length of Sand Pack) 2 ft. r_s (Radius of Borehole at Screen) .25 ft. r_c (Radius of Screen) .083 ft.
Slug Dimensions or Volume NA

TEST:

Start Date: 5/25/90
Start Time (To):
Static Level (H): 10.15 ft. BRP
Initial Pressure Head (Ho): 30.28 ft. BRP
Will Water Level Remain Above the Screen During the Test? (Yes) YES (No)

CLOCK TIME	ELAPSED TIME t(h-m-s)	DEPTH H(ft. BRP)	H-h (ft.)	H-h / H-Ho
	DAYS			
5/25	0	30.28	20.13	1.0
5/29	4	28.28	18.13	0.90
6/1	7	27.10	16.95	0.84
6/8	14	24.43	14.28	0.71
6/15	21	22.20	12.05	0.60
6/22	28	20.30	10.15	0.50
6/29	35	18.65	8.50	0.42
7/6	43	17.32	7.17	0.36
7/13	50	16.41	6.26	0.31
8/16	84	12.80	2.65	0.13
11/9		10.15		0

CLOCK TIME	ELAPSED TIME t(h-m-s)	DEPTH h(ft. BRP)	H-h (ft.)	H-h / H-Ho

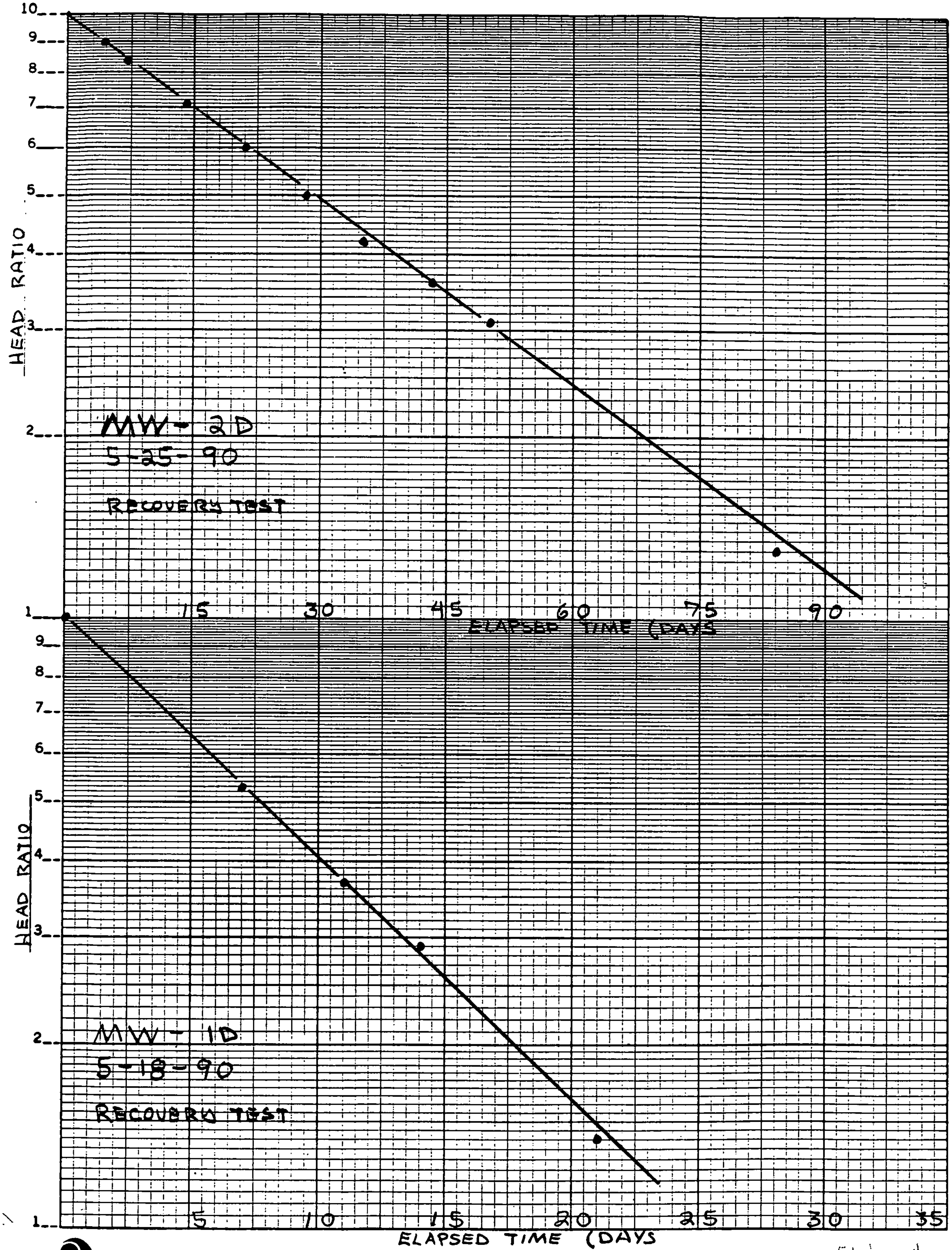
NOTE STATIC LEVEL (H) IS ESTIMATED AS 10.15 -

WELL HAD NOT EQUILIBRATED PRIOR TO BEGINNING OF TEST AND MAY NOT HAVE EQUILIBRATED BY LAST MEASUREMENT DATE (11/9/90)

COMMENTS:

$$K = \frac{(r_c)^2 \ln(L/r_s) \ln(h_1/h_2)}{2(L)(t_2 - t_1)} = \frac{(.083)^2 \ln(2/.25) \ln(.60/.31)}{2L\ (50-21 \text{ days})} = 2.9 \times 10^{-7} \frac{cm}{s}$$

MALCOLM PIRNIE



AMPAD 22-119 · SEMI-LOG 2 x 10

Total 51 days to .01

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APPENDIX C2

SOIL LOSS CALCULATIONS

SOIL LOSS CALCULATIONS

METHOD : UNIVERSAL SOIL LOSS EQUATION

SOURCE : EQUATION AND EMPIRICAL PARAMETERS FROM USEPA MANUAL - WATER QUALITY ASSESSMENT: A SCREENING PROCEDURE FOR TOXIC AND CONVENTIONAL POLLUTANTS IN SURFACE AND GROUND WATERS - PART 1. (REVISED - 1985) EPA/600/6-85/002a

ASSUMPTIONS :

1) NO SHEET AND RILL EROSION ON OIL DISPOSAL AREA DUE TO PLASTIC SHEETING

2) NO EROSION OF CREEK BANK ALONG OIL DISPOSAL AREA DUE TO RIP RAP AND EROSION CONTROL FABRIC

3) SOIL TYPE TAKEN AS SANDY LOAM OR LOAMY SAND BASED ON SEIVE ANALYSES OF COMPOSITE SOIL MATERIAL FROM EACH AREA. (SEE ATTACHMENT A FOLLOWING PAGE 10)

4) COVER MANAGEMENT FACTOR

FOR NORTH AREA ASSUME
- a) NO CANOPY
- b) COVER AT SURFACE IS GRASS
- c) % COVER IS 80%
  - eg) SOME BARE SPOTS ON LAWN

FOR CONRAIL PROPERTY
- a) HAS A TREE CANOPY,
- b) COVER AT SURFACE IS GRASS
- c) % CANOPY IS 75%
- d) % GROUND COVER IS 95%

USE TABLE III-6 C FACTORS FOR PASTURE, RANGE AND IDLE LAND

4) cont'd

FOR CREEK BANK

a) COVER IS CRUSHED STONE @ 240 tons/acre

b) LAND SLOPE IS 34 – 50 %

USE TABLE III-5 C FACTORS FOR CONSTRUCTION SITES

5) ASSUME 2.0 % ORGANICS IN FILL

6) ASSUME FILL WEIGHS 125 lbs/FT^3

7) (P) (SUPPORTING PRACTICE FACTOR) EQUALS 1.0 SINCE THERE IS NO TILLAGE

EQUATION:

$$X = (1.29)\, E \cdot K \cdot ls \cdot C \cdot P$$

WHERE

X = AVERGE ANNUAL SOIL LOSS m Tons / hectare

E = RAINFALL AND RUNOFF EROSIVITY INDEX

K = SOIL ERODIBILITY FACTOR m Tons / hectare

ls = length-slope FACTOR

C = COVER MANAGEMENT FACTOR

P = PRACTICE FACTOR

and

1.29 = English to metric conversion factor

NORTH AREA

DIVIDED IN TWO SEGMENTS BASED ON DIFFERENT LENGTH - SLOPE FACTORS

SEGMENT A - NARROW ACCESS AREA ALONG CREEK

$E = 75^{(1)}$ FROM FIGURE III-10 p 162

$K = 0.24^{(2)}$ FOR A SANDY LOAM (3) WITH 2% ORGANICS FROM TABLE III-3 p 165

$Ls = .156$ FOR SLOPE OF 5% AND SLOPE-LENGTH OF 25 FT

EQUATION :

$$ls = (0.045 \times l)^b (65.41 \sin^2\theta + 4.56 \sin\theta + .065)$$

where l = slope length

θ = slope angle = $\tan^{-1}$ (% slope)

C = 0.013 ; SEE ASSUMPTIONS

P = 1.0

(1) units 10^2 ft-tons-in/ac-hr multiply by 1.735 to obtain metric units of 10^2 m-tonnes-cm/ha-hr

(2) units tonnes/ha / unit of E

(3) See ATTACHMENT A Following Page 10 FOR SEIVE ANALYSIS

SOIL LOSS :

$$X = (1.29)(75 \times 10^2)(1.735)(0.24)(.156)(0.013)(1.0)$$

$$= (8.17 \text{ metric tonne/ha/year})\left(\frac{1 \text{ ha}}{2.405 \text{ ac}}\right)\left(\frac{1 \text{ ac}}{43600 \text{ ft}^2}\right)\left(\frac{2205 \text{ lbs}}{\text{m tonne}}\right)$$

$$= 1.020 \frac{\text{lbs}}{\text{ft}^2} / \text{year}$$

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MALCOLM PIRNIE, INC.

BY RHO DATE 11-28-90 SHEET NO. 4 OF 10

CHKD. BY KPM DATE 11/30/90 JOB NO. 1332-01-1

SUBJECT SOIL LOSS

SEGMENT B – GRASSY AREA BETWEEN OFFICE AND LOCKER ROOM

E = 75 FIGURE III-11

K = 0.24 TABLE III-3

ls = .377 where slope length = 50 ft = 15.2 m
slope = 5%

C = 0.013 see ASSUMPTIONS

P = 1.0 SEE ASSUMPTIONS

SOIL LOSS:

$$X = (1.29)(75 \times 10^2)(1.735)(0.24)(.377)(0.013)(1.0)$$

$$= (19.74 \text{ metric tonnes/ha/year})\left(\frac{1 \text{ ha}}{.405 \text{ ac}}\right)\left(\frac{1 \text{ ac}}{43600 \text{ ft}^2}\right)\left(\frac{2205 \text{ lbs}}{\text{m tonne}}\right)$$

$$= 2.466 \frac{\text{lbs}}{\text{ft}^2}/\text{year}$$

10.13

CENTRAL AREA

ASSUMES PLASTIC SHEETING IS NOT PRESENT

E = 75 FROM FIGURE III-T0 (1) p162

K = 0.10 FOR A LOAMY SAND WITH 2% ORGANIC CONTENT FROM TABLE III-3

ls = .377 where slope length = 50 ft = 15.2 m
slope = 5%

C = 0.013 SEE ASSUMPTIONS FOR NORTH AREA

P = 1.0 SEE ASSUMPTIONS

SOIL LOSS

$$= (1.29)(75 \times 10^2)(1.735)(0.10)(.377)(0.013)(1.0)$$

$$= (8.227 \text{ m tonnes/ha/yr})\left(\frac{1 \text{ ha}}{.405 \text{ ac}}\right)\left(\frac{1 \text{ ac}}{43600 \text{ ft}^2}\right)\left(\frac{2205 \text{ lbs}}{\text{m tonne}}\right)$$

$$= 1.027 \frac{\text{lbs}}{\text{ft}^2} / \text{year}$$

(1) See ATTACHMENT A following page 10 for Seive Analyses.

CONRAIL PROPERTY

E = 75 FROM FIGURE III-10

K = 0.24 FOR A SANDY LOAM WITH 2% ORGANIC CONTENT (1)

ls = 0.377 slope length = 50 ft
slope = 5%

C = 0.003 SEE ASSUMPTIONS

P = 1.0 SEE ASSUMPTIONS

SOIL LOSS:

$$x = (1.29)(75 \times 100)(1.735)(0.24)(0.377)(0.003)(1.0)$$

$$= (4.556 \text{ tonnes/ha/year})\left(\frac{1 \text{ ha}}{.405 \text{ ac}}\right)\left(\frac{1 \text{ ac}}{43600 \text{ ft}^2}\right)\left(\frac{2205 \text{ lbs}}{\text{m tonne}}\right)$$

$$= .569 \frac{\text{lbs}}{\text{ft}^2} / \text{year}$$

(1) SEE ATTACHMENT A following Page 10 of 10 for Seive Analyses

CREEK BANK

NOTE: AREA EVALUATED EXTENDS FROM EACH END OF IRM CREEK BANK IMPROVEMENTS TO A DISTANCE 50 FEET NORTH, AND 70 FEET SOUTH.
AREA INCLUDES THE EXISTING RIP RAP PROTECTED CREEK BANK, BUT NOT THE NEW IRM IMPROVEMENT (WHICH HAS EROSION CONTROL FABRIC).

E = 75 FROM FIGURE III-10

K = 0.10 SEE FOOTNOTE PAGE 8 of 10

ls = 5.64 slope length averages. 10 ft = 3.05 m
slope averages 50 %
$TAN^{-1}(50) = 26.6$

$$ls = (0.045 \times 3.05m)^{.5} (65.41 \sin^2 26.6 + 4.56 \sin 26.6 + 0.065)$$
$$= (.3705)(13.14 + 2.042 + 0.065)$$
$$= 5.64$$

C = 0.02 SEE ASSUMPTIONS

P = 1.0 SEE ASSUMPTIONS

SOIL LOSS:

$$X = (1.29)(75 \times 100)(1.735)(0.10)(5.64)(0.02)(1.0)$$
$$= (189 \text{ tonnes/ha/year})\left(\frac{1 ha}{.405 ac}\right)\left(\frac{1 ac}{43600 ft^2}\right)\left(\frac{2205 lbs}{mtonne}\right)$$
$$= 23.6 \frac{lbs}{ft^2}/year$$

CREEK BANK

ALONG IRM IMPROVEMENTS – INTENT IS TO MODEL EXISTING CONDITIONS PRIOR TO IRM CREEK BANK STABILIZATION.

E = 75 FROM FIGURE III-10

K = 0.10 FOR A LOAMY SAND – BASED ON (SEE FOOTNOTE 1)

ls = 5.64 slope length = 10' = 3.05 m
slope % = 50 %

C = 0.02 SEE ASSUMPTIONS.

P = 1.0 SEE ASSUMPTIONS

SOIL LOSS:

$$X = (1.29)(75 \times 100)(1.735)(0.10)(5.64)(0.02)(1.0)$$

$$= (189 \text{ tonnes/ha/yr})\left(\frac{1 \text{ ha}}{.405 \text{ ac}}\right)\left(\frac{1 \text{ ac}}{43600 \text{ ft}^2}\right)\left(\frac{2205 \text{ lbs}}{\text{m Tonnes}}\right)$$

$$= 23.6 \ \frac{\text{lbs}}{\text{ft}^2}/\text{yr}$$

(1) SOIL CLASSIFICATION FOR THE CREEK BANK IS BASED ON 2-4 and 4-6 foot SOIL DESCRIPTIONS IN SOIL BORINGS COMPLETED ALONG THE CREEK BANK
SB90-1, 2, 3, 4, 6, 8, 10, 12, 14, 21, 28, 29, 35, 36, 41, 42, 48.

COMPUTE AVERAGE VOLUME OF SOIL LOSS PER YEAR

NORTH AREA

1) SEGMENT A $1.02 \frac{lb}{ft^2} / 125 \frac{lbs}{ft^3} = .008 \frac{ft}{yr} = .096 \frac{in}{yr}$

2) SEGMENT B $2.47 \frac{lb}{ft^2} / 125 \frac{lbs}{ft^3} = .020 \frac{ft}{yr} = .237 \frac{in}{yr}$

3) *

CONRAIL PROPERTY $0.57 \frac{lbs}{ft^2} / 125 \frac{lbs}{ft^3} = .005 \frac{ft}{yr} = .055 \frac{in}{yr}$

VOLUME OF LOSS APPEARS RESONABLE FOR RELATIVELY FLAT, VEGETATED LAND.

CREEK BANK

$23.6 \frac{lbs}{ft^2} / 125 \frac{lbs}{ft^3} = .189 \frac{ft}{yr} = 2.27 \frac{inches}{yr.}$

Volume OF LOSS APPEARS CONSERVATIVELY HIGH - SINCE THIS RESULT SUGGESTS APPROX 23 inches of SOIL LOST FROM BENEATH EXISTING RIPRAP IN 10 YEARS

HOWEVER

YET THERE HAS BEEN NO EROSION PROBLEM ALONG CREEK BANK AND RIP RAP APPEARS TO BE STABLE

THEREFORE

RATE OF SOIL LOSS IS JUDGED TO BE LESS THAN THE CALCULATED RATE.

* CENTRAL AREA $1.03 \frac{lb}{ft^2} / 125 \frac{lbs}{ft^3} = .008 \frac{ft}{yr} = .099 \frac{in}{yr}$

YEARLY SOIL LOSS PER AREA

AREA	SOIL LOSS (lbs/Ft²/yr)	AREAL EXTENT (FT²)	SOIL LOAD/AREA lbs/yr	Volume/AREA* CY/YR	Volume/AREA* IN/YR
NORTH AREA A	1.02	155' x 25'	3,953	1.17	0.096
B	2.47	45' x 60'	6,669	1.98	0.237
CONRAIL PROPERTY	0.57	65' x 90' x 1/2	1,667	0.49	0.055
CREEK BANK	23.6	(50'+70') x 10'	28,320	8.39	2.27
IRM AREA[1]	23.6	150' x 10'	35,400	10.49	2.27

* ASSUMES 125 lbs/Ft^3

eg) FOR NORTH AREA A

$$3{,}953\ \frac{lbs}{yr} \times \frac{Ft^3}{125\ lbs} \times \frac{1\ cy}{27\ ft^3} = 1.17$$

$$1.02\ \frac{lbs/ft^2}{yr} \times \frac{ft^3}{125\ lbs} \times \frac{12\ in}{ft} = 0.096\ in/yr$$

(1) SOIL LOSS UNDER CONDITIONS EXISTING PRIOR TO IRM IMPROVEMENT

MALCOLM PIRNIE

MALCOLM PIRNIE, INC.

ATTACHMENT 1

BY RHO DATE 5-17-91 SHEET NO. .... OF ....

CHKD. BY .... DATE .... JOB NO. ....

SUBJECT ....

Attachment 1 documents the soil type that was selected in Table III-3 for the determination of the soil erodability factor in the USLE.

Methodology

~~3~~ Soil samples were collected from 0-6" ~~in~~ at three (3) locations in each Area. The following locations were sampled:

~~S~~ North Area : SB90-10, SB90-15, SB90-19

CENTRAL ~~SOUTH~~ AREA : MW-1D, ~~±~~ SB90-34, SB90-37

SOUTH ~~CENTRAL~~ AREA : SB90-39, SB90-41, SB90-46

SOIL SAMPLES WERE COMPOSITED INTO 1 SOIL SAMPLE FROM EACH AREA AND SUBMITTED TO GZA SOIL LAB IN UPPER NEWTON FALLS, MA. FOR SEIVE ANALYSES.

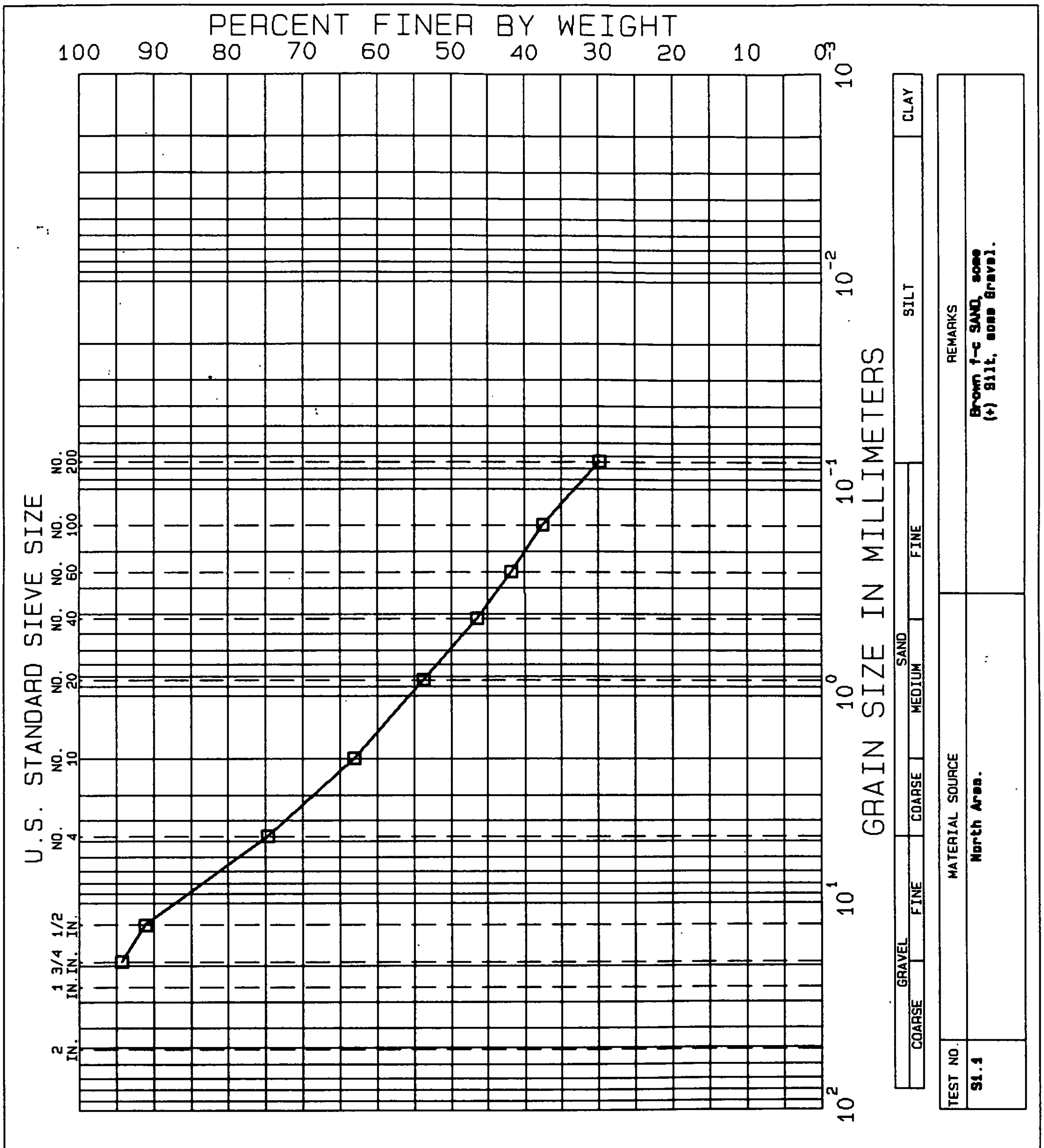
RESULTS

GZA SEIVE ANALYSIS RESULTS ARE ATTACHED

A CONVERSION FROM THE USCS SOIL CLASSIFICATION SYSTEM TO THE USDA SOIL CLASSIFICATION SYSTEM IS ALSO ATTACHED.

NOTE

NO SEIVE ~~SOILS~~ ANALYSES WERE ~~OF~~ CONDUCTED FOR SUBSURFACE SOIL/FILL EXPOSED ALONG THE CREEK BANK - THEREFORE - SOIL BORING LOGS FOR BORINGS COMPLETED ALONG THE CREEK BANK WERE UTILIZED TO ESTIMATE SOIL TYPE.

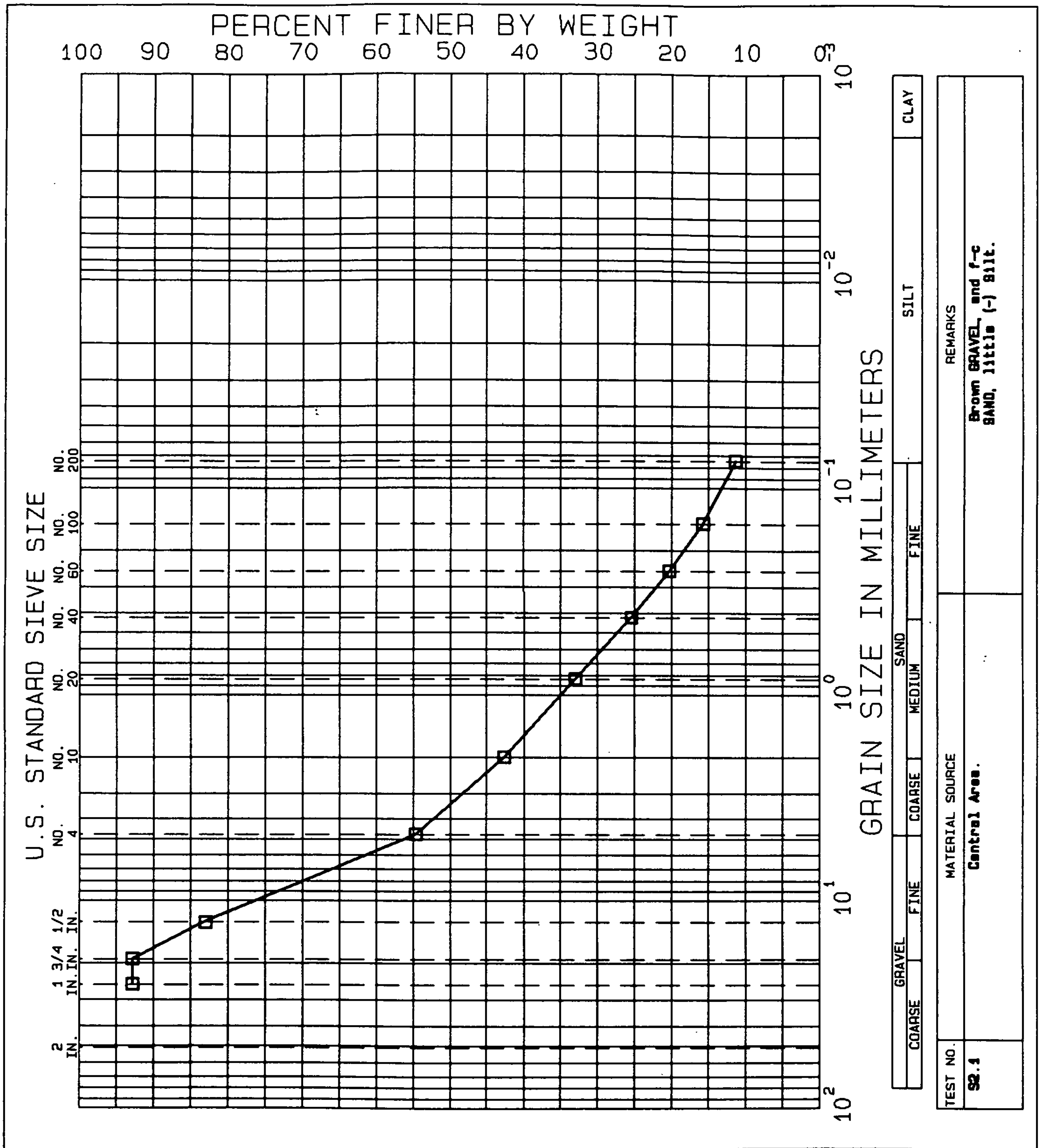


PROJECT # 1332011

BUFFALO N.Y.

GRADATION TESTS

BORING NO.		TEST SERIES	
SAMPLE		NO.	1
DEPTH		DATE	May 91
TECH.	EH		
REVIEWER	JK	FILE	L12546

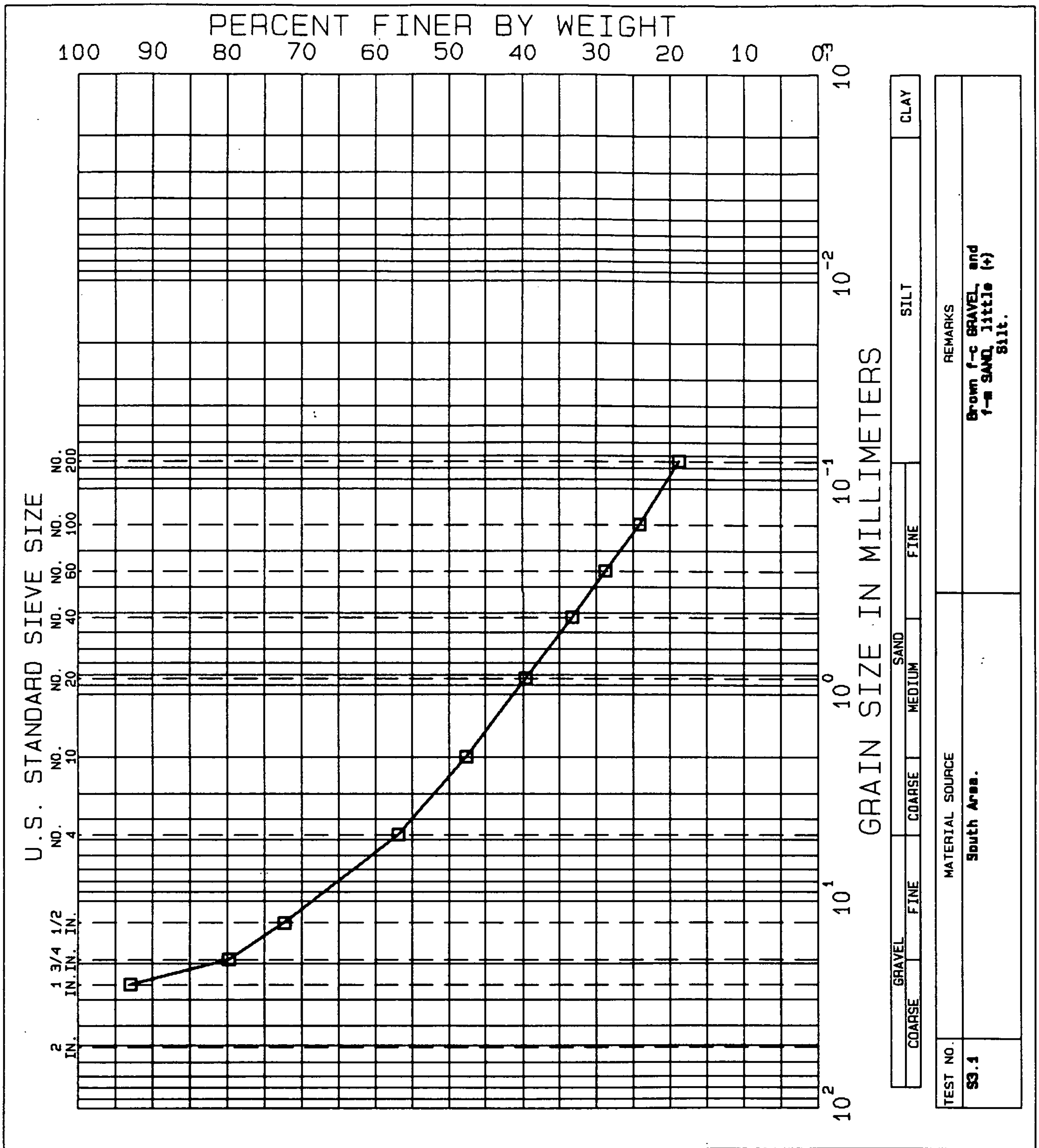


PROJECT # 1332011

BUFFALO N.Y.

GRADATION TESTS

BORING NO.		TEST SERIES	
SAMPLE		NO.	**2**
DEPTH		DATE	**May 91**
TECH.	**EH**		
REVIEWER	**JK**	FILE	**L12548**



PROJECT # 1332011

BUFFALO N.Y.

GRADATION TESTS

BORING NO.	TEST SERIES
SAMPLE	NO. **3**
DEPTH	DATE **May 91**
TECH. **EH**	
REVIEWER **JK**	FILE **L12548**

MALCOLM PIRNIE

MALCOLM PIRNIE, INC.

BY RHO DATE 5-17-91 SHEET NO. ...... OF ......

CHKD. BY ...... DATE ...... JOB NO. ......

SUBJECT SURFICIAL SOIL CLASSIFICATION

ITEM	AREA NORTH	CENTRAL	SOUTH
USCS - SEIVE ANALYSES			
SILT : SAND : GRAVEL	19 : 38 : 43	12 : 43 : 45	19 : 38 : 43
USCS - NAME/CLASS	SM - Silty Sand w/ Gravel	GP-GM Poorly Graded Grvl w/ Silt and Sand	GM - Silty Gravel w/ Sand
USDA - SEIVE ANALYSES			
SILT : SAND : GRAVEL	26 : 37 : 37	10 : 32 : 58	15 : 33 : 52
Silt : Sand	41 : 59	24 : 76	31 : 69
m/c Sand : f-Sand : vf-sand = Sand	21 : 10 : 6 = 37	22 : 7 : 3 = 32	20 : 7 : 6 = 33
m/c Sand : f-sand : vf-sand = 100	57 : 27 : 16 = 100	69 : 22 : 9 = 100	61 : 21 : 18 = 100
USDA - Name	Sandy Loam	Loamy Sand	Sandy Loam

NOTE:

This worksheet shows the conversion from USCS soil classifications provided by GZA seive analyses to the USDA soil classification used in the ~~Unified So~~ Universal Soil Loss Equation, for the determination of soil erodibility factor, k.

~~The~~ Figure 15-1 from Methods of Soil Analysis which follows this sheet - shows the correlation between the USCS and USDA soil classification systems. Figure 15-3 shows the USDA classification.

METHODS OF SOIL ANALYSIS

Part 1

Physical and Mineralogical Methods

Second Edition

Arnold Klute, *Editor*

Editorial Committee

Number 9 (Part 1) in the series
AGRONOMY

American Society of Agronomy, Inc.
Soil Science Society of America, Inc.
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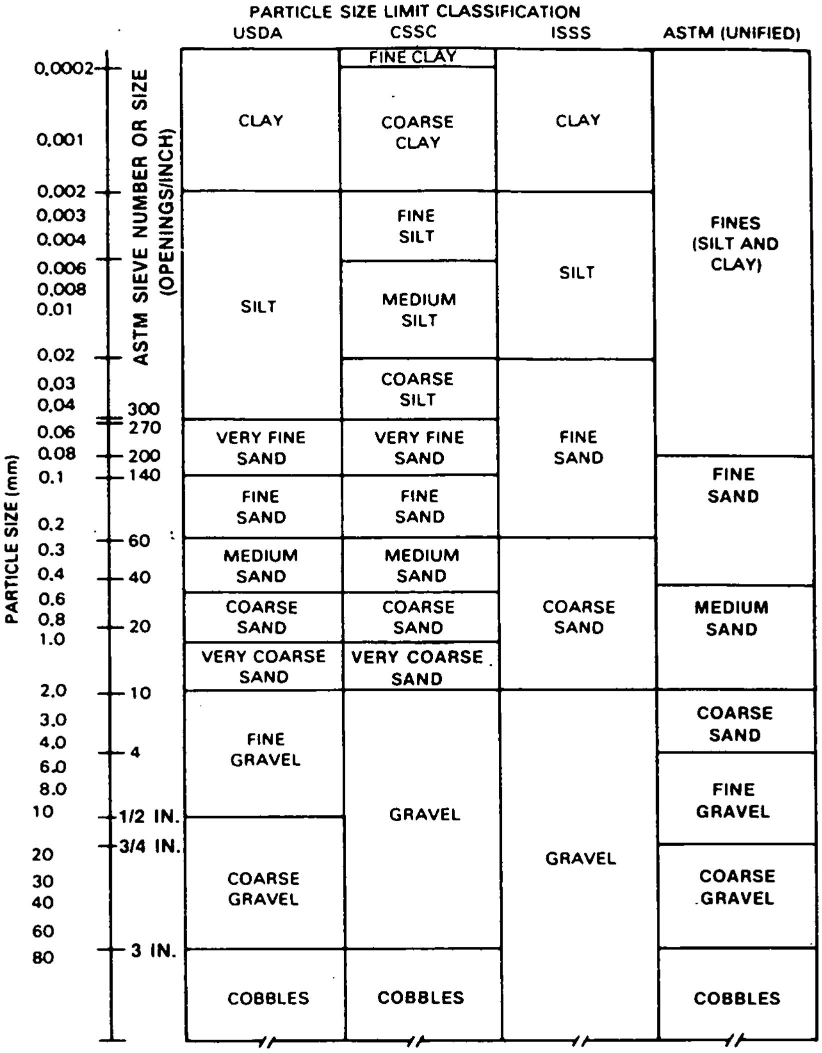
1986



USDA—U.S. DEPARTMENT OF AGRICULTURE, (SOIL SURVEY STAFF, 1975)
CSSC—CANADA SOIL SURVEY COMMITTEE, (McKEAGUE, 1978)
ISSS—INTERNATIONAL SOIL SCI. SOC. (YONG AND WARKENTIN, 1966)
ASTM (UNIFIED)—AMERICAN SOCIETY FOR TESTING & MATERIALS (ASTM, D-2487, 1985a)

Fig. 15-1. Particle-size limits according to several current classification schemes.

less than a given particle size is plotted against the logarithm of the "effective" particle diameter. Particle-size distribution curves, when differentiated graphically, produce frequency distribution curves for various particle sizes. Frequency curves usually exhibit a peak or peaks representing the most prevalent particle sizes.

Particle-size distribution curves are used extensively by geologists in geomorphological studies to evaluate sedimentation and alluvial pro-

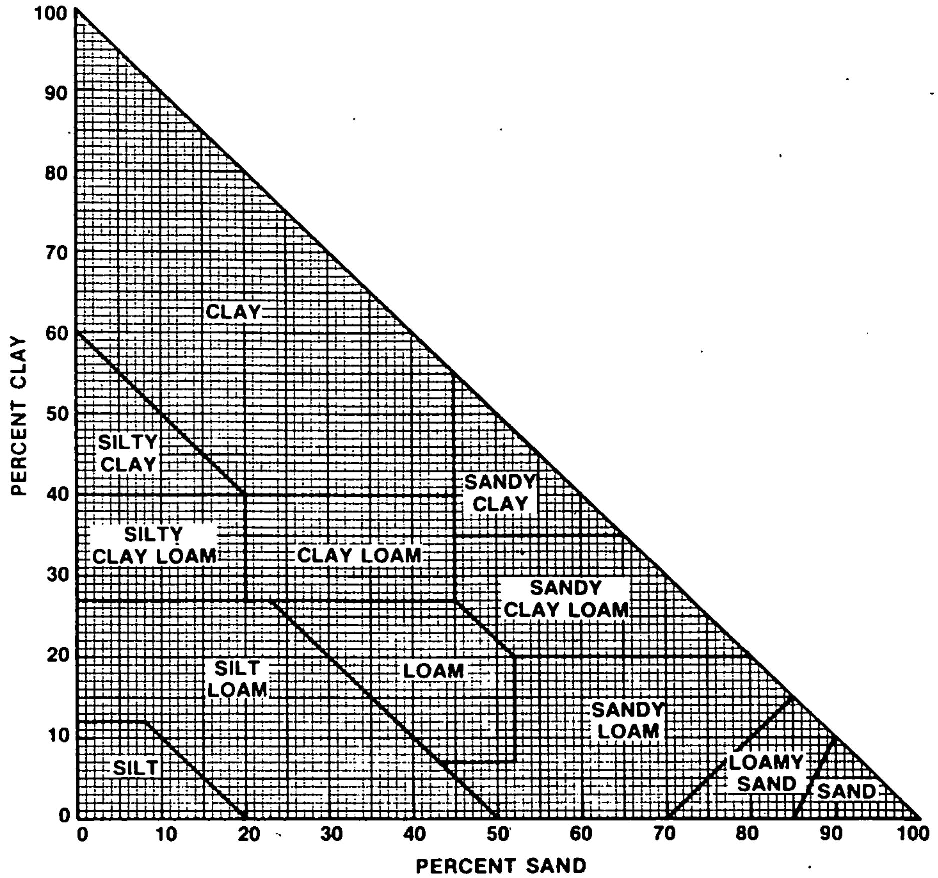


Fig. 15–3. Textural triangle for soil textural analysis using the USDA classification scheme.

soils contain aggregates that are not readily dispersed. Soils generally contain organic matter and often contain iron oxides and carbonate coatings that bind particles together. Chemical pretreatments are used for removal of these coatings; however, chemical treatment can result in destruction and dissolution of some soil minerals. Physical treatments are also used, but standardization of treatment and adequate testing of specific methods are needed, since the very process of separation by mechanical or ultrasonic means can fragment the individual particles into further subunits. Procedures should clearly specify the sample pretreatment, the separation method, and the purpose for which the size analysis is intended for a particular soil.

Standard PSA methods require that soil particles be dispersed in an aqueous solution by both chemical and physical means. After pretreatment, chemical dispersion is often accomplished using a dilute alkaline solution of sodium polyphosphate. The effectiveness of the chemical dispersing agent depends on its ability to create and maintain repulsive

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WATER QUALITY ASSESSMENT:
A Screening Procedure for Toxic and Conventional Pollutants in Surface and Ground Water
(Revised 1985)
Part 1

by

W.B. Mills, D.B. Porcella, M.J. Ungs, S.A. Gherini, K.V. Summers,
Lingfung Mok, G.L. Rupp, and G.L. Bowie
Tetra Tech, Incorporated
Lafayette, California 94549

and

D.A. Haith
Cornell University
Ithaca, New York 14853

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ENVIRONMENTAL RESEARCH LABORATORY
OFFICE OF RESEARCH AND DEVELOPMENT
U.S. ENVIRONMENTAL PROTECTION AGENCY
ATHENS, GEORGIA 30613

total upstream erosion since much of the transported sediment has been deposited or filtered from the water. Near a sediment source, nearly all eroded soil becomes a sediment mass flux. For example the sediment yield in runoff from a corn field is approximately equal to the eroded soil mass from the field. However, as the runoff travels from the field in drainage ditches and stream channels, portions of the sediment are removed, until only a fraction remains to exit the watershed.

Erosion of the land surface by sheet and rill erosion is the major source of solid-phase pollutants in surface waters, and most of this section is accordingly devoted to prediction of this sediment source. Although channel erosion may also be a significant component of sediment yield, it is not generally considered a pollution hazard and will not be considered in the following discussion.

3.4.3.1 The Universal Soil Loss Equation

The Universal Soil Loss Equation (USLE) is an empirical equation which was developed to predict average annual soil loss by sheet and rill erosion from source areas (Wischmeier and Smith, 1978). The equation, which was obtained by statistical analyses of over 10,000 plot-years of erosion field research data is:

$$X = 1.29\, E(K)(ls)C(P) \qquad \text{(III-11)}$$

where

- X = soil loss (t/ha; 1 t = 1 tonne = 1000 kg = 2205 lb)
- E = rainfall/runoff erosivity index (10^2 m-tonne-cm/ha-hr)
- K = soil erodibility (t/ha per unit of E)
- ls = topographic factor
- C = cover/management factor
- P = supporting practice factor.

The three factors ls, C, P are dimensionless. The 1.29 is a conversion constant to obtain metric units.

The USLE is an important component of loading functions for runoff waste loads because its parameters have been evaluated for a wide range of conditions and many important pollutants are transported on eroded soil. For example, most organochlorine pesticides are very strongly adsorbed to soil particles. Procedures for determining the USLE parameters are presented in the following subsections.

3.4.3.1.1 Rainfall/Runoff Erosivity

The erosivity term E is related to rainfall intensity. Average annual values for the United States have been computed by Wischmeier and Smith (1978) and are given in Figures III-10 and 11. The values of E in these figures are in English units (10^2 ft-tons-in/ac-hr) and can be converted to the metric units of Equation III-11 by multiplying by 1.735; i.e. E (metric) = 1.735 E (English, Figures III-10, 11). For example the erosivity for northern Maine is E = 1.735 (75) = 130.

It can be seen from Figure III-10 that the intense rainstorms of the Southeast produce the highest levels of erosivity in the United States. In contrast, erosivity in much of the western mountain region (Figure III-11) is less than 10 percent of the southeast values.

3.4.3.1.2 Soil Erodibility

Typical values of K are given in Table III-3 as a function of soil texture and organic matter content. Values for specific soils are available from local Soil and Water Conservation Districts and state offices of the Soil Conservation Service.

3.4.3.1.3 Topographic Factor

The topographic factor ls, is related to the angle of slope θ and slope length x (m) by:

$$ls = (0.045x)^b \; (65.41 \sin^2\theta + 4.56 \sin\theta + 0.065) \qquad \text{(III-12)}$$

The slope angle θ is obtained from percent slope, s by:

$$\theta = \tan^{-1}(s/100) \qquad \text{(III-13)}$$

For example, a slope of s = 8 percent has a slope angle of θ = 4.6°. The exponent in Equation III-12 is given by $b = 0.5$ for $s > 5$, $b = 0.4$ for $3.5 \leq s \leq 4.5$, $b = 0.3$ for $1 \leq s \leq 3$, and $b = 0.2$ for $s \leq 1$ (Wischmeier and Smith, 1978).

Research data support Equation III-12 for $x \leq 100$ m and $s \leq 18$, although in practice it is often applied beyond these limits.

3.4.3.1.4 Cover/Management Factor

The cover/management factor C describes the protection of the soil surface by plant canopy, crop residues, mulches, etc. The maximum C value is 1.0, corresponding to no protection. Cropland C values change dramatically during the year in response to planting operations, crop growth and harvest. Although C values have been determined for each of these stages (Wischmeier and Smith, 1978), generalized annual values such as those given in Table III-4 are more suitable for loading functions.

Wischmeier and Smith (1978) have also developed C factors for construction sites; pasture, range and idle land; undisturbed forests; and mechanically prepared woodland sites. These C values are given in Tables III-5 through III-8. Note that cover factors are so small for undisturbed forest and pasture or range with good ground cover that these erosion sources can generally be neglected in water quality studies.

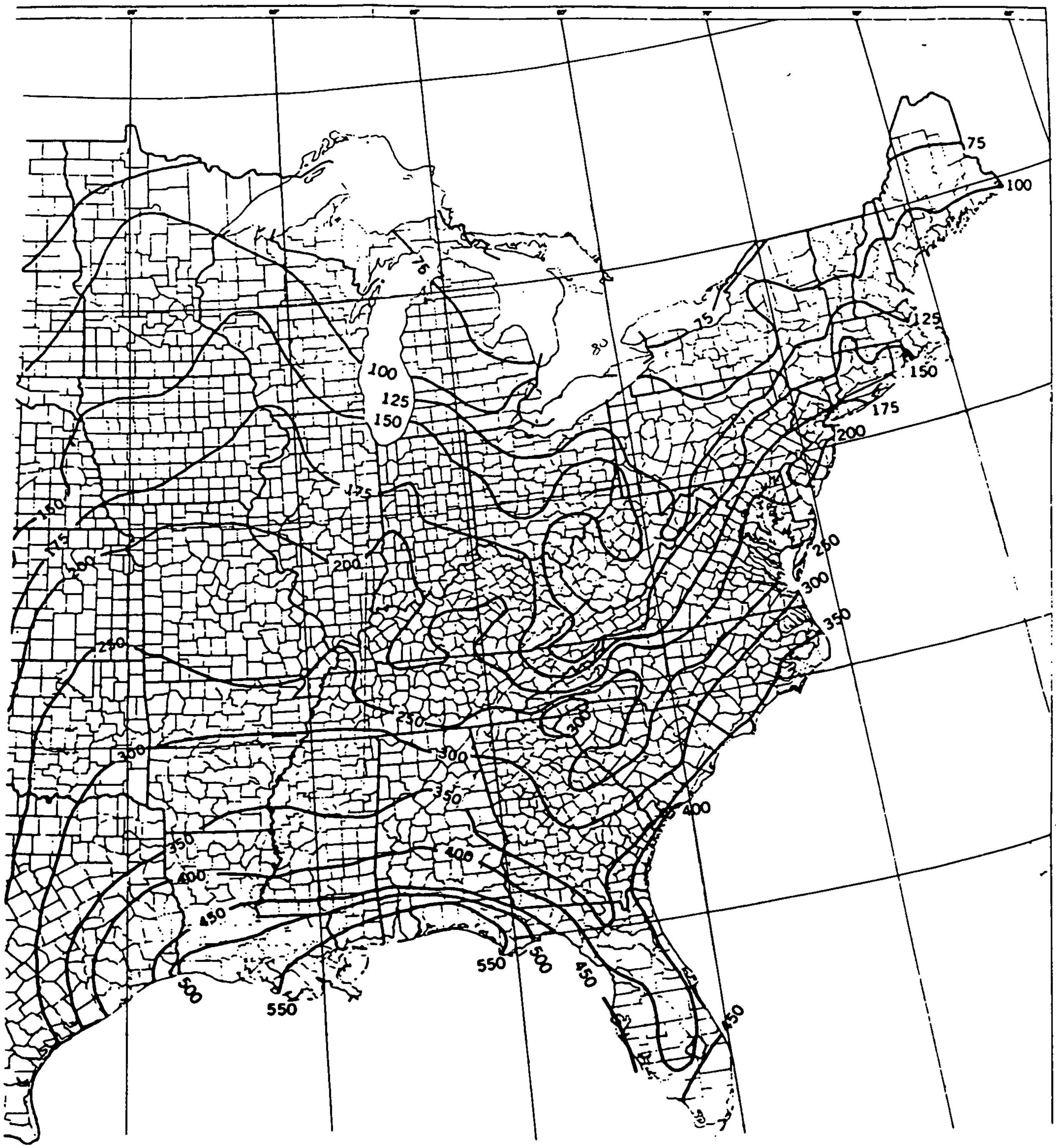

FIGURE III-10 AVERAGE ANNUAL EROSIVITY INDICES (ENGLISH UNITS) FOR EASTERN U.S. (WISCHMEIER AND SMITH, 1978)

TABLE III-3

SOIL ERODIBILITY, K

(Stewart *et al*, 1975)

Texture	Organic Matter		
	0.5%	2%	4%
Sand	0.05	0.03	0.02
Fine sand	0.16	0.14	0.14
Very fine sand	0.42	0.36	0.28
Loamy sand	0.12	0.10	0.08
Loamy fine sand	0.24	0.20	0.16
Loamy very fine sand	0.44	0.38	0.30
Sandy loam	0.27	0.24	0.19
Fine sandy loam	0.35	0.30	0.24
Very fine sandy loam	0.47	0.41	0.33
Loam	0.38	0.34	0.29
Silt loam	0.48	0.42	0.33
Silt	0.60	0.52	0.42
Sandy clay loam	0.27	0.25	0.21
Clay loam	0.28	0.25	0.21
Silty clay loam	0.37	0.32	0.26
Sandy clay	0.14	0.13	0.12
Silty clay	0.25	0.23	0.19
Clay		0.13-0.29	

TABLE III-6

C FACTOR VALUES FOR PERMANENT PASTURE, RANGE AND IDLE LAND

(Wischmeier and Smith, 1978)[1]

Vegetative canopy		Cover that contacts the soil surface						
			Percent ground cover					
Type and height[2]	Percent cover[3]	Type[4]	0	20	40	60	80	95+
No appreciable canopy		G	0.45	0.20	0.10	0.042	0.013	0.003
		W	.45	.24	.15	.091	.043	.011
Tall weeds or short brush with average drop fall height of 20 in	25	G	.36	.17	.09	.038	.013	.003
		W	.36	.20	.13	.083	.041	.011
	50	G	.26	.13	.07	.035	.012	.003
		W	.26	.16	.11	.076	.039	.011
	75	G	.17	.10	.06	.032	.011	.003
		W	.17	.12	.09	.068	.038	.011
Appreciable brush or bushes, with average drop fall height of 6½ ft	25	G	.40	.18	.09	.040	.013	.003
		W	.40	.22	.14	.087	.042	.011
	50	G	.34	.16	.08	.038	.012	.003
		W	.34	.19	.13	.082	.041	.011
	75	G	.28	.14	.08	.036	.012	.003
		W	.28	.17	.12	.078	.040	.011
Trees, but no appreciable low brush. Average drop fall height of 13 ft	25	G	.42	.19	.10	.041	.013	.003
		W	.42	.23	.14	.089	.042	.011
	50	G	.39	.18	.09	.040	.013	.003
		W	.39	.21	.14	.087	.042	.011
	75	G	.36	.17	.09	.039	.012	.003
		W	.36	.20	.13	.084	.041	.011

[1] The listed C values assume that the vegetation and mulch are randomly distributed over the entire area.

[2] Canopy height is measured as the average fall height of water drops falling from the canopy to the ground. Canopy effect is inversely proportional to drop fall height and is negligible if fall height exceeds 33 ft.

[3] Portion of total-area surface that would be hidden from view by canopy in a vertical projection (a bird's-eye view).

[4] G: cover at surface is grass, grasslike plants, decaying compacted duff, or litter at least 2 in deep.

W: cover at surface is mostly broadleaf herbaceous plants (as weeds with little lateral-root network near the surface) or undecayed residues or both.

TABLE III-5

C FACTOR VALUES FOR CONSTRUCTION SITES

(Wischmeier and Smith, 1978)[1]

Type of mulch	Mulch Rate	Land Slope	Factor C	Length limit[2]
	Tons per acre	*Percent*		*Feet*
None	0	all	1.0	—
Straw or hay,	1.0	1-5	0.20	200
tied down by	1.0	6-10	.20	100
anchoring and				
tacking	1.5	1-5	.12	300
equipment[3]	1.5	6-10	.12	150
Do.	2.0	1-5	.06	400
	2.0	6-10	.06	200
	2.0	11-15	.07	150
	2.0	16-20	.11	100
	2.0	21-25	.14	75
	2.0	26-33	.17	50
	2.0	34-50	.20	35
Crushed stone,	135	<16	.05	200
¼ to 1½ in	135	16-20	.05	150
	135	21-33	.05	100
	135	34-50	.05	75
Do.	240	<21	.02	300
	240	21-33	.02	200
	240	34-50	.02	150
Wood chips	7	<16	.08	75
	7	16-20	.08	50
Do.	12	<16	.05	150
	12	16-20	.05	100
	12	21-33	.05	75
Do.	25	<16	.02	200
	25	16-20	.02	150
	25	21-33	.02	100
	25	34-50	.02	75

[1] . Developed by an interagency workshop group on the basis of field experience and limited research data.

[2] Maximum slope length for which the specified mulch rate is considered effective. When this limit is exceeded, either a higher application rate or mechanical shortening of the effective slope length is required.

[3] When the straw or hay mulch is not anchored to the soil, C values on moderate or steep slopes of soils having K values greater than 0.30 should be taken at double the values given in this table.

TABLE III-9

PRACTICE FACTORS (P) USED IN UNIVERSAL SOIL LOSS EQUATION

(Stewart et al, 1975)

Practice	Land slope (percent)				
	1.1-2	2.1-7	7.1-12	12.1-18	18.1-24
	(Factor P)				
Contouring (P_c)	0.60	0.50	0.60	0.80	0.90
Contour strip cropping (P_{sc})					
R-R-M-M[1]	0.30	0.25	0.30	0.40	0.45
R-W-M-M	0.30	0.25	0.30	0.40	0.45
R-R-W-M	0.45	0.38	0.45	0.60	0.68
R-W	0.52	0.44	0.52	0.70	0.90
R-O	0.60	0.50	0.60	0.80	0.90
Contour listing or ridge planting (P_{cl})	0.30	0.25	0.30	0.40	0.45
Contour terracing (P_t)[2]	[3] $0.6/\sqrt{n}$	$0.5/\sqrt{n}$	$0.6/\sqrt{n}$	$0.8/\sqrt{n}$	$0.9/\sqrt{n}$
No support practice	1.0	1.0	1.0	1.0	1.0

1 R = rowcrop, W = fall-seeded grain, O = spring-seeded grain, M = meadow. The crops are grown in rotation and so arranged on the field that rowcrop strips are always separated by a meadow or winter-grain strip.

2 These P_t values estimate the amount of soil eroded to the terrace channels and are used for conservation planning. For prediction of off-field sediment, the P_t values are multiplied by 0.2.

3 n = number of approximately equal-length intervals into which the field slope is divided by the terraces. Tillage operations must be parallel to the terraces.

return periods. Note that the English units E values given in Table III-10 must be multiplied by 1.735 to obtain the metric E used in Equation III-11.

Method 3: Erosivities from daily rainfall data.

Richardson et al. (1983) developed a regression equation for erosivity based on daily rainfall data. Converting their results to the units of E in Equation III-11, the expected values of E for a daily rainfall R (cm) is:

$$E = 6.46a\ R^{1.81} \qquad \text{(III-14)}$$

The coefficient "a" varies with location and season. Richardson et al. (1983) determined cool season (October-March) and warm season (April-September) coefficients for the locations shown in Figure III-12.

MALCOLM PIRNIE

APPENDIX C3

CONTAMINANT LOADING TO ELLICOTT CREEK VIA SOIL EROSION AND GROUND WATER

ZONE	LOCATION	AREA	SOIL LOSS lbs/ft²/yr
A	NORTH AREA - along Creek	155' x 25'	1.02
B	NORTH AREA between Office and Locker Room	45' x 60'	2.47
C	CONRAIL PROPERTY	65' x 90' x ½	0.57
D	CREEK BANK ALONG NORTH AREA	50' x 8'	23.6
E	Creek Bank ALONG IRM	57' x 10'	23.6
	"	60' x 10' } 1650	
	"	48' x 10'	
F	CREEK BANK ALONG CONRAIL PROP.	70' x 10'	23.6
	CENTRAL AREA*	140 x 60	1.03

NOTE:

FOR Page 2 of 7 - Average Concentrations of Site Surface locations are arithmetic averages of analyses from 0 to 2 feet bgs. at the sampling locations indicated.

- Average concentrations of Creek Bank locations are arithmetic averages of analyses from below 2 feet bgs at the sampling locations indicated.

n = number of analyses averaged.

MALCOLM PIRNIE, INC.

BY RHO DATE 12-16-90 SHEET NO. 2 OF 7

CHKD. BY .... DATE .... JOB NO. 1332-01-1

SUBJECT AVERAGE CONCENTRATIONS IN NONREMEDIATED SUBAREAS

ZONE	SITE SURFACE			CREEK BANK	
PARAMETER	NORTH AREA A (DRY wght mean)	NORTH AREA B	CONRAIL PROPERTY	NORTH AREA	CONRAIL
PCBs (mg/Kg)	11.5 n= 18	33 n=12	51 n= 21	3.3 n=17	0.57 n= 4
Locations Averaged	SB90-1,2,4,5,6 7,10,11,12,13 BH-48,49,58,59 60,61,62,63	BH 36 to 47	SB90-42 to 48 BH 30 to 35 - 50 to 57	SB90- 1,2,3,4 6,8,10,12,14,21	SB90-42 and 48
Cadmium	2.3 n= 10	NOT ANALYZED	48 n= 7	3.3 n= 18	4.5 n= 4
	SB90-1,2,4,5,6 7,10,11,12,13		SB90-42,43,44, 45,46,47,48	SB90-1,2,3,4,6,8 10,12,14,21	SB90- 42,48
Chromium	65 n=10	NA	391 n=7	29 n=18	129 n=4
	(as above)	(as above)	(as above)	(as above)	(as above)
Nickel	36 n=10	NA	692 n=7	40 n=18	131 n=4
	(as above)	(as above)	(as above)	(as above)	(as above)
Lead	215 n=10	NA	5020 n=7	68 n=18	626 n=4
	(as above)	(as above)	(as above)	(as above)	(as above)

MALCOLM PIRNIE

MALCOLM PIRNIE, INC.

BY RHO DATE 12-7-90 SHEET NO. 2a OF 7

CHKD. BY .... DATE .... JOB NO. 1332-01-1

SUBJECT ~~SOIL~~ CONTAM. LOADING VIA SOIL EROSION

AVERAGE CONCENTRATIONS

AVERAGE CONCENTRATIONS OF CONTAMINANTS IN REMEDIATED AREA

ZONE	CENTRAL AREA (2) ✓	✓ IRM CREEK BANK (1)
PARAMETER mg/kg	DRY WEIGHT MEAN (PPM)	DRY WGT MEAN (PPM)
TOTAL PCB (LOCATIONS AVERAGED)	249 ppm n = 37 SB90-25, 26, 27, 28, 37, 38 MW-2D, ~~MW-1D~~ BH 1 to BH 29 B2 to B7, B10, B11	63. n = 15 SB90-28, 29, 35, 36, 41 BH - 14, 21, 23 B3
CADMIUM	10 ppm n = 12 SB90- 25, 26, 27, 28, 37, 38, 22 MW-2D, MW-1D B4, B5, B6,	11.5 n = 12 SB90 - 28, 29, 35, 36, 41 B3
Chromium	139 ppm n = 12 (as above)	116 n = 12 (as above)
Nickel	310 n = 12 (as above)	406 n = 12 (as above)
Lead	1617 n = 12 (as above)	474 n = 12 (as above)

NOTES:

(1) Average of all analyses below 2 feet (bgs) at specified locations. n = total number of analyses which were averaged.

(2) Average of all analyses from 0 to 2 feet (bgs) at specified locations.

CONTAMINANT LOADING - PCBs

AREA	SOIL LOSS (lbs/ft²/yr)	Area (ft²)	conversion (kg/lb)	Average Conc. (mg/kg)	conversion (kg/mg)	Loading(1) (kg/yr)
NORTH AREA A	1.02	155′ x 25′	.4356	11.5	10^{-6}	.020
NORTH AREA B	2.47	45′ x 60′	.4356	33	10^{-6}	.096
CENTRAL AREA (2)	1.03	140′ x 60′	.4356	249	10^{-6}	(.938)(3)
CONRAIL PROPERTY	0.57	65′ x 90′ x 1/2	.4356	51	10^{-6}	.037
TOTAL SITE SURFACE						1.091
NORTH AREA BANK	23.6	1100/1100 200 x 5′	.4356	3.3	10^{-6}	0.034
IRM AREA BANK	23.6	1650′	.4356	63	10^{-6}	(1.069)(3)
CONRAIL PROP. BANK	23.6	75′ x 10′	.4356	0.57	10^{-6}	0.004
TOTAL CREEK BANK						1.107

TOTAL LOADING , kg/yr

(1) Loading (kg/yr) = SOIL LOSS $\left(\frac{lbs/ft^2}{yr}\right)$ x Area (ft^2) x .4356 $\frac{kg}{lb}$ x Average Concentration $\left(\frac{mg}{kg}\right)$ x 10^{-6} $\frac{kg}{mg}$

(2) Assumes Plastic Sheeting is Absent

(3) 0.0 for Existing Conditions

CONTAMINANT LOADING – CADMIUM

AREA	SOIL LOSS (lbs/ft²/yr)	AREA (ft²)	Conversion (kg/lb)	AVERAGE CONC (mg/kg)	Conversion (kg/mg)	LOADING[1] (Kg/yr)
NORTH AREA A	1.02	155' x 25'	.4356	2.3	10^{-6}	0.004
NORTH AREA B	2.47	45' x 60'	.4356	NA	10^{-6}	NA
CENTRAL AREA[2]	1.03	140 x 60'	.4356	10	10^{-6}	(.038)[3]
CONRAIL PROPERTY	0.57	65' x 90' x ½	.4356	48	10^{-6}	.035
TOTAL SITE SURFACE						.077
NORTH AREA BANK	23.6	200' x 5'	.4356	3.3	10^{-6}	.034
IRM AREA BANK	23.6	1650'	.4356	11.5	10^{-6}	(.195)
CONRAIL PROP. BANK	23.6	75' x 10'	.4356	4.5	10^{-6}	.035
TOTAL CREEK BANK						.264

(1) $\text{Loading}\left(\frac{\text{Kg}}{\text{yr}}\right) = \text{SOIL LOSS}\left(\frac{\text{lbs/ft}^2}{\text{yr}}\right) \times \text{Area}\,(\text{ft}^2) \times .4356\,\frac{\text{kg}}{\text{lb}} \times \text{Average Concentration}\left(\frac{\text{mg}}{\text{kg}}\right) \times 10^{-6}\,\frac{\text{Kg}}{\text{mg}}$

(2) Assumes Plastic Sheeting is Absent

(3) 0.0 for Existing Conditions

CONTAMINANT LOADING - CHROMIUM

AREA	SOIL LOSS (lbs/ft²/yr)	AREA (ft²)	Conversion (kg/lb)	AVE. CONCENTRAT. (mg/kg)	Conversion (Kg/mg)	LOADING(1) (Kg/yr)
NORTH AREA A	1.02	155' x 25'	.4356	65	10^{-6}	0.112
NORTH AREA B	2.47	45' x 60'	.4356	NA	10^{-6}	NA
CENTRAL AREA	1.03(2)	140' x 60'	.4356	139	10^{-6}	(0.524)(3)
CONRAIL PROPERTY	0.57	65' x 90' x 1/2	.4356	391	10^{-6}	0.284
TOTAL SITE SURFACE						.920
NORTH AREA BANK	23.6	200' x 5'	.4356	29	10^{-6}	0.298
IRM AREA BANK	23.6	1650'	.4356	116	10^{-6}	(1.968)(3)
CONRAIL PROP BANK	23.6	75' x 10'	.4356	129	10^{-6}	.995
TOTAL CREEK BANK						3.26

(1) $\text{Loading}\left(\frac{kg}{yr}\right) = \text{Soil loss}\left(\frac{lbs/ft^2}{yr}\right) \times \text{Area}(ft^2) \times .4356\left(\frac{kg}{lb}\right) \times \text{Average Concentration}\left(\frac{mg}{Kg}\right) \times 10^{-6}\left(\frac{kg}{mg}\right)$

(2) Assumes Plastic Sheeting is Absent

(3) 0.0 for Existing Conditions

CONTAMINANT LOADING - NICKEL

AREA	SOIL LOSS (lbs/ft²/yr)	AREA (ft²)	conversion (Kg/lb)	Average Conc (mg/Kg)	conversion (Kg/mg)	Loading[1] (Kg/yr)
NORTH AREA A	1.02	155 x 25	.4356	36	10^{-6}	0.062
NORTH AREA B	2.47	45 x 60	.4356	NA	10^{-6}	NA
CENTRAL AREA	1.03[2]	140 x 60	.4356	310	10^{-6}	(1.168)[3]
CONRAIL PROP.	0.57	65 x 90 x 1/2	.4356	692	10^{-6}	0.503
TOT. SITE SURFACE						1.733
NORTH AREA BANK	23.6	200' x 5'	.4356	40	10^{-6}	0.411
IRM AREA BANK	23.6	1650	.4356	406	10^{-6}	(6.89)[3]
CONRAIL PROP. BANK	23.6	75 x 10	.4356	131	10^{-6}	1.011
TOTAL CREEK BANK						8.31

(1) $\text{Loading}\left(\frac{Kg}{yr}\right) = \text{Soil loss}\left(\frac{lbs/ft^2}{yr}\right) \times \text{Area}(ft^2) \times .4356\left(\frac{Kg}{lb}\right) \times \text{Average Concentration}\left(\frac{mg}{Kg}\right) \times 10^{-6}\left(\frac{Kg}{mg}\right)$

(2) Assumes Plastic Sheeting is Absent

(3) 0.0 for existing Conditions

CONTAMINANT LOADING - LEAD

AREA	SOIL LOSS (lbs/ft²/yr)	AREA (ft²)	CONVERSION (Kg/lb)	AVERAGE CONC (mg/kg)	CONVERSION (Kg/mg)	LOADING (1) (Kg/yr)
NORTH AREA A	1.02	155 x 25	.4356	215 (171)	10^{-6}	0.370
NORTH AREA B	2.47	45 x 60	.4356	NA	10^{-6}	NA
CENTRAL AREA	1.03 (2)	140 x 60	.4356	101.7 (1,143)	10^{-6}	(3.83) (3)
CONRAIL PROPERTY	0.57	65 x 90 x 1/2	.4356	5020 (3201)	10^{-6}	3.651
TOT. SITE SURFACE						7.85
NORTH AREA BANK	23.6	200' x 5'	.4356	68 (37.1)	10^{-6}	0.699
IRM AREA BANK	23.6	1650	.4356	474 (255)	10^{-6}	(8.04) (3)
CONRAIL PROP BANK	23.6	75 x 10	.4356	626 (1267)	10^{-6}	4.83
TOTAL CREEK BANK						13.57

(1) $\text{Loading}\left(\frac{Kg}{yr}\right) = \text{Soil loss}\left(\frac{lbs/ft^2}{yr}\right) \times \text{Area}(ft^2) \times .4356\left(\frac{Kg}{lb}\right) \times \text{Average Concentration}\left(\frac{mg}{Kg}\right) \times 10^{-6}\left(\frac{kg}{mg}\right)$

(2) Assumes Plastic Sheeting is Absent

(3) 0.0 for Existing Conditions

MALCOLM PIRNIE

MALCOLM PIRNIE, INC.

BY R.H.O. DATE 12-18-90 SHEET NO. 1 OF 2

CHKD. BY .... DATE .... JOB NO. 1332-01-1

SUBJECT ....

CALCULATION OF BACKGROUND LOADINGS TO ELLICOTT CREEK

AREA	SOIL LOSS (lbs/ft²/yr)	AREA (ft²)	CONVERSION (Kg²/lbmg)	BACKGROUND[1] CONCENTRATION (mg/kg)	LOADING (Kg/yr)
CADMIUM					
NORTH A	1.02	155 x 25	.4356 x 10⁻⁶	1.0	.0017
NORTH B	2.47	45 x 60	↓		.0029
CONRAIL	0.57	65 x 90 x 1/2	↓		.0013
IRM BANK	23.6	165 x 10'	↓		.0170
NORTH BANK	23.6	200 x 5'	↓		.0103
CONRAIL BANK	23.6	75 x 10	↓		.0077
TOTAL					.0409
CHROMIUM					
NORTH A	1.02	155 x 25	.0017	20	.0340
NORTH B	2.47	45 x 60	.0029		.0580
CONRAIL	0.57	65 x 90 x 1/2	.0007		.0140
IRM BANK	23.6	165 x 10'	.0170		.3400
NORTH BANK	23.6	200 x 5'	.0103		.2060
CONRAIL BANK	23.6	70 x 10	.0072		.1440
TOTAL					.796
NICKEL					
NORTH A	1.02	155 x 25	↓	23	.0391
NORTH B	2.47	45 x 60	↓		.0667
CONRAIL	0.57	65 x 90 x 1/2	↓		.0161
IRM BANK	23.6	165' x 10'	↓		.3910
NORTH BANK	23.6	200 x 5'	↓		.2369
CONRAIL BANK	23.6	70 x 10	↓		.1656
TOTAL					.9154

NOTE

(1) Background Concentrations are from 4-6 ft at MW-3.

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MALCOLM PIRNIE, INC.

BY RHO DATE 12-18-90 SHEET NO. 2 OF 2

CHKD. BY .... DATE .... JOB NO. 1332-01-1

SUBJECT ....

CALCULATION OF BACKGROUND LOADING to EllICOTT CREEK

AREA	SOIL LOSS (lbs/ft²/yr)	AREA (ft²)	CONVERSION (Kg²/lb mg)	BACKGROUND CONCENTRATION (mg/Kg)	LOADING (Kg/yr)
Lead					
NORTH A	1.02	155.x25	$.4356 \times 10^{-6}$	22	.0374
NORTH B	2.47	45x60	↓		.0638
CONRAIL	0.57	65x90x½	↓		.0154
IRM BANK	23.6	165x10'	↓		.3740
NORTH BANK	23.6	200'x5'	↓		.2266
CONRAIL BANK	23.6	70x10	↓		.1584
TOTAL					.8756

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MALCOLM PIRNIE, INC.

BY R.H.O. DATE 12-10-90 SHEET NO. 1 OF 1

CHKD. BY .... DATE .... JOB NO. 1333-01-1

SUBJECT GROUND WATER LOADING TO ELLICOTT CREEK

AVERAGE CONCENTRATIONS WERE DETERMINED FROM ANALYTICAL RESULTS AT MW 1S/1I, AND MW-2S/2I FOR THE FOLLOWING PARAMETERS:

	NUMBER OF LOCATIONS DETECTED	AVERAGE (ug/L)
TOTAL PCBs	(ND @ 1.0)*	(<1.0)
TOTAL VOLATILE ORG.		
CADMIUM	(ND @ <5.0)*	(<5.0)
CHROMIUM	(11 + 3 ND @ <10)*	(10.3)
NICKEL	(88 + 3 ND @ <40)*	(52)
LEAD	(22 + 3 ND @ <3.0)*	(7.8)

* MAY 1991 Data

PARAMETER	AVERAGE [CONC] (ug/L)	×	(L/ft³)	×	SPECIFIC DISCHARGE (ft³/Day)	×	(Kg/ug)	×	(day/yr)	=	Loading (Kg/yr)
Total PCBs	≤1.0		28.3	×	404*	×	10^{-9}	×	365	=	[illegible]
Total VOCs	15		(0.00417312)							=	.063
Cd	<5.0		(")							=	.02
Cr	10		(")							=	.04
Ni	52		(")							=	.21
Pb	7.8		(")							=	.031

* see GW DISCHARGE Section 4.4.3

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APPENDIX D

ANALYTICAL DATA INFORMATION

D1 Analytical Laboratory Report
D2 Analytical Data Validation Report

APPENDIX D1

Analytical Report
prepared by
Wadsworth Alert Laboratories, Inc.

Due to the large volume of analytical results, the analytical report will be sent under separate cover.

MALCOLM PIRNIE

APPENDIX D2

ANALYTICAL DATA VALIDATION REPORT

QUALITY CONTROL

INTRODUCTION

This section details an assessment and validation of analytical results reported for ground water, soil and sediment samples which were collected from the Columbus McKinnon Site. All samples were collected by Malcolm Pirnie personnel during the period April 10 through May 18, 1990 and August 22 through 24, 1990. The samples were analyzed by Wadsworth/-Alert Laboratories, Inc. for volatile organic compounds, PCBs and the inorganic elements nickel, cadmium, chromium and lead.

The data assessment is a measure of data quality and reliability which provides the data user with an explanation of the qualitative confidence and quantitative error associated with individual results. The evaluation is based upon information obtained from completed data sheets, document control forms, blank data, and recovery data for both matrix and surrogate spikes. The USEPA "Functional Guidelines for Evaluating Organic Analyses" (February 1988) and "Functional Guidelines for Evaluating Inorganic Analyses" (June 1988), hereinafter referred to as "guidelines", were used for the validation.

SAMPLE HOLDING TIMES

The federal guidelines for evaluating organic analyses, define the holding time as the number of days from sample collection to the date of analysis or extraction. For volatile organics, the federal guidelines recommend a maximum holding time of fourteen days for soil samples and preserved aqueous samples. According to the 1987 NYS CLP protocol, the maximum holding time for aqueous and soil/sediment samples intended for volatile organic analyses is seven days from Verified Time of Sample Receipt (VTSR) to date of analyses.

By comparing the actual dates of sample receipt the dates of analyses, the following samples submitted for volatile organic analyses were analyzed after the maximum holding time mandated by the NYSDEC had expired, but were within the maximum holding time prescribed by the EPA:

SAMPLE	HOLDING TIME (From VTSR)
SB90-20 (10-12)	8 days
SB90-26 (4-6)	13 days
SB90-32 (4-6)	9 days
SB90-31 (4-6)	9 days
SB90-30 (4-6)	13 days
SB90-30 (6-8)	13 days
SB90-29 (6-8)	13 days
SB90-29 (8-10)	13 days
SB90-35 (6-8)	8 days
SB90-36 (4-6)	13 days
SB90-36 (6-8)	8 days
SB90-33 (4-6)	8 days
SB90-37 (26-28) (duplicate of SB90-37 (6-8)	13 days

According to the guidelines, all positive results for volatile organic compounds detected in these samples should be estimated and therefore qualified with a "J".

For pesticides/PCBs, the federal guidelines recommend a maximum holding time of seven days from date of collection to date of extraction. The extract must then be analyzed within forty days. This holding time applies to both soil/sediment and aqueous samples. The 1987 NYS CLP protocol recommends a maximum holding time of five days from VTSR to date of extraction for aqueous samples and ten days from VTSR to date of extraction for soil/sediment samples. All aqueous, soil and sediment samples analyzed for pesticide/PCBs were extracted and analyzed within the holding time requirements stipulated in the 1987 NYS CLP protocol and the federal guidelines. Therefore, no qualification of the PCB data based on holding times is required.

Technical requirements for sample holding times for inorganics in soil matrices have not yet been established. According to the guidelines, holding times for water matrices should be applied to soil matrices. The following holding times have been established under 40 CFR Part 136 (Clean Water Act). Preservation refers to aqueous samples only:

METALS: 6 months; preserved at pH < 2

MERCURY: 28 days; preserved at pH < 2

All groundwater, sediment and soil samples submitted for inorganic analyses were analyzed prior to expiration of the established holding times. In addition, all water samples were preserved with the appropriate preservatives. Therefore, no qualification of the inorganic data based on holding times is required.

CALIBRATION

Requirements for satisfactory instrument calibration are established to ensure that a particular instrument (ICP, AA, GC) is capable of producing acceptable quantitative data. Initial calibration and continuing calibration data are needed to document acceptable performance at the beginning of an analytical run and to verify that the initial calibration is still valid at a later time during the analytical run. An EPA certified standard is normally used for the calibration verification.

An assessment of the calibration data for both organic and inorganic analyses indicated satisfactory instrument performance.

BLANKS

The purpose of assessing the results of blank analyses is to determine the existence and magnitude of contamination which may potentially be introduced during preparation of sample containers, sample collection and/or sample analysis. Many types of blanks such as laboratory/method blanks, field/equipment blanks and trip blanks are analyzed. Each type of blank will give the data user an indication of the source of the contamination, if any.

According to the guidelines, blank evaluation criteria apply to any blank associated with the samples. When more than one blank is associated with a given sample, qualification is based on a comparison with the associated blank having the highest concentration of a contaminant. Positive results for compounds reported in the samples at a concentration of less than ten (10) times the associated blank contamination value, five (5) times for less common contaminants), are qualified as not detected (ND) and the method detection limit set equal to the value detected in the sample. The method detection limit is then qualified with a "B".

As part of this sampling program, trip blanks and equipment blanks were collected. In addition, the laboratory analyzed method blanks. In evaluating all blank data for inorganic analyses, it is noted that no inorganic contaminants were detected in any of the blanks. In evaluating the blank data for organic analyses, only the equipment blanks were found to contain some volatile organic contamination. The following compounds were detected in the equipment blanks:

BLANK IDENTIFICATION	ANALYTE	CONCENTRATION
EB-3	1,2-dichlorobenzene	1 ug/l
	dichloromethane	1 ug/l
Equipment Blank	dichloromethane	6 ug/l
EB-8	dichloromethane	15 ug/l
EB-9	dichloromethane	10 ug/l
	1,2-dichlorobenzene	2 ug/l

No samples are affected by the 1,2-dichlorobenzene contamination as this compound was detected at concentrations greater than five times the concentration detected in the equipment blank. The following qualifications apply to only dichloromethane:

SAMPLE	ANALYTE	CONCENTRATION	REVISED CONCENTRATION
SB90-42 (4-6)	dichloromethane	0.005 mg/l	ND (MDL = 0.005B)
SB90-42 (20-22)	dichloromethane	0.005 mg/l	ND (MDL = 0.005B)

ND = Not Detected
MDL = Method Detection Limit
R = Estimated Detection Limit due to Blank Contamination

MATRIX SPIKE/MATRIX SPIKE DUPLICATE (MS/MSD) ANALYSES

MS/MSD data are generated to determine long-term precision and accuracy of the analytical method on various matrices. Matrix spike recoveries must be within advisory limits given in the guidelines. The relative percent difference between the MS and the MSD must also be within advisory limits given in the guidelines. The following matrix spike recoveries were outside of the advisory limits:

SAMPLE	ANALYTE	RECOVERY	ACCEPTANCE LIMITS
SB90-14 (8-10)	1,1-dichloroethene	175%	67% - 122%
	trichloroethene	66%	71% - 119%
Creek Sediment #4	PCB (no distinction)	60%	65% - 142%

The MS/MSD data alone can not be used to evaluate the precision and accuracy of individual samples. In general, no action is taken on MS/MSD data to qualify an entire case. Qualification is limited to the unspiked sample associated with the MS/MSD. Therefore, any positive results for these compounds in the unspiked sample have been qualified with a "J" to indicate that the result is estimated.

All matrix spike criteria were met for inorganic analyses.

SURROGATE SPIKE RECOVERY

Although no "raw" surrogate spike recovery data was given in the data package, the laboratory reported that the volatile surrogate recoveries were within established criteria.

FIELD DUPLICATE PRECISION

Field duplicate samples were collected during both sampling rounds to assess the aggregate analytical and sampling protocol precision. The results of the duplicate samples collected during the first round of sampling generally showed satisfactory reproducibility indicating adequate analytical and sampling protocol precision. One exception is as follows:

PCB-1254 was detected in creek sediment #11 at 0.27 mg/kg but was not detected in the duplicate sample (viz. creek sediment #8). In addition, cadmium was not detected in creek sediment #11 but was detected at 0.6 mg/kg in the duplicate sample (viz. creek sediment #8). According to the guidelines, analytes detected in duplicate samples at concentrations exceeding a relative percent difference of 30% or greater are qualified with a "J". The qualification applies only to the duplicate sample set and indicates that the particular analyte is estimated.

It is noted that PCB-1254, cadmium, chromium, lead, and nickel were detected in sample SB90-37 (6-8) but these parameters were not analyzed in the duplicate sample due to a laboratory error. Therefore, no qualification of this duplicate data set is necessary.

The results of the duplicate samples collected during the second sampling round showed satisfactory reproducibility for the volatile organic fraction but poor reproducibility for the PCB and inorganic fractions. PCB concentrations differed by more than 100% and some inorganic results differed by more than two orders of magnitude. This difference may be due to the non-homogeneous nature of the particular sample analyzed. These results are noted by an "J" on the analytical results table. Results which exhibited between 30% and 100% difference are also qualified with a "J".

CHECK SAMPLE RECOVERY

As an additional evaluation of technique, methodology and calibration, check samples were analyzed for volatile organic compounds, PCBs, and inorganic elements for each of the sampling rounds. Each of the check samples consisted of reagent-grade water which had been spiked with the analytes of interest by an independent source.

The check sample recoveries for volatile organic compounds were within established control limits except for the recovery of toluene and 1,1-dichloroethene. Both of these compounds exhibited recoveries greater than the upper control limit established by the laboratory, indicating a potential high bias.

A review of the inorganic check sample recovery data showed cadmium and chromium recoveries to be slightly greater than the upper control limit established by the laboratory. Again, these results indicate a potential high bias.

All PCB check recoveries were within the established control limits.

CONCLUSION

Based on the above assessment the analytical data generated for the Columbus McKinnon Site is considered to be valid and useful for the purpose of conducting the RI/FS. It is recommended that the analytical data generated for the Columbus McKinnon site be accepted with the specific qualifications noted herein.

MALCOLM PIRNIE

APPENDIX E

HISTORIC ANALYTICAL DATA

APPENDIX E

HISTORIC ANALYTICAL DATA LIST OF HISTORIC ANALYTICAL REPORTS PREPARED BY ACTS TESTING LAB FOR VSSR ENGINEERS			
DATE SAMPLE SUBMITTED TO LAB	DATE OF ANALYTICAL REPORT	SOIL SAMPLE LOCATION	NUMBER OF SOIL SAMPLES/ LOCATION
July 20, 1979	Dec. 5, 1979	Boring 2 Boring 3	3 2
Sept. 25, 1979	Dec. 5, 1979	Boring 4 Boring 5 Boring 6	4 4 4
Feb. 12, 1980	March 6, 1980	Boring 7 Boring 8 Boring 9	3 5 3
Sept. 9, 1981	October 7, 1981	Boring 10 Boring 11 Boring 12	3 6 4

ACTS TESTING LABS, INC.
3900 Broadway • Buffalo, N. Y. 14227 • (716) 684-3300

TECHNICAL REPORT 9-439 December 5, 1979

Mr. John Schmitt
Van Wert, Snyder, Sklarsky, Rowley

OBJECT:

Analysis of soil borings taken from the inactive dump site at Columbus McKinnon Corporation, Tonawanda, New York.

INTRODUCTION:

On July 20, 1979 a preliminary set of sixteen bore samples was received from Mr. John Schmitt of VSSR. The samples designated for analysis were as follows:

Samples	Code
Bore 2, Sample 1 & 2 composited	2-1/2
Bore 2, Sample 5	2-5
Bore 2, Sample 9	2-9
Bore 3, Sample 1 & 2 composited	3-1/2
Bore 3, Sample 5	3-5

On September 25, 1979 a second set of borings containing twelve samples was received from Mr. John Schmitt of VSSR. The samples for analysis were designated as follows:

Samples	Code
Bore 4, Sample 1	4-1
Bore 4, Sample 2	4-2
Bore 4, Sample 3	4-3
Bore 4, Sample 5	4-5
Bore 5, Sample 1	5-1
Bore 5, Sample 2	5-2
Bore 5, Sample 3	5-3
Bore 5, Sample 5	5-5
Bore 6, Sample 1	6-1
Bore 6, Sample 2	6-2
Bore 6, Sample 4	6-4
Bore 6, Sample 6	6-6

Each sample in the first set was subjected to a variety of tests whose overall effect was to screen the samples for the possible presence of hazardous materials. The results of the analyses indicated the presence of one or more hazardous substances in all samples.

Based on these preliminary findings on the hand-drawn bore samples, a second set of samples was collected at additional sites and analyzed. The analytical scheme employed on this set was designed to obtain a more comprehensive qualitative and quantitative description of the location of any hazardous materials.

EXPERIMENTAL:

All tests were conducted according to procedures approved by the New York State Department of Environmental Conservation. Exact details will be provided in a final report.

RESULTS:

(A) Set #1, 7/20/79

(1) Organic Constituents

See Table I

All results are reported as dry weight basis except C56 and Oil & Grease which are reported on an as received basis. All results are reported as micrograms per gram. In addition the C56 and Oil & Grease results for the composite sample 2-1/2 were actually obtained only on one of the components of the composite, namely Bore 2 Sample 2.

(2) Inorganic Constituents

	2-5	3-5
Lead	2638	1266
Silver	20.4	21.8
Cadmium	16.9	9.62
Manganese	1214	1834
Chromium	154	208
Thallium	<10	<10
Zinc	2140	750
Nickel	498	891

All results are reported as micrograms per gram (ppm) dry weight basis.

(3) Component Analysis

Bore 2-1 Rust, cinder, pebbles, large chunks of stone (granite, limestone) Dry, 3.8% water - no odor

Bore 2-2 Rust, cinders, etc. (same as Bore 2-1) Moist, 12% water - oil odor, oil identified as a straight chain hydrocarbon (oil such as a #2 fuel oil) - odor of C56

Bore 2-5 Rust, chunks of brick, limestone, chunks of slag. Moist 15.6% water - slight odor, oil identified as a weathered straight chain hydrocarbon oil

Bore 2-9 Some clay, glass, chunks of pressed non-homogeneous material. Wet material, 31.3% water - no odor

Bore 3-1 Cinder, coal. No odor - 1.3% water

Bore 3-2 Clay, nails and metal pieces, pebbles, rust, fines. Moist, 17.1% water - no odor

Bore 3-5 Same as Bore 3-2. 20.5% water

(B) Set #2, 9/25/79

(1) Organic Consituents

See Table II

All results are reported on a dry weight basis as micrograms per gram (ppm).

(2) Inorganic Constiuents

(a) Total metal content

The total metal content for eleven heavy metals are listed in Table III. All results are reported as micrograms per gram (ppm) on an as received basis.

(b) Leachable metal content

Samples as received were extracted by constant stirring of a mixture of one part sample and sixteen parts of an acetic acid solution at a pH of 5.0, for a period of twenty-four hours. The leachate was filtered and analyzed for the presence of eleven heavy metals. The results are given in Table IV and are reported in milligrams per liter (mg/l).

(3) Component Analysis

The gross component description of each sample has been provided by Earth Dimensions, Inc. No deviations were noted in the inspection of the submitted samples. In addition, there were no extraordinary materials such as screws, nails, or springs.

DISCUSSION:

Table III shows, in general, very low Mercury, Selenium, and Arsenic; low levels of Chromium, Silver, Barium (except 6-2), Nickel, and Zinc (except 6-2); and moderate levels of Lead, Manganese. Table IV shows that even in those samples which have moderate levels of any of the heavy metals, the leachable amount of those metals is negligible. The overall conclusion one can draw from the metal analyses performed so far is that there is no significant amount of leachable hazardous heavy metal waste in the dump site.

The original organic analysis of Set #1 samples showed the presence of a sufficent amount of Polychlorinated Biphenyl's in two of the five samples so as to be classified as PCB Material. The second set drawn at different locations shows significantly less PCB's, and while three of the twelve samples show a statistically significant amount of PCB's, all twelve samples are below the 50 ppm limit established in 40 CFR Part 761, May 3, 1979. In both sets of samples insignificant amounts of other hazardous organic materials were detected. For this reason and because the PCB Hazardous Waste limit of 50 ppm is based on total PCB and not leachable PCB, organic leachate analyses were not performed.

CONCLUSIONS:

The seventeen waste oil dump site samples analyzed to date indicate that there are in all probability no hazardous amounts of leachable heavy metals.

The data do show the presence of PCB's. At some locations the concentration exceeds the hazardous waste limit of 50 ppm. The data also show the presence of other hazardous substances such as aldrin and C56 (hexachlorocyclopenetadiene) in non-hazardous concentrations.

It is recommended that additional samples be taken at the dump site for the purpose of accurately delineating the extent of hazardous concentrations of PCB's.

TABLE I

	2-1/2	2-5	2-9	3-1/2	3-5
PCB's	50.6	115	14.4	13.3	0.8
Aldrin	0.33	2.00	0.04	0.067	0.004
Dieldrin	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Methoxychlor	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
p,p[1]-DDT	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
C56	0.04	0.02	--	--	--
Oil & Grease	26,000.00	9,600.00	--	--	--

TABLE II

Received 9/25/79

ORGANIC COMPONENTS OF SET #2

	4-1	4-2	4-3	4-5	5-1	5-2
PCB's	10.9	1.0	0.13	0.69	30	14.4
ALDRIN	0.20	<0.001	<0.001	0.002	--	0.03
DIELDRIN	$<10^{-5}$	$<10^{-5}$	$<10^{-5}$	$<10^{-5}$	$<10^{-5}$	$<10^{-5}$
METHOXYCHLOR	$<10^{-5}$	$<10^{-5}$	$<10^{-5}$	$<10^{-5}$	$<10^{-5}$	$<10^{-5}$
p,p1-DDT	$<10^{-5}$	$<10^{-5}$	$<10^{-5}$	$<10^{-5}$	$<10^{-5}$	$<10^{-5}$
C56	--	--	--	0.001	0.05	0.07
OIL & GREASE	31,000.00	1,600.00	200.00	<70.00	47,000.00	4,300.00

	5-3	5-5	6-1	6-2	6-4	6-6
PCB's	0.76	0.86	0.22	2.2	<0.001	<0.001
ALDRIN	0.02	0.008	<0.001	0.012	--	--
DIELDRIN	$<10^{-5}$	$<10^{-5}$	$<10^{-5}$	$<10^{-5}$	$<10^{-5}$	$<10^{-5}$
METHOXYCHLOR	$<10^{-5}$	$<10^{-5}$	$<10^{-5}$	$<10^{-5}$	$<10^{-5}$	$<10^{-5}$
p,p1-DDT	$<10^{-5}$	$<10^{-5}$	$<10^{-5}$	$<10^{-5}$	$<10^{-5}$	$<10^{-5}$
C56	0.04	--	--	0.006	--	--
OIL & GREASE	1,200.00	10,000.00	2,000.00	7,900.00	<60	3,800.00

TABLE III

Received 9/25/79

TOTAL METAL CONTENT OF SET #2

	4-1	4-2	4-3	4-5	5-1	5-2
LEAD	1627.00	735.00	23.9	<9	149	35.1
CADMIUM	15.1	31.4	1.6	<1.0	6.6	<2.0
CHROMIUM	90.5	70.1	7.2	4.4	351	29.2
SILVER	31.2	24.7	4.8	5.3	22.3	11.7
MERCURY	4.3	2.8	1.1	2.4	1.2	4.9
SELENIUM	0.67	0.45	<0.24	<0.26	< 0.25	< 0.35
BARIUM	90.5	107.00	47.8	<9	82.5	23.4
ARSENIC	5.9	4.8	1.5	0.5	1.4	3.0
NICKEL	121.00	194.00	23.9	17.5	380.00	339.00
ZINC	985.00	387.00	55.7	45.5	437.00	63.2
MANGANESE	829.00	518.00	82.00	219.00	2,228.00	4,093.00

TABLE III (con't)

	5-3	5-5	6-1	6-2	6-4	6-6
LEAD	114.00	<12	195.00	2,020.00	<9	<7
CADMIUM	1.4	<2.0	<1.0	5.6	<1.0	<1.0
CHROMIUM	46.4	5.0	39.0	152.00	10.0	7.0
SILVER	12.1	3.7	21.5	51.2	1.8	1.4
MERCURY	<1.0	1.7	1.4	1.6	1.3	4.0
SELENIUM	0.52	<0.37	<0.30	0.67	<0.27	0.38
BARIUM	920.00	<12	<10	2,623.00	128.00	<7
ARSENIC	3.4	1.9	0.3	7.2	0.8	1.0
NICKEL	157.00	<12	472.00	614.00	27.4	21.1
ZINC	350.00	45.8	97.4	1,083.00	67.5	51.4
MANGANESE	214.00	130.00	1,436.00	1,088.00	91.3	71.1

TABLE IV

Received 9/25/79

LEACHABLE METAL CONTENT OF SET #2

	4-1	4-2	4-3	4-5	5-1	5-2
LEAD	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
CADMIUM	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
CHROMIUM	0.23	<0.01	<0.01	<0.01	<0.01	<0.01
SILVER	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
MERCURY	<0.014	<0.014	<0.014	<0.014	<0.014	<0.014
SELENIUM	<0.003	<0.003	<0.003	0.005	<0.003	<0.003
BARIUM	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
ARSENIC	0.003	<0.001	<0.001	<0.001	<0.001	<0.001
NICKEL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
ZINC	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
MANGANESE	0.76	<0.01	<0.01	0.51	0.97	0.23

TABLE IV (con't)

	5-3	5-5	6-1	6-2	6-4	6-6
LEAD	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
CADMIUM	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
CHROMIUM	0.02	<0.01	0.02	<0.01	<0.01	0.07
SILVER	<0.01	<0.01	<0.01	<0.01	<0.01	0.02
MERCURY	<0.014	<0.014	<0.014	<0.014	<0.014	<0.014
SELENIUM	0.015	0.003	0.011	0.005	<0.003	<0.003
BARIUM	0.2	<0.1	<0.1	0.6	0.7	0.4
ARSENIC	0.002	<0.001	0.008	0.005	0.002	0.005
NICKEL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
ZINC	0.10	<0.02	<0.01	0.01	0.11	0.20
MANGANESE	0.30	<0.01	0.21	<0.01	<0.01	<0.01

October 30, 1981

Ms. Alice J. Kryzan, Attorney at Law
Phillips, Lytle, Hitchcock, Blaine & Huber
3400 Marine Midland Center
Buffalo, New York 14203

Dear Madam:

Attached you will find the following:

1. ACTS Testing Labs, Inc. Reports
   a) Analysis of Soil Samples for Polychlorinated Biphenals (PCB) - 10/23/81
   b) Copy of Federal Register/Vol. 44 No. 233/Monday, December 3, 1979/Proposed Rules, pages 69501-69503

2. ACTS Testing Labs, Inc. Technical Report 3/6/80 - Results of eleven soil bore sample analysis for Bores No. 7, 8 and 9

3. Soil Borings and Chain Lab Tests - Summary 10/26/81

The Soils Report for bores 7, 8 and 9 was requested and will be sent to you as soon as I receive it.

Sincerely,

John Dicky, Manager
Equipment Engineering Department

asc
Attach.
cc: T. M. Sweeney
    F. M. Lisick

ACTS TESTING LABS, INC.
3900 Broadway • Buffalo. N.Y. 14227-1192 • (716) 684-3300

October 26, 1981

Mr. John Dicky
COLUMBUS MCKINNON CORPORATION
Fremont Street
Tonawanda, New York 14150

Dear Mr. Dicky:

Enclosed please find technical information from the Federal Register which was inadvertently omitted from your letter mailed on Friday. Please excuse this oversight.

Thank you.

Sincerely,

Mary Alice Frutchey

Mary Alice Frutchey
Secretary

THE FOLLOWING

IMAGES ARE THE BEST

COPIES AVAILABLE

Organochlorine Pesticides and PCB's—Method 608

1. *Scope and Application*

1.1 [illegible] determination of [illegible] pesticides and polychlorinated biphenyls (PCBs). The following [illegible] parameters may be determined by this method: [illegible]

Parameter	
Aldrin	[illegible]
α-BHC	[illegible]
β-BHC	[illegible]
δ-BHC	[illegible]
γ-BHC	[illegible]
Chlordane	[illegible]
[illegible]	[illegible]

1.2 [illegible] determination [illegible] municipal and [illegible] Pollutant [illegible] (NPDES) [illegible] expectation of [illegible] all of the compounds above, [illegible] develop independent protocols for the verification of identity.

1.3 [illegible] in Table 1 [illegible] can be achieved [illegible] absence of interferences.

1.4 This method is [illegible] use only by experienced [illegible] analysts or under [illegible] of such qualified [illegible]

2. *Summary of Method*

2.1 A 1-liter sample of [illegible] is extracted with methylene chloride using a separatory funnel [illegible] extract is dried and [illegible] volume of 10 ml or less. [illegible] Chromatographic conditions are described which allow for the accurate measurement of the compounds in the extract.

2.2 If interferences are encountered, the method provides selected general purpose cleanup procedures to aid the analyst in their elimination.

3. *Interferences*

3.1 Solvents, reagents, glassware, and other sample processing hardware may yield discrete artifacts and/or elevated baselines causing misinterpretation of gas chromatograms. All of these materials must be demonstrated to be free from interferences under the conditions of the analysis by running method blanks. Specific selection of reagents and purification of solvents by distillation in all-glass systems may be required.

3.2 Interferences coextracted from the samples will vary considerably from source to source, depending upon the diversity of the industrial complex or municipality being sampled. While general cleanup techniques are provided as part of this method, unique samples may require additional cleanup approaches to achieve the sensitivities stated in Table 1.

3.3 Glassware must be scrupulously cleaned. Clean all glassware as soon as possible after use by rinsing with the last solvent used. This should be followed by detergent washing in hot water. Rinse with tap water, distilled water, [illegible] and finally pesticide quality [illegible] treatment in a muffle furnace [illegible] for 15 to 30 [illegible] boiling materials [illegible] not be eliminated by [illegible] volumetric ware should not be heated in a muffle furnace. [illegible] glassware should be sealed/stored in a clean environment immediately after drying [illegible] accumulation of dust or other contaminants. Store inverted or capped with aluminum foil.

3.4 Interferences by phthalate esters can pose a major problem in pesticide analysis. These materials [illegible] fraction of the Florisil [illegible] usually can be minimized by avoiding contact with any plastic materials. The contamination from phthalate esters can be completely eliminated with the use of a microcoulometric or electrolytic conductivity detector.

4. *Apparatus and Materials*

4.1 Sampling equipment, for discrete or composite sampling.

4.1.1 Grab sample bottle—amber glass, 1-liter or 1-quart volume. French or Boston Round design is recommended. The container must be washed and solvent rinsed before use to minimize interferences.

4.1.2 Bottle caps—Threaded to screw on to the sample bottles. Caps must be lined with Teflon. Foil may be substituted if sample is not corrosive.

4.1.3 Compositing equipment—Automatic or manual compositing system. Must incorporate glass sample containers for the collection of a minimum of 250 ml. Sample containers must be kept refrigerated during sampling. No tygon or rubber tubing may be used in the system.

4.2 Separatory funnel—2000 ml, with Teflon stopcock.

4.3 Drying column—20 mm ID pyrex chromatographic column with coarse frit.

4.4 Kuderna-Danish (K–D) Apparatus

4.4.1 Concentrator tube—10 ml, graduated (Kontes K–570050–1025 or equivalent). Calibration must be checked at 1.0 and 10.0 ml level. Ground glass stopper (size 19/22 joint) is used to prevent evaporation of extracts.

4.4.2 Evaporative flask—500 ml (Kontes K–57001–0500 or equivalent). Attach to concentrator tube with springs. (Kontes K–662750–0012).

4.4.3 Snyder column—three-ball macro (Kontes K503000–0121 or equivalent).

4.4.4 Boiling chips—extracted, approximately 10/40 mesh.

4.5 Water bath—Heated, with concentric ring cover, capable of temperature control (±2°C). The bath should be used in a hood.

4.6 Gas chromatograph—Analytical system complete with gas chromatograph suitable for on-column injection and all required accessories including electron capture or halogen-specific detector, column supplies, recorder, gases, syringes. A data system for measuring peak areas is recommended.

4.7 Chromatographic column—Pyrex, 400 mm × 25 mm OD, with coarse fritted plate and Teflon stopcock (Kontes K–42054–213 or equivalent).

5. *Reagents.*

5.1 Preservatives:

5.1.1 Sodium hydroxide—(ACS) 10 N in distilled water.

5.1.2 Sulfuric acid (1+1)—(ACS) Mix equal volumes of conc. H_2SO_4 with distilled water.

5.2 Methylene chloride—Pesticide quality or equivalent.

5.3 Sodium Sulfate—(ACS) Granular, anhydrous (purified by heating at 400°C for 4 hrs. in a shallow tray).

5.4 Stock standards—Prepare stock standard solutions at a concentration of 1.00 μg/μl by dissolving 0.100 grams of assayed reference material in pesticide quality isooctane or other appropriate solvent and diluting to volume in a 100 ml ground glass stoppered volumetric flask. The stock solution is transferred to ground glass stoppered reagent bottles, stored in a refrigerator, and checked frequently for signs of degradation or evaporation, especially just prior to preparing working standards from them.

5.5 Boiling chips—Hengar granules (Hengar Co.; Fisher Co.) or equivalent.

5.6 Mercury—triple distilled.

5.7 Aluminum oxide—basic or neutral, active.

5.8 Hexane—pesticide residue analysis grade.

5.9 Isooctane (2,2,4-trimethyl pentane)—pesticide residue analysis grade.

5.10 Acetone—pesticide residue analysis grade.

5.11 Diethyl ether—Nanograde, redistilled in glass if necessary.

5.11.1 Must be free of peroxides as indicated by EM Quant test strips (Test strips are available from EM Laboratories, Inc., 500 Executive Blvd., Elmsford, N.Y., 10523).

5.1.2 Procedures recommended for removal of peroxides are provided with the test strips. After cleanup 20 ml ethyl alcohol preservative must be added to each liter of ether.

5.12 Florisil—PR grade (60/100 mesh); purchase activated at 1250°F and store in glass containers with glass stoppers or foil-lined screw caps. Before use activate each batch at least 16 hours at 130°C in a foil covered glass container.

6. *Calibration.*

6.1 Prepare calibration standards that contain the compounds of interest, either singly or mixed together. The standards should be prepared at concentrations covering two or more orders of magnitude that will completely bracket the working range of the chromatographic system. If the sensitivity of the detection system can be calculated from Table I as 100 µg/l in the final extract, for example, prepare standards at 10 µg/l, 50 µg/l, 100 µg/l, 500 µg/l, etc., so that injections of 1–5 µl of each calibration standard will define the linearity of the detector in the working range.

6.2 Assemble the necessary gas chromatographic apparatus and establish operating parameters equivalent to those indicated in Table I. By injecting calibration standards, establish the sensitivity limit of the detector and the linear range of the analytical system for each compound.

6.3 The cleanup procedure in Section 10 utilizes Florisil chromatography. Florisil from different batches or sources may vary in absorption capacity. To standardize the amount of Florisil which is used, the use of lauric acid value (Mills, 1968) is suggested. The referenced procedure determines the adsorption from hexane solution of lauric acid (mg) per gram Florisil. The amount of Florisil to be used for each column is calculated by dividing this factor into 110 and multiplying by 20 grams.

6.4 Before using any cleanup procedure, the analyst must process a series of calibration standards through the procedure to validate elution patterns and the absence of interferences from the reagents.

7. *Quality Control.*

7.1 Before processing any samples, the analyst should demonstrate through the analysis of a distilled water method blank, that all glassware and reagents are interference-free. Each time a set of samples is extracted or there is a change in reagents, a method blank should be processed as a safeguard against chronic laboratory contamination.

7.2 Standard quality assurance practices should be used with this method. Field replicates should be collected to validate the precision of the sampling technique. Laboratory replicates should be analyzed to validate the precision of the analysis. Fortified samples should be analyzed to validate the accuracy of the analysis. Where doubt exists over the identification of a peak on the chromatogram, confirmatory techniques such as mass spectroscopy should be used.

8. *Sample Collection, Preservation, and Handling.*

8.1 Grab samples must be collected in glass containers. Conventional sampling practices should be followed, except that the bottle must not be prewashed with sample before collection. Composite samples should be collected in refrigerated glass containers in accordance with the requirements of the program. Automatic sampling equipment must be free of tygon and other potential sources of contamination.

8.2 The samples must be iced or refrigerated from the time of collection until extraction. Chemical preservatives should not be used in the field unless more than 24 hours will elapse before delivery to the laboratory. If the samples will not be extracted within 48 hours of collection, the sample should be adjusted to a pH range of 6.0–8.0 with sodium hydroxide or sulfuric acid.

8.3 All samples must be extracted within 7 days and completely analyzed within 30 days of collection.

9. *Sample Extraction.*

9.1 Mark the water meniscus on the side of the sample bottle for later determination of sample volume. Pour the entire sample into a two-liter separatory funnel. Check the pH of the sample with wide-range pH paper and adjust to within the range of 5–9 with sodium hydroxide or sulfuric acid.

9.2 Add 60 ml methylene chloride to the sample bottle, seal, and shake 30 seconds to rinse the inner walls. Transfer the solvent into the separatory funnel, and extract the sample by shaking the funnel for two minutes with periodic venting to release vapor pressure. Allow the organic layer to separate from the water phase for a minimum of ten minutes. If the emulsion interface between layers is more than one-third the size of the solvent layer, the analyst must enploy mechanical techniques to complete the phase separation. The optimum technique depends upon the sample, but may include stirring, filtration of the emulsion through glass wool, or centrifugation. Collect the methylene chloride extract in a 250-ml Erlenmeyer flask.

9.3 Add a second 60-ml volume of methylene chloride to the sample bottle and complete the extraction procedure a second time, combining the extracts in the Erlenmeyer flask.

9.4 Perform a third extraction in the same manner. Pour the combined extract through a drying column containing 3–4 inches of anhydrous sodium sulfate, and collect it in a 500-ml Kuderna-Danish (K-D) flask equipped with a 10 ml concentrator tube. Rinse the Erlenmeyer flask and column with 20–30 ml methylene chloride to complete the quantitative transfer.

9.5 Add 1–2 clean boiling chips to the flask and attach a three-ball Snyder column. Prewet the Snyder column by adding about 1 ml methylene chloride to the top. Place the K-D apparatus on a hot water bath (60–65°C) so that the concentrator tube is partially immersed in the hot water, and the entire lower rounded surface of the flask is bathed in vapor. Adjust the vertical position of the apparatus and the water temperature as required to complete the concentration in 15–20 minutes. At the proper rate of distillation the balls of the column will actively chatter but the chambers will not flood. When the apparent volume of liquid reaches 1 ml, remove the K-D apparatus and allow it to drain for at least 10 minutes while cooling.

9.6 Increase the temperature of the hot water bath to about 80°C. Momentarily remove the Snyder column, add 50 ml of hexane and a new boiling chip and reattach the Snyder column. Pour about 1 ml of hexane into the top of the Snyder column and concentrate the solvent extract as before. The elapsed time of concentration should be 5 to 10 minutes. When the apparent volume of liquid reaches 1 ml, remove the K-D apparatus and allow it to drain at least 10 minutes while cooling. Remove the Snyder column and rinse the flask and its lower joint into the concentrator tube with 1-2 ml of hexane, and adjust the volume to 10 ml. A 5-ml syringe is recommended for this operation. Stopper the concentrator tube and store refrigerated if further processing will not be performed immediately. If the sample extract requires no further cleanup, proceed with gas chromatographic analysis. If the sample requires cleanup, proceed to Section 10.

9.7 Determine the original sample volume by refilling the sample bottle to the mark and transferring the liquid to a 1000 ml graduated cylinder. Record the sample volume to the nearest 5 ml.

10. *Cleanup and Separation.*

10.1 Cleanup procedures are used to extend the sensitivity of a method by minimizing or eliminating interferences that mask or otherwise disfigure the gas chromatographic response to the pesticides and PCB's. The Florisil column allows for a select fractionation of the compounds and will eliminate polar materials. Elemental sulfur interferes with the electron capture gas chromatography of certain pesticides but can be removed by the techniques described below.

10.2 Florisil Column Cleanup

10.2.1 Add a weight of Florisil, (nominally 21g,) predetermined by calibration (6.3, 6.4), to a chromatographic column. Settle the Florisil by tapping the column. Add sodium sulfate to the top of the Florisil to form a layer 1-2 cm deep. Add 60 ml of hexane to wet and rinse the sodium sulfate and Florisil. Just prior to exposure of the sodium sulfate to air, stop the elution of the hexane by closing the stopcock on the chromatography column. Discard the eluate.

10.2.2 Adjust the sample extract volume to 10 ml and transfer it from the K-D concentrator tube to the Florisil column. Rinse the tube twice with 1-2 ml hexane, adding each rinse to the column.

10.2.3 Place a 500 ml K-D flask and clean concentrator tube under the chromatography column. Drain the column into the flask until the sodium sulfate layer is nearly exposed. Elute the column with 200 ml of 6% ethyl ether in hexane (Fraction 1) using a drip rate of about 5 ml/min. Remove the K-D flask and set aside for later concentration. Elute the column again, using 200 ml of 15% ethyl ether in hexane (Fraction 2), into a second K-D flask. Perform the third elution using 200 ml of 50% ethyl in hexane (Fraction 3). The elution patterns for the pesticides and PCB's are shown in Table II.

10.2.4 Concentrate the eluates by standard K-D techniques (9.5), substituting hexane for the glassware rinses and using the water bath at about 85° C. Adjust final volume to 10 ml with hexane. Analyze by gas chromatography.

10.3 Elemental sulfur will usually elute entirely in Fraction 1. To remove sulfur interference from this fraction or the original extract, pipet 1.00 ml of the concentrated extract into a clean concentrator tube or Teflon-sealed vial. Add 1-3 drops of mercury and seal. Agitate the contents of the vial for 15-30 seconds. Place the vial in an upright position on a reciprocal laboratory shaker and shake for 2 hours. Analyze by gas chromatography.

11. *Gas Chromatography.*

11.1 Table I summarizes some recommended gas chromatographic column materials and operating conditions for the instrument. Included in this table are estimated retention times and sensitivities that should be achieved by this method. Examples of the separations achieved by these columns are shown in Figures 1 through 10. Calibrate the system daily with a minimum of three injections of calibration standards.

11.2 Inject 2-5 μl of the sample extract using the solvent-flush technique. Smaller (1.0 μl) volumes can be injected if automatic devices are employed. Record the volume injected to the nearest 0.05 μl, and the resulting peak size, in area units.

11.3 If the peak area exceeds the linear range of the system, dilute the extract and reanalyze.

11.4 If the peak area measurement is prevented by the presence of interferences, further cleanup is required.

12. *Calculations.*

12.1 Determine the concentration of individual compounds according to the formula:

$$\text{Concentration, } \mu g/l = \frac{(A)(B)(V_t)}{(V_i)(V_s)}$$

Where:

A = Calibration factor for chromatographic system, in nanograms material per area unit.

B = Peak size in injection of sample extract, in area units

V_i = Volume of extract injected (μl)

V_t = Volume of total extract (μl)

V_s = Volume of water extracted (ml)

12.2 Report results in micrograms per liter without correction for recovery data. When duplicate and spiked samples are analyzed, all data obtained should be reported.

13. *Accuracy and Precision.*

13.1 The U.S. EPA Environmental Monitoring and Support Laboratory in Cincinnati is in the process of conducting an interlaboratory method study to determine the accuracy and precision of this test procedure.

Bibliography

1. "Development and Application of Test Procedures for Specific Organic Toxic Substances in Wastewaters. Category 10—Pesticides and PCB's." Report for EPA Contract 68-03-2606.

2. Mills, P. A., "Variation of Florisil Activity: Simple Method for Measuring Absorbent Capacity and Its Use in Standardizing Florisil Columns," Journal of the Association of Official Analytical Chemists, 51, 29 (1968).

Table I.—Gas Chromatography of Pesticides and PCB's

Parameter	Retention time (min) Col. 1 [1]	Col. 2 [2]	Detection limit (μg/l) [3]
Aldrin	2.40	4.10	0.003
a-BHC	1.35	1.82	0.002
b-BHC	1.90	1.97	0.004
d-BHC	2.15	2.20	0.004
g-BHC	1.70	2.13	0.002
Chlordane	(4)	(4)	0.04
4,4'-DDD	7.83	9.08	0.012
4,4'-DDE	5.13	7.15	0.006
4,4'-DDT	9.40	11.75	0.016
Dieldrin	5.45	7.23	0.006
Endosulfan I	4.50	6.20	0.006
Endosulfan II	8.00	8.28	0.01
Endosulfan sulfate	14.22	10.70	0.03
Endrin	6.55	8.10	0.009
Endrin aldehyde	11.82	9.30	0.023
Heptachlor	2.00	3.35	0.002
Heptachlor epoxide	3.50	5.00	0.004
Toxaphene	(4)	(4)	0.40
PCB-1016	(4)	(4)	0.04
PCB-1221	(4)	(4)	0.10
PCB-1232	(4)	(4)	0.10
PCB-1242	(4)	(4)	0.06
PCB-1248	(4)	(4)	0.08
PCB-1254	(4)	(4)	0.08
PCB-1260	(4)	(4)	0.15

[1] Supelcoport 100/120 mesh coated with 1.5% SP-2250/1.95% SP-2401 packed in a 180 cm long x 4 mm ID glass column with 5% Methane/95% Argon carrier gas at 60 ml/min flow rate. Column temperature is 200°C.

[2] Supelcoport 100/120 mesh coated with 3% OV-1 in a 180 cm long x 4 mm ID glass column with 5% Methane/95% Argon carrier gas at 60 ml/min flow rate. Column temperature is 200°C.

[3] Detection limit is calculated from the minimum detectable GC response being equal to five times the GC background noise, assuming a 10 ml final volume of the 1 liter sample extract, and assuming a GC injection of 5 microliters.

[4] Multiple peak response. See Figures 2-10.

ACTS TESTING LABS, INC.

3900 Broadway • Buffalo, N.Y. 14227-1192 • (716) 684-3300

October 23, 1981

Mr. John Dicky
COLUMBUS MCKINNON CORPORATION
Fremont Street
Tonawanda, New York 14150

Dear Mr. Dicky:

As per your request of October 22, 1981, I have enclosed the analytical procedure used to determine the PCB content of the soil samples collected at Columbus McKinnon. Also enclosed is EPA Method 608, Organo Chlorine Pesticides and PCB's in water. As you will note that beginning at Section 9.5, our procedure closely parallels the EPA Method.

If I can be of further assistance, please call me. I will forward the remaining information as soon as possible.

Sincerely,

ACTS TESTING LABS, INC.

Angelo M. Fatta

Angelo M. Fatta, Ph.D.
President

maf

Enclosure

ACTS TESTING LABS, INC.

ANALYSIS OF SOIL SAMPLES FOR

POLYCHLORINATED BIPHENYLS (PCB)

I Moisture

1. Spread the sample onto a clean surface.
2. Manually choose a subsample of 50 grams that is representative of the whole sample.
3. Transfer the 50 grams to a tared evaporating dish and reweigh.
4. Dry the subsample to constant weight at 50°C.
5. Reweigh the dried sample and determine the percent moisture.

II Extraction

1. Accurately weigh twenty grams of dried sample from I above and transfer to a hexane rinsed paper extractor cup. Exercise care to ensure the sample is representative.
2. Extract for 24-hours in a Soxhlet Extractor using pesticide grade hexane.
3. Transfer the extract to a Kuderna-Danish concentrator. Rinse the extractor with fresh hexane and add these washings to the concentrator.
4. Concentrate the sample to a final volume of 10.0 ml.

III. Purification

1. Transfer 1.0 ml of concentrate from II-4 above to the top of a pre-wetted Florisil column.
2. Elute the sample using pesticide grade hexane.
3. Discard the first 10 ml.
4. Collect the next 25 ml of elute in a 25 ml volumetric flask.

ACTS TESTING LABS, INC.

Analysis of soil samples for
Polychlorinated Biphenyls (PCB) - Continued

IV. Analysis

1. Inject the elute from III-4 into a gas chromatograph at the following conditions:

Column	6' X 4 mm ID, glass
Packing	80/100 Gas Chrom Q
Liquid Phase	1.5% OV-17 + 1.95% QF-1
Detector	Electron Capture
Oven Temp	220°C
Detector Temp	290°C
Carrier Gas -	N_2
Carrier Flow	30 ml/min

2. Compare the areas of the sample PCB chromatograms to the standard PCB chromatogram.

3. Calculate the amount of PCB in the original sample.

TECHNICAL REPORT March 6, 1980

[illegible] John Schmitt
[illegible] Snyder, Sklarsky, Rowley

[illegible]

[illegible] of eleven Columbus McKinnon soil bore samples for PCB content. [illegible] received on February 12, 1980 from Mr. John Schmitt.

[illegible]	PCB's as Aroclor 1260	% Water
[illegible]	0.52	19.5
7-3	0.29	13.3
[illegible]	~~0.004~~ 0.04	17.5
[illegible]	[illegible].08	18.3
[illegible]	[illegible]	[illegible]1.0
[illegible]	[illegible].81	24.7
[illegible]-5	3.26	25.5
[illegible]	3.25	25.7
[illegible]	0.94	16.5
[illegible]	2.36	17.7
[illegible]	0.15	15.0

[illegible] results are reported as micrograms per gram (parts per million) [illegible] basis.

EXPERIMENTAL:

Samples were dried, extracted, isolated and analyzed by Gas Chromatography according to Environmental Protection Agency procedures.

A.M. Fatta, Ph.D.
Technical Director

AMF/sih

10/26/81

SOIL BORINGS & CHEM. LAB. TESTS

SUMMARY

Boring	Depth	Water Table	Fill Depth	Date	Lab. Test Conc. PCB	Date
1	1.0'	-	-	7/13/79	-	-
2	7.0'	6.0'	7.0'	"	50.6, 115, 14.4	8/13/79
3	7.0'	-	7.0'	"	13.3, 0.8	"
4	9.0'	6.5'	5.5'	9/13/79	10.9, 1.0, 0.13, 0.69	12/5/79
5	11.0'	10.0'	6.0'	"	30., 14.4, 0.76, 0.86	"
6	11.0'	8.0'	7.2'	"	0.22, 2.2, <.001, <.001	"
7					0.52, 0.29, 0.04	Jan.1980
8					1.63, 1.48, 1.91, 3.26, 3.25	"
9					0.94, 2.36, 0.15	"
10	3.0'	3.5'	3.0'	9/4/81	160, 478, 122	10/7/81
11	4.75'	-	4.75'	"	175, 270, 260, 147, 108	"
12	5.0'	-	4.5'	"	278, 230, 51.7, 146	"

VSSR

VAN WERT • SNYDER • SKLARSKY • ROWLEY
ARCHITECTS/CONSULTING ENGINEERS

1965 Sheridan Drive, Buffalo, New York 14223, (716) 877-3350

PRINCIPALS
Paul H. Van Wert, A.I.A.
Julian Snyder, P.E., Ph.D.
Richard A. Sklarsky, P.E.
Donald H. Rowley, P.E.

ASSOCIATES
Lester B. O'Donnell, A.I.A., C.S.I.
Anthony J. Cartonia, Jr., A.I.A.
Charles J. Hutchison, P.E.
Ronald W. Friend, P.E.
Peter H. Grace, P.E.
Neal Jacobus, P.E.
Robert J. Gill, R.A.

October 7, 1981

Columbus McKinnon Corp.
One Fremont Street
Tonawanda, N. Y. 14150

Attn: Mr. John Dicky

Re: VSSR #5393

Gentlemen:

Enclosed are the final PCB counts on the soil samples taken from bores #10, #11 and #12. Also enclosed is a Quality Assurance Statement representing the analysis of two new extracts selected at random and the reanalysis of a previously analyzed extract.

Very truly yours,

Peter H Grace

Peter H. Grace, P. E.

PHG:sh

John P. Hutten, C.S.I., *Mgr. Design Staff* • Raymond F. Johnson, *Mgr. Mechanical* • Victor E. Summerfield, *Mgr Electrical*

A PROFESSIONAL CORPORATION

ACTS TESTING LABS, INC.
3900 Broadway • Buffalo, N.Y. 14227-1192 • (716) 684-3300

TECHNICAL REPORT October 7, 1981

Mr. Peter Grace
VAN WERT, SNYDER, SKLARSKY AND ROWLEY

OBJECT:

Analysis of thirteen soil samples for Polychlorinated Biphenyl (PCB) content. The samples were received on September 9, 1981 from Mr. John Schmitt.

RESULTS:

add in

Sample		PCB's
B-10 Composite	0-2½'	160
B-10 S-1	½-1'	478
B-10 S-2	2-3'	122
B-11 S-1	0-1'	175
B-11 S-2	1½-2'	270*
B-11 S-3	2½-3'	260
B-11 S-4	3-3½'	147*
B-11 S-5	3½-4'	108
B-11 S-6	4½-4 3/4'	106
B-12 S-1	2-2½'	278
B-12 S-2	3-3½'	230
B-12 S-3	4¼-4½'	51.7
B-12 S-4	4½-5'	146

All results are reported as parts per million (micrograms of PCB per gram of soil) dry weight basis.

*Duplicate Analysis. See Quality Assurance

ACTS TESTING LABS, INC.

3900 Broadway • Buffalo, N.Y. 14227-1192 • (716) 684-3300

QUALITY ASSURANCE:

Sample	Reanalysis of	Result
B-11 S-2	New Extract	259
B-11 S-4	Original Extract	143
B-11 S-4	New Extract	153

EXPERIMENTAL:

Portions of each sample were dried to constant weight at 50°C. Twenty grams of dried material was extracted for 24 hours with hexane in a Soxhlet Extractor. The extracts were concentrated, purified on Florisil and analyzed for PCB content using Gas Chromatography according to CFR 40 Part 761 (May 1979).

ACTS TESTING LABS, INC.

Daniel P. Murtha

Daniel P. Murtha, Ph.D.
Laboratory Director

jbg

MALCOLM PIRNIE

APPENDIX F

WET WEIGHT - DRY WEIGHT CONVERSION DOCUMENTATION

MALCOLM PIRNIE

MALCOLM PIRNIE, INC.

BY RHO DATE .... SHEET NO. 1 OF 1

CHKD. BY .... DATE .... JOB NO. 1332-01-1

SUBJECT Moisture Content Data

NYSDEC SPLIT SAMPLES

NYSDEC SAMPLE #	MALCOLM PIRNIE SAMPLE #	% MOISTURE (1)	SAMPLING DEPTH	DEPTH TO WATER	COMMENT
915016-0568	SB90-33		6-8		
915016-V0446	SB90-33	17	4-6	8.7	UNDER
-V0346	SB90-33	17	4-6		PLASTIC
915016-0346	SB90-35		4-6		
-0446	SB90-35		4-6		
-V0168	SB90-35	34	6-8	6.2	
-V0268	SB90-35	41	6-8		
915016-101012	SB90-35	NA	10-12		
-101012	MS				
-101012	MSD				
915016-0802	SB90-37		0-2		
-0946	SB90-37	~~13~~	~~0-2~~ 4-6		
-V0502	SB90-37	13	0-2	UNSATURATED	Under Plastic
915016-0646	SB90-38		4-6		
-071012	SB90-38		10-12		
915016-V06	~~SE~~ NA				SEEP SAMPLE
915016-39A	SB90-39	21	4-6	9.1	
-40A	SB90-40	12	4-6		
-41A	SB90-41	9	4-6		
-41B	SB90-41	22	12-14	7.1	
-43A	SB90-43	12	4-6		
-45A	SB90-45	6	4-6		

(1) % moisture as reported in laboratory analyses of NYSDEC split samples.

MALCOLM PIRNIE

MALCOLM PIRNIE, INC.

BY JPH DATE .... SHEET NO. 1 OF 8

CHKD. BY .... DATE .... JOB NO. ....

SUBJECT ....

Borehole Number Sampled Interval	Sample Recovery	Ground Elev (AMSL)	Est. Water Table Elev	Sampled Interval Elev	Sample Interval Conversion Factor		DATE Sampled
SB-90-1		569.	565.5-566.				4/10/
0-2	.9			569. -568.1	.8		
4-6	1.2			565. -563.8	.6	▽	
6-8	1.6			563. -561.4	.6		
SB-90-2		569.	565.5-566.				4/10/9
0-2	.8			569. -568.2	.8		
4-6	1.8			565. -563.2	.6	▽	
6-8	1.4			563. -561.6	.6		
SB-90-3		569.	565.5-566.				4/10/9
4-6	1.4			565. -563.6	.6	▽	
6-8	1.5			563. -561.5	.6		
SB-90-4		569.	565.5-566.				
0-2	1.0			569. -568.	.8		4/10/9
4-6	1.7			565. -563.3	.6	▽	
6-8	1.8			563. -561.2	.6		
SB-90-5		572.	566-566.5				4/10/9
0-2	.8			572. -571.8	.8		
4-6	1.8			568. -566.2	.6	▽	
6-8	1.8			566. -564.2	.6		
SB-90-6		569.	565.5-566.				4/11/9
0-2	1.0			569. -568.	.8		
4-6	.8			565. -564.2	.6	▽	
SB-90-7		571.	566-566.5				4/11/9
0-2	1.0			571. -570.	.8		
6-8	.2			565. -564.8	.6	▽	
SB-90-8		569.	565.5-566.				
4-6	1.0			565. -564.	.6	▽	4/11/9

MALCOLM PIRNIE

MALCOLM PIRNIE, INC.

BY JPH DATE ______ SHEET NO. 2 OF 8

CHKD. BY ______ DATE ______ JOB NO. ______

SUBJECT ______

Borehole Number Sample Interval	Sample Recovery	Ground Elev (AMSL)	Est. Water Table Elev.	Sampled Interval Elev.	Sample Interval Conversion Factor	Date Sampled
SB-90-9		571.	566.-566.5			4/11/9
4-6	1.9			567.-565.1	.6 ▽	
SB-90-10		569.	565.5-566			4/11/9
0-2	.8			569.-568.2	.8	
6-8	1.0			563.-562.	.6 ▽	
12-14	2.0			557.-555.	.6	
SB-90-11		571.5	566-566.5			4/11/9
0-2	.6			571.5-570.9	.8	
4-6	.4			567.5-567.1	.8	
SB-90-12		570.	565.5-566			4/12/9
0-2	.3			570.-569.7	.8	
4-6	.3			566-565.7	.8	
SB-90-13		572.	566.5-567.			4/12/9
0-2	.7			572.-571.3	.8	
4-6	.5			568.-567.5	.8	
8-10	1.0			564.-565.	.6 ▽	
SB-90-14		570.	565.5-566.			4/12/9
4-6	.5			566.-565.5	.6 ▽	
8-10	1.3				.6	
14-16	.3				.6	
SB-90-15		572.	566.5-567			4/12/9
4-6	.3			568-567.7	.8	
8-10	1.4			564-562.6	.6 ▽	
12-14	1.9			560-558.1	.6	
SB-90-16		573.5	566.5-567			4/13/9
4-6	1.6			569.5-567.9	.8	
6-8	1.8			567.5-565.7	.6 ▽	

MALCOLM PIRNIE

MALCOLM PIRNIE, INC.

BY J.P.H. DATE ________ SHEET NO. 3 OF 8

CHKD. BY ________ DATE ________ JOB NO. ________

SUBJECT ________

Borehole Number Sample Interval	Sample Recovery	Ground Elev (ft msl)	Est. Water Table Elev.	Sampled Interval Elev	Sample Interval Conversion Factor	Date Sampled
SB-90-17		574.5	567. -567.5			4/13/90
4 - 6	1.5			570.5 - 569.	.8	
6 - 8	1.5			568.5 - 567	.6 ▽	
SB-90-18		574.	567. -567.5			4/13/90
4 - 6	1.8			570. - 568.2	.8	
6 - 8	1.7			568 - 566.3	.6 ▽	
SB-90-19		573.2	566.5 - 567.			4/13/90
4 - 6	1.4			569.2 - 567.8	.8	
8 - 10	2.0			565.2 - 563.2	.6 ▽	
SB-90-20		571.8	566.5 - 567.			4/16/9
6 - 8	.8			565.8 - 565.	.6 ▽	
10 - 12	1.7			561.8 - 560.1	.6	
12 - 14	1.1			559.8 - 558.7	.6	
SB-90-21		570.2	565.5 - 566			4/16/9
6 - 8	.5			564.2 - 563.7	.6 ▽	
14 - 16	1.9			556.2 - 554.3	.6	
SB-90-22		572.	566.5 - 567			
0 - 2	1.1			572 - 570.9	.8	4/16/9
6 - 8	.3			566 - 565.7	.6 ▽	
10 - 12	1.3			562 - 560.7	.6	
SB-90-23		572.7	566.5 - 567			4/16/90
4 - 6	1.9			568.7 - 566.8	.8	
10 - 12	1.4			562.7 - 561.3	.6 ▽	
SB-90-24		573.6	567.5 - 568			4/16/9
4 - 6	1.9			569.6 - 567.7	.8	
10 - 12	1.8			563.6 - 561.8	.6 ▽	

MALCOLM PIRNIE

MALCOLM PIRNIE, INC.

BY JPH DATE .... SHEET NO. 4 OF 8

CHKD. BY .... DATE .... JOB NO. ....

SUBJECT ....

Borehole Number Sample Interval	Sample Recovery	Ground Elev (AMSL)	Est. Water Table Elev.	Sampled Interval Elev	Sample Interval Conversion Factor	Date Sampled
SB-90-25		574.1	567.5-568			4/17/9
0-2	1.1			574.1-573.	.8	
4-6	1.9			570.1-568.2	.8	
8-10	1.4			566.1-564.7	.6 ▽	
SB-90-26		572.8	567-567.5			4/17/9
0-2	1.1			572.8-571.7	.8	
4-6	1.7			568.8-567.1	.8	
10-12	2.0			562.8-560.8	.6 ▽	
SB-90-27		571.8	566.5-567			
0-2	.5			571.8-571.3	.8	4/17/9
6-8	.9			565.8-564.9	.6 ▽	
SB-90-28		570.8	565.5-566.			
0-2	.5			570.8-570.3	.8	
4-6	.6			566.8-566.3	.8	
10-12	1.9			560.8-558.9	.6 ▽	
SB-90-29		571.1	565.5-566			4/17/9
4-6	.4			567.1-566.7	.8	
6-8	1.3			565.1-563.8	.6 ▽	
8-10	1.7			563.1-561.4	.6	
10-12	1.8			561.1-559.3	.6	
SB-90-30		572.2	566-567			4/17/9
4-6	1.4			568.2-566.8	.8	
6-8	1.7			566.2-564.5	.6 ▽	
10-12	1.6			562.2-560.2	.6	
SB-90-31		573.4	567-568			4/17/9
4-6	1.8			569.4-567.6	.8	
8-10	1.4			565.4-564.0	.6 ▽	

MALCOLM PIRNIE

MALCOLM PIRNIE, INC.

BY JPH DATE .... SHEET NO. 5 OF 8

CHKD. BY .... DATE .... JOB NO. ....

SUBJECT ....

Borehole Number Sample Interval	Sample Recovery	Ground Elevation	Est. Water Table Elev.	Sampled Interval Elev	Sample Interval Conversion Factor	Date Sampled
SB-90-32		574.2	567-568			4/17/9
4-6	2.0			570.2-568.2	.8	
10-12	2.0			564.2-562.2	.6 ▽	
SB-90-33		574.6	566-566.5			4/18/9
4-6	1.8			570.6-568.8	.8	
6-8	1.6			568.6-567.0	.6 ▽	
20-22	.9			554.6-553.7	.6	
SB-90-34		574.2	567-568			4/19/9
8-10	1.6			566.2-564.6	.6 ▽	
10-12	1.9			564.2-562.3	.6	
16-18	1.7			558.2-556.5	.6	
SB-90-35		572.7	566-566.5			4/18/9
4-6	.5			568.7-568.2	.8	
6-8	.4			566.7-566.3	.6 ▽	
8-10	1.5			564.7-563.2	.6	
12-14	.8			560.7-559.9	.6	
20-22	(12-14) Duplicate					
SB-90-36		572.5	566-566.5			
4-6	.9			568.5-567.6	.8	4/18/9
6-8	.9			566.5-565.6	.6 ▽	
10-12	1.7			562.5-560.5	.6	
SB-90-37		574.1	567.5-568			4/19/9
0-2	1.6			574.1-572.5	.8	
4-6	1.6			570.1-568.5	.8	
6-8	1.7			568.1-566.4	.6 ▽	
14-16	1.7			560.1-558.4	.6	

MALCOLM PIRNIE

MALCOLM PIRNIE, INC.

BY JPH DATE .... SHEET NO. 6 OF 8

CHKD. BY .... DATE .... JOB NO. ....

SUBJECT ....

Borehole Number Sample Interval	Sample Recovery	Ground Elev (AMSL)	Est. Water Table Elev.	Sampled Interval Elev.	Sample Interval Conversion Factor	Date Sampled
SB-90-38		574.2	567.5-568.0			4/19/9
0-2	.8			574.2-573.4	.8	
4-6	.3			570.2-569.9	.8	
10-12	1.6			564.2-562.6	.6 ▽	
SB-90-39		575.2	566.0-566.5			8/23/9
4-6	.4			571.2-570.8	.8	
10-12	1.8			565.2-563.4	.6 ▽	
SB-90-40		574.5	565.5-566			8/22/9
4-6	.4			570.5-570.1	.8	
12-14	2.0			562.5-560.5	.6 ▽	
SB-90-41		573.2	565.5-566			8/22/9
4-6	.8			569.2-568.4	.8	
8-10	1.1			565.2-564.1	.6 ▽	
12-14	1.5			561.2-559.7	.6	
SB-90-42		571.0	565.5-566			8/24/
0-2	.8			571.0-570.2	.8	
4-6	.8			567.0-566.2	.8	
10-12	1.1			561.0-559.9	.6 ▽	
SB-90-43		575.1	565.5-566			8/23/9
0-2	1.3			575.1-573.8	.8	
4-6	.7			571.1-570.4	.8	
12-14	1.9			563.1-561.2	.6 ▽	
SB-90-44		575.5				8/23/9
0-2	.6		566-566.5	575.5-574.9	.8	
4-6	.4			571.5-571.1	.8	
10-12	1.7			565.5-563.8	.6 ▽	

MALCOLM PIRNIE

MALCOLM PIRNIE, INC.

BY JPH DATE .... SHEET NO. 7 OF 8

CHKD. BY .... DATE .... JOB NO. ....

SUBJECT ....

Borehole Number Sample Interval	Sample Recovery	Ground Elev (AMSL)	Est. Water Table Elev.	Sampled Interval Elev	Sample Interval Conversion Factor	Date Sample
SB-90-45		575.8	566.5-567			8/23/9
0 - 2	.6			575.8 - 575.2	.8	
4 - 6	1.1			571.8 - 570.7	.8	
12 - 14	1.6			563.8 - 562.2	.6 ▽	
SB-90-46		575.3	565.5-566			8/23/90
0 - 2	.9			575.3 - 574.4	.8	
4 - 6	.7			571.3 - 570.6	.8	
12 - 14	1.7			563.3 - 561.6	.6 ▽	
SB-90-47		575.3	565.5-566			8/24/9
0 - 2	.5			575.3 - 574.8	.8	
4 - 6	.4			571.3 - 570.9	.8	
10 - 12	1.3			565.3 - 564.0	.6 ▽	
SB-90-48		574.0	565.5-566			8/24/9
0 - 2	.4			574.0 - 573.6	.8	
4 - 6	.9			570.0 - 573.1	.8	
8 - 10	1.4			566.0 - 564.6	.6 ▽	

MALCOLM PIRNIE

MALCOLM PIRNIE, INC.

BY J.P.H. DATE ______ SHEET NO. 8 OF 8

CHKD. BY ______ DATE ______ JOB NO. ______

SUBJECT ______

Borehole Number Sample Interval	Sample Recovery	Ground Elev (AMSL)	Est. Water Table Elev.	Sampled Interval Elev.	Sample Interval Conversion Factor	Date Sampled
MW-1 D		572.2	565.5-566			4/25-4/
0 - 2	1.1			572.2 - 571.1	.8	
4 - 6	.3			568.2 - 567.9	.8	
6 - 8	1.1			566.2 - 565.1	.6 ▽	
18 - 20	1.9			554.2 - 52.3	.6	
MW - 2D		574.6	567.5 568.0			4/23 4/2
0 - 2	.6			574.6 - 574.0	.8	
4 - 6	.6			570.6 - 570.0	.8	
6 - 8	1.6			568.6 - 567.0	.6 ▽	
MW-3		576.7	572-572.5			4/30
4 - 6	1.6			572.7 - 571.1	.6 ▽	

MALCOLM PIRNIE

APPENDIX G

SUPPLEMENTAL GROUND WATER SAMPLING DATA - MAY 1991

MALCOLM PIRNIE

APPENDIX G

SUPPLEMENTAL GROUND WATER SAMPLING DATA - MAY 1991

1.0 INTRODUCTION

The ground water monitoring wells at the Columbus McKinnon Corporation Remedial Investigation study area were resampled in May 1991 to verify previous (May 1990) sampling results. Malcolm Pirnie's review of the May 1990 sampling results indicates that elevated concentrations of metals and PCB may have occurred in monitoring wells MW-1S and MW-S2 due to the entry of contaminated soil/fill particles into the well.

In order to minimize the potential influence of soil/fill material on ground water sampling results for these two (2) wells, the procedures for well purging and sampling that were presented in Work Plan Addendum 1 and used during the May 1990 sampling event were modified for the May 1991 sampling event and documented in Work Plan Addendum 2. In addition, wells MW-1I and MW-2I were sampled (in addition to MW-1S and MW-2S) in order to evaluate the occurrence of PCB 1242 at the base of the shallow water bearing zone. This occurrence may be anomalous since the 1242 isomer was not detected in any other soil or ground water sample collected during all previous investigations. Well MW-3 was sampled to obtain comparative background concentrations for this sampling event. A description of the sampling program is presented below.

2.0 SAMPLING PROGRAM

A total of five (5) ground water monitoring wells (viz. MW-1S/1I, MW-2S/2I and MW-3) were sampled on May 1-2, 1991. The site specific parameters monitored are listed in Table 1.

Prior to purging, the static ground water levels were measured in the monitoring wells. The results are presented in Table 2. All wells were purged and sampled in accordance with Sections 2.2 and 2.3 of Work Plan Addendum 2. Filtered metals samples and filtered PCB samples were obtained by pressure filtration through a 0.45 μm filter using compressed air. All filtration was performed by pressurizing the sample within the sample bailer and allowing the sample to pass through the filter directly into the laboratory cleaned sample container. This minimized potential sample aeration due to transferring the sample to a separate filtration apparatus. Field measurements were taken for pH, temperature, specific conductivity, and turbidity. A summary of field measurements is presented in Table 3. Field sampling data sheets are given as Attachment 1.

Upon purging, all samples were collected with a teflon bailer. Samples for laboratory analysis were placed in appropriate containers, preserved and cooled for shipment. The samples were transferred under chain-of-custody to Wadsworth Laboratories, Inc. of Pittsburgh, PA. Information pertinent to the purging and sampling of specific wells is detailed below.

2.1 MW-1S

MW-1S was purged with a peristaltic pump at an average flow rate of 0.02 gpm for a period of 22-1/2 hours. The purge water initially contained a suspended rust-colored floc and silt that was removed from the bottom of the well. An iridescent sheen was observed to form on top of the purge water. The well was purged to a turbidity of less than 50 NTU.

The well was allowed to recover for 4 hours prior to sampling in order to obtain a sufficient sample volume. Samples collected from the well immediately after the 4-hour recovery period contained a rust-colored floc, which increased in density as the water level in the well was drawn down by sampling. Filtered samples with a turbidity of 30 NTU were collected following the VOC samples. Total (non-filtered) samples were collected last from near the base of the well and exhibited a substantially higher density of floc than the filtered samples. The well went dry before all sample containers were filled. The well was allowed to recover for one hour and the newly recovered water was visually comparable in terms of floc density to the sample water collected for filtered samples. Measured turbidity was 37 NTU. Therefore, the non-filtered samples collected previously from MW-1S were poured out and re-collected. All NYSDEC split samples, and the Columbus McKinnon VOC and filtered metal and PCB samples were collected from the first recovery volume. Columbus McKinnon non-filtered samples were collected from the second recovery volume.

2.2 MW-1I

This well was purged using a pre-cleaned teflon bailer on 5/1/91. Sampling was delayed until 5/2/91. Therefore, the well was purged again on 5/2/91 prior to sampling.

2.3 MW-2S

MW-2S was purged using a peristaltic pump at an average flow rate of 0.05 gpm. Purging and sampling was performed on 5/1/91. The purge water initially contained a suspended rust-colored flocculent, which cleared during purging, and an oil or solvent-like sheen was observed to form on top of the containerized water.

During sampling, the turbidity of the initial samples were 71 NTU. This was due to a rust-colored floc that was present in the upper portion of the standing water column. As a result, the samples for total metals and total PCBs taken at the top of the water column contained visible amounts of floc. These samples were subsequently poured out and collected again at a lower depth. Since the total volume requirements for Columbus McKinnon samples and NYSDEC split samples was 11 liters, and one (1) well volume was 5.5 liters, MW-2S was effectively purged again during sampling. Two (2) well volumes were removed over a sampling period of approximately one (1) hour. Therefore, the residence for ground water in the well during which precipitates could flocculate and settle from suspension was minimized for all samples.

All samples collected from MW-2S for the analysis of PCBs and metals (filtered and unfiltered) exhibited a red-orange color and a turbidity of approximately 33 NTU. Floc particles of visually observable size were not present. However, pressure filtration of the samples removed the color. Therefore, floc particles with a particle size greater than 0.45 μm were most likely responsible for the observed color.

2.4 MW-2I

Purging and sampling was completed at MW-2I on 5/1/91. Purging was performed with a pre-cleaned teflon bailer. Purge water cleared to <10 NTU at the end of well purging.

2.5 MW-3

Purging and sampling was completed at MW-3 on 5/2/91. Purging was performed with a pre-cleaned teflon bailer. the purged water initially contained a substantial amount of a dark, rust-colored floc. the floc was removed from the wellbore, and a turbidity value of less than 20 NTU was obtained after 50 gallons of water had been removed. Sample water was visually clear of floc and color.

3.0 ANALYTICAL RESULTS

3.1 Laboratory Data

The analytical laboratory report from Wadsworth Alert Laboratories is presented in Attachment II. The data is summarized and discussed in Section 6.3.2 of the RI Report.

3.2 Data Validation

A data validation report is presented in Attachment III.

MALCOLM PIRNIE

TABLE 1

COLUMBUS McKINNON CORPORATION

Ground Water Analytical Parameters

Parameter	Method[2]
Halogenated Volatile Organics	8010
PCBs[1]	8080
Cadmium[1]	7131
Chromium[1]	7191
Nickel[1]	6010
Lead[1]	7421
pH	portable field meter
Turbidity	portable field meter
Specific Conductivity	portable field meter
Temperature	portable field meter

NOTE:

(1) Both total and filtered samples analyzed.

(2) USEPA SW-846, Third Edition, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," September 1986.

MALCOLM PIRNIE

TABLE 2

COLUMBUS McKINNON CORPORATION

Monitoring Well Water Elevations

Well Number	PVC Riser[1] Elevation	Bottom Depth[2]	Static Water	
			Depth[2]	Elevation[1]
MW-1S	573.49	18.11	6.75	566.74
MW-1I	574.07	29.2	6.20	567.87
MW-1D	574.80	-	6.03	568.77
MW-2S	574.35	17.61	8.92	565.43
MW-2I	576.45	29.85	8.62	567.83
MW-2D	575.69	-	8.05	567.64
MW-3	578.56	22.46	6.40	572.16

Note:

(1) Measured in feet above sea level.
(2) Measured in feet; distance from top of PVC riser on May 1, 1991.

TABLE 3

COLUMBUS MCKINNON CORPORATION

TONAWANDA FACILTY

FIELD MEASUREMENT DATA (1)

SAMPLING LOCATION	DATE SAMPLED	SAMPLING TIME	TEMP (C)	pH (UNITS)	CONDUCTANCE (uhmos/cm)	TURBIDITY (NTU)	SAMPLE APPEARANCE
MW-1S	5/02/91	12:05PM	10.5	7.47	370	30	CLEAR
*		1:30PM	10.2	7.41	410	37	CLOUDY
MW-1I	5/02/91	2:10PM	11.7	7.06	800	4.7	CLEAR
*		2:43PM	11.3	7.12	800	6.4	CLEAR
MW-2S	5/01/91	2:27PM	14.8	7.44	750	71	SLIGHTLY TURBID
*		3:40PM	12.6	7.23	700	33	CLEAR
MW-2I	5/01/91	1:20PM	17.3	7.54	940	4	CLEAR
*		2:05PM	15.6	7.48	930	2.5	CLEAR
MW-3	5/02/91	10:53AM	10.1	7.31	650	15	CLEAR
*		11:09PM	9.4	7.29	1125	27	CLEAR

NOTES:

* Measurement taken from the last bailer of water sampled.

MALCOLM PIRNIE

ATTACHMENT 1

FIELD SAMPLING LOGS FOR MAY 1991 GROUND WATER SAMPLING

WATER SAMPLING FIELD DATA SHEETS

PROJECT: Columbus McKinnon - G.W. Sampling
CLIENT: Columbus McKinnon
JOB NO.: 1332-011

TYPE OF SAMPLE: Groundwater
LOCATION NO.: MW-1S
LAB SAMPLE NO.:

WELL DATA: DATE: 5-1-91 TIME: 0930

Casing Diameter (inches): 2
Screened Interval (ft BGS):
Static Water Level Below TOR (ft.): 6.75
Elevation Top of Well Riser:
Elevation Top of Screen:

Casing Material:
Screen Material:
Bottom Depth (ft.) 18.11
Datum Ground Surface:

PURGING DATA: DATE: 5-1-91 TIME: Start: 10:00 Finish: 0830-5-2-91

Method: Peristaltic pump
Well Volumes Purged ($\pi R^2 H/231$): 12
Standing Volume (GAL.) 1.9
Volume Purged (GAL.) 23

Pumping Rate (gal/min):
Was well purged dry? Yes ___ No ✓
Was well purged below sand pack? Yes ✓ No ___

Well I.D. (inches)	Volume (gal/ft)
2	0.17
4	0.66
6	1.50

Is purging equipment dedicated to sample location?
Yes ___ No ✓

Field Personnel: JPH, RHO, RLD

SAMPLING DATA: DATE: 5-2-91 TIME: Start: 1205 Finish: 1330

Method: Teflon Bailer
Sampler: JPH, RLD
Present Water Level (ft.): 6.74
Air Temperature (F°): 50
Depth of Sample (ft.): 6.74
Weather Conditions: cloudy
Is sampling equipment dedicated to sample location: Yes ___ No ✓
Source and type of water used in field for QC purposes: WADSWORTH LABS, INC

PRESERVATION DATA: DATE: 5-2-91 TIME: Start: 1330 Finish: 1332

Filtered: Yes ✓ No ___
Cool to 4°C: ✓
Preservative: H_2SO_4 ___ HNO_3 ✓ NaOH ___ Other ___

PHYSICAL AND CHEMICAL DATA:

Appearance: Clear: ✓ Turbid: ___
Contains Sediment: contains floc
Color: red-orange
Odor:
Other:
Temperature (°C): 10.5/10.2 pH 7.47/7.41
Specific Conductivity (µmhos/cm): 370/410
Turbidity (NTU): 30/37
Other:

REMARKS: Split Samples with DEC - Unfiltered metals, PCB's, VOC's

WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: Columbus McKinnon

PROJECT NO.: 1332 011 153

STAFF: JPH, RHO, RLD

DATE: Wed 5/1/91 + Thurs 5/2/91

WELL NO.: MW-1 S

① TOTAL CASING AND SCREEN LENGTH (FT.): 18.11

② CASING INTERNAL DIAMETER (in.): 2"

③ WATER LEVEL BELOW TOP OF CASING (FT.) 6.75

④ VOLUME OF WATER IN CASING (GAL.) 1.9

V = 0.0408 (②)^2 x (①-③) = ______ GAL.

WELL I.D.	VOL. GAL./FT.
1"	0.04
2"	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)										
Gallons	<1	>1	5	7	5/2 25						
Time	10:00	11:10	11:45	1:10	12:00						
Temp	14.4	12.3	15.6	15.2	10.5						
Turbidity	>100	>100	60	36	30						
pH	6.71	7.32	7.35	7.62	7.47						
Conductivity	375	390	410	420	370						

COMMENTS:
- Reportedly muddy (silt) bottom when initial depth taken
- began purging at 930
- H_2O @ 9.95 @ 11:45
- H_2O @ 9.95 @ 1:00
- pumped w/slow peristaltic purge until 8:30 Am 5/2/91 removed Approx 18 gallons overnight

5/2 pumping discontinued at 8:30 Am well allowed to recharge prior to sampling

Average Pumping Rate 25gal/1350 min = (0.02 gpm)

MALCOLM PIRNIE

WATER SAMPLING FIELD DATA SHEETS

PROJECT: Columbus McKinnon - Sampling
CLIENT: Columbus McKinnon
JOB NO.: 1332-011

TYPE OF SAMPLE: Groundwater
LOCATION NO.: MW - 1 I
LAB SAMPLE NO.:

WELL DATA: DATE: 5-2-91
TIME: ~~0435~~ 1330
Casing Diameter (inches): 2
Casing Material: Stainless Steel
Screened Interval (ft BGS):
Screen Material:
Static Water Level Below TOR (ft.): 6.07
Bottom Depth (ft.) 29.2
Elevation Top of Well Riser:
Datum Ground Surface:
Elevation Top of Screen:

PURGING DATA: DATE: 5-1-91/5-2-91
TIME: Start: 5-2-91 1335 Finish: 1400
Method: Teflon Bailer
Pumping Rate (gal/min):
Well Volumes Purged ($\pi R^2 H/231$): ~~3.8~~ 6.5
Was well purged dry? Yes ___ No ✓
Standing Volume (GAL.) 3.9
Was Well purged below sand pack? Yes ___ No ✓
Volume Purged (GAL.) 25

Well I.D. (inches)	Volume (gal/ft)
2	0.17
4	0.66
6	1.50

Is purging equipment dedicated to sample location?
Yes ___ No ✓

Field Personnel:

SAMPLING DATA: DATE: 5-2-91
TIME: Start: 1410 Finish: 1443
Method: Teflon Bailer
Sampler: JPH, RLD
Present Water Level (ft.): 6.14
Air Temperature (F°): 50
Depth of Sample (ft.): 6.14
Weather Conditions: Cloudy
Is sampling equipment dedicated to sample location: Yes ___ No ✓
Source and type of water used in field for QC purposes: WADSWORTH LABS Inc

PRESERVATION DATA: DATE: 5-2-91
TIME: Start: 1445 Finish: 1446
Filtered: Yes ✓ No ___
Cool to 4°C: ✓
Preservative: H_2SO_4 ___ HNO_3 ✓ NaOH ___ Other ___

PHYSICAL AND CHEMICAL DATA:
Appearance: Clear: ✓ Turbid: ___
Color:
Contains Sediment ___
Odor: Other:
Temperature (°C): 11.7/11.3 pH 7.06/7.12
Specific Conductivity (µmhos/cm): 800/800
Turbidity (NTU): 4.7/6.4
Other:

REMARKS: MS/MSD Taken at MW 1I
Well purged 5-1-91 and 5-2-91

WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: Columbus McKinnon

PROJECT NO.: 1332 011 153

STAFF: JPH, RHO, RLD

DATE: Wed 5/1/91

WELL NO.: MW-1I

① TOTAL CASING AND SCREEN LENGTH (FT.): 29.2

② CASING INTERNAL DIAMETER (in.): 2"

③ WATER LEVEL BELOW TOP OF CASING (FT.) 6.2

④ VOLUME OF WATER IN CASING (GAL.) 3.9

V = 0.0408 (②)^2 x (①-③) = ______ GAL.

WELL I.D.	VOL. GAL./FT.
1"	0.04
2"	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)										
Gallons	2.5	5	7	8	10						
Time	10:20	10:55	11:05	11:15	11:25						
Temp	13	13	13.3	13.0	13.6						
Turbidity	>100	>100	60	27	12						
pH	6.75	6.88	7.08	7.06	7.05						
Cond	700	850	800	725	750						

COMMENTS: Started bailing @ 10:10

MALCOLM PIRNIE

WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: Columbus McKinnon

PROJECT NO.: 1332 011 153

STAFF: JPH, RHO, RLD

DATE: Thur 5/2/91

WELL NO.: MW-1I

	WELL I.D.	VOL. GAL./FT.
① TOTAL CASING AND SCREEN LENGTH (FT.): 29.2	1"	0.04
② CASING INTERNAL DIAMETER (in.): 2	2"	0.17
	3"	0.38
③ WATER LEVEL BELOW TOP OF CASING (FT.) 6.07	4"	0.66
	5"	1.04
④ VOLUME OF WATER IN CASING (GAL.) 3.9	6"	1.50
	8"	2.60

V = 0.0408 (②)^2 x (①-③) = ______ GAL.

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)										
Gallons	initial	5	10	15							
Time	1:40	1:50	1:55	2:00							
Temp	10.6	11.4	11.3	11.7							
Turbidity	6	8	7	4							
pH	7.17	7.02	7.00	7.08							
Cond	780	800	800	800							

COMMENTS: started bailing @ 1:35

MALCOLM PIRNIE

WATER SAMPLING FIELD DATA SHEETS

PROJECT: Columbus McKinnon - G.W. Sampling
CLIENT: Columbus McKinnon
JOB NO.: 1332011

TYPE OF SAMPLE: Ground Water
LOCATION NO.: MW - 2S
LAB SAMPLE NO.:

WELL DATA: DATE: 5-1-91 TIME: 0855
Casing Diameter (inches): 2
Casing Material:
Screened Interval (ft BGS):
Screen Material:
Static Water Level Below TOR (ft.): 8.92
Bottom Depth (ft.) 12.61
Elevation Top of Well Riser:
Datum Ground Surface:
Elevation Top of Screen:

PURGING DATA: DATE: 5-1-91 TIME: Start: 0945 Finish: 1150
Method: Peristaltic Pump
Pumping Rate (gal/min):
Well Volumes Purged ($\pi R^2 H/231$): 4
Was well purged dry? Yes ___ No ✓
Standing Volume (GAL.) 1.5
Was Well purged below sand pack? Yes ✓ No ___
Volume Purged (GAL.) 6

Well I.D. (inches)	Volume (gal/ft)
2	0.17
4	0.66
6	1.50

Is purging equipment dedicated to sample location? Yes ___ No ✓
Field Personnel: JPH, RHO, RLD

SAMPLING DATA: DATE: 5-1-91 TIME: Start: 1427 Finish: 1540
Method: Teflon Bailer
Sampler: RLD RHO JPH
Present Water Level (ft.): 9.4
Air Temperature (F°): 70
Depth of Sample (ft.): 9.4
Weather Conditions: cloudy
Is sampling equipment dedicated to sample location: Yes ___ No ✓
Source and type of water used in field for QC purposes: WADSWORTH LABS INC

PRESERVATION DATA: DATE: 5-2-91 TIME: Start: 1430 Finish: 1445
Filtered: Yes ✓ No ___
Cool to 4°C: ✓
Preservative: H_2SO_4 ___ HNO_3 ✓ NaOH ___ Other ___

PHYSICAL AND CHEMICAL DATA:
Appearance: Clear: ✓ Turbid: ___
Color: red-orange
Contains Sediment: NO
Odor: Other:
Temperature (°C): 14.8/12.6 pH 7.44/7.23
Specific Conductivity (µmhos/cm): 750/700
Turbidity (NTU): 71/33
Other:

REMARKS: Samples split with DEC — Filtered + UnFiltered metals, - Filtered + UnFiltered PCBs VOCs
Due to weather, samples were filtered inside Columbus McKinnon Bldg.
Equip Blank poured after sampling MW -2S

WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: Columbus McKinnon

PROJECT NO.: 1332 011 153

STAFF: JPH, RHD, RLD

DATE: Wed 5/1/91

WELL NO.: MW-2S

① TOTAL CASING AND SCREEN LENGTH (FT.): 17.61

② CASING INTERNAL DIAMETER (in.): 2

③ WATER LEVEL BELOW TOP OF CASING (FT.) 8.92

④ VOLUME OF WATER IN CASING (GAL.) 1.5

$V = 0.0408 (②)^2 \times (① - ③) =$ ______ GAL.

WELL I.D.	VOL. GAL./FT.
1"	0.04
2"	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)										
Gallons		3	5	6							
Time	9:45	10:45	11:25	11:50							
Temp	13.4	13.8	13.2	14.6							
Conductivity	600	605	550	650							
pH	6.12	6.86	7.07	7.11							
Turbidity	10	14	2.9	3.2 clear							

COMMENTS: Started purging @ 9:00 Am
wl 12.9 (TOR) @ 11:52

Average Pumping Rate 6 gal / 125 min = 0.05 gpm

MALCOLM PIRNIE

WATER SAMPLING FIELD DATA SHEETS

PROJECT: Columbus McKinnon G.W. Sampling
CLIENT: Columbus McKinnon
JOB NO.: 1332011
TYPE OF SAMPLE: Ground water
LOCATION NO.: MW - 2I
LAB SAMPLE NO.:

WELL DATA: DATE: 5-1-91 TIME: 1025
Casing Diameter (inches): 2"
Casing Material: Stainless Steel
Screened Interval (ft BGS):
Screen Material:
Static Water Level Below TOR (ft.): 8.62
Bottom Depth (ft.) 29.85
Elevation Top of Well Riser:
Datum Ground Surface:
Elevation Top of Screen:

PURGING DATA: DATE: 5-1-91 TIME: Start: 1030 Finish: 1120
Method: Teflon Bailer
Pumping Rate (gal/min):
Well Volumes Purged ($\pi R^2 H/231$): 3
Was well purged dry? Yes ___ No ✓
Standing Volume (GAL.) 3.6
Was Well purged below sand pack? Yes ___ No ✓
Volume Purged (GAL.) 10.8

Well I.D. (inches)	Volume (gal/ft)
2	0.17
4	0.66
6	1.50

Is purging equipment dedicated to sample location?
Yes ___ No ✓
Field Personnel: RLD JPH RHO

SAMPLING DATA: DATE: 5-1-91 TIME: Start: 1320 Finish: 1405
Method: Teflon Bailer
Sampler: RLD RHO JPH
Present Water Level (ft.): 8.8
Air Temperature (F°): 70
Depth of Sample (ft.): 8.8
Weather Conditions: Sunny
Is sampling equipment dedicated to sample location: Yes ___ No ✓
Source and type of water used in field for QC purposes: WADSWORTH LABS INC.

PRESERVATION DATA: DATE: 5-1-91 TIME: Start: 1325 Finish: 1410
Filtered: Yes ✓ No ___
Cool to 4°C: ✓
Preservative: H_2SO_4 ___ HNO_3 ✓ NaOH ___ Other ___

PHYSICAL AND CHEMICAL DATA:
Appearance: Clear: ✓ Turbid: ___
Color:
Contains Sediment ___
Odor: Other:
Temperature (°C): 17.3 / 15.6 pH 7.54 / 7.48
Specific Conductivity (µmhos/cm): 940 / 930
Turbidity (NTU): 4 / 2.5
Other:

REMARKS: Field BLANK obtained From MW-2I
Split SAmples with DEC - Filtered + UnFiltered metals / PCB, VOC's

WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: Columbus McKinnon

PROJECT NO.: 1332 011 153

STAFF: JPH, RHD, RLD

DATE: Wed 5/1/91

WELL NO.: MW-2I

① TOTAL CASING AND SCREEN LENGTH (FT.): 29.85

② CASING INTERNAL DIAMETER (in.): 2"

③ WATER LEVEL BELOW TOP OF CASING (FT.) 8.62

④ VOLUME OF WATER IN CASING (GAL.) 3.6

$V = 0.0408 (②)^2 \times (① - ③) =$ ________ GAL.

WELL I.D.	VOL. GAL./FT.
1"	0.04
2"	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)										
Gallons	3.6	7.2	10.8								
Time	10:30	11:00	11:20								
Temp	12	12.5	13.1								
Turbidity	27	9.2	5.9								
pH	6.66	6.98	6.97								
Cond	795	925	800								

COMMENTS:

MALCOLM PIRNIE

WATER SAMPLING FIELD DATA SHEETS

PROJECT: Columbus McKinnon - G.W. Sampling
CLIENT: Columbus McKinnon
JOB NO.: 1332-011

TYPE OF SAMPLE: Groundwater
LOCATION NO.: MW-3
LAB SAMPLE NO.:

WELL DATA: DATE: 5-2-91 TIME: 0850

Casing Diameter (inches): 2"
Casing Material: Stainless Steel
Screened Interval (ft BGS):
Screen Material:
Static Water Level Below TOR (ft.): 6.40
Bottom Depth (ft.) 22.46
Elevation Top of Well Riser:
Datum Ground Surface:
Elevation Top of Screen:

PURGING DATA: DATE: 5-2-91 TIME: Start: 0853 Finish: 1009

Method: Teflon Bailer
Pumping Rate (gal/min):
Well Volumes Purged ($\pi R^2 H/231$): ~~50~~ 18.5
Was well purged dry? Yes ___ No ✓
Standing Volume (GAL.) 2.7
Was Well purged below sand pack? Yes ___ No ✓
Volume Purged (GAL.) 50

Well I.D. (inches)	Volume (gal/ft)
2	0.17
4	0.66
6	1.50

Is purging equipment dedicated to sample location? Yes ___ No ✓

Field Personnel: JPH / RLD

SAMPLING DATA: DATE: 5-2-91 TIME: Start: 1053 Finish: 1109

Method: Teflon Bailer
Sampler: JPH / RLD
Present Water Level (ft.): 6.73
Air Temperature (F°): 48
Depth of Sample (ft.): 6.73
Weather Conditions: cloudy
Is sampling equipment dedicated to sample location: Yes ___ No ✓
Source and type of water used in field for QC purposes: WADSWORTH LABS INC

PRESERVATION DATA: DATE: 5-2-91 TIME: Start: 1115 Finish: 1118

Filtered: Yes ✓ No ___
Cool to 4°C: ✓
Preservative: H_2SO_4 ___ HNO_3 ✓ NaOH ___ Other ___

PHYSICAL AND CHEMICAL DATA:

Appearance: Clear: ✓ Turbid: ___
Color:
Contains Sediment
Odor:
Other:
Temperature (°C): 10.1 / 9.4 pH 7.31 / 7.29
Specific Conductivity (µmhos/cm): 650 / 1125
Turbidity (NTU): 15 / 27
Other:

REMARKS: initial purge water has a dense, rust-colored floc.

WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: Columbus McKinnon

PROJECT NO.: 1332-011 153

STAFF: JPH, RHD, RLD

DATE: Thur 5/2/91

WELL NO.: MW-3

① TOTAL CASING AND SCREEN LENGTH (FT.): 22.46

② CASING INTERNAL DIAMETER (in.): 2"

③ WATER LEVEL BELOW TOP OF CASING (FT.) 6.4

④ VOLUME OF WATER IN CASING (GAL.) 2.7

V = 0.0408 (②)² x (① - ③) = ________ GAL.

WELL I.D.	VOL. GAL./FT.
1"	0.04
2"	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)										
Gallons	Initial / 5	10	15	20	25	30	40	45	50		
Time	0853 / 0859	0907	0915	0922	0932	0937	0952	1000	1009		
Temp	9.3 / 9.0	8.9	9.0	9.1	9.3	8.9	8.5	8.4	8.7		
Turbidity	70 / >100 RED	>100 LT Brown	>100 LT Brown	>100 LT Gray	Less Turbid 95	Turbid cloudy >100	Cloudy >100	Less Turbid 70	Clear 19		
pH	6.38 / 6.61	6.79	6.71	6.71	6.89	7.01	7.19	7.19	7.16		
Cond	690 / 700	700	695	690	695	695	695	695	700		

COMMENTS: • Arrived @ 8:45 well #3
(Appearance Initial) — Red, High Iron Floc

MALCOLM PIRNIE

ATTACHMENT II

LABORATORY ANALYTICAL REPORT
FOR
MAY 1991 GROUND WATER SAMPLING

**Due to large volume of analytical results,
the analytical report has been sent under separate cover.**

ATTACHMENT III

DATA VALIDATION REPORT
FOR
MAY 1991 GROUND WATER SAMPLING

QUALITY CONTROL

INTRODUCTION

This section details an assessment and validation of analytical results reported for five (5) ground water samples which were collected from the Columbus McKinnon Site. All samples were collected by Malcolm Pirnie personnel during the period May 1 through May 2, 1991. The samples were analyzed by Wadsworth/Alert Laboratories, Inc. for volatile organic compounds, PCBs and the inorganic elements nickel, cadmium, chromium and lead.

The USEPA "Functional Guidelines for Evaluating Organic Analyses" (February 1988) and "Functional Guidelines for Evaluating Inorganic Analyses" (June 1988), hereinafter referred to as "guidelines", were used for the validation.

SAMPLE HOLDING TIMES

The federal guidelines for evaluating organic analyses, define the holding time as the number of days from sample collection to the date of analysis or extraction. For volatile organics, the federal guidelines recommend a maximum holding time of fourteen days for preserved aqueous samples. According to the 1987 NYSDEC CLP protocol, the maximum holding time for aqueous samples intended for volatile organic analyses is seven days from Verified Time of Sample Receipt (VTSR) to date of analyses regardless of preservation.

By comparing the actual dates of sample receipt to the dates of analyses, the following samples submitted for volatile organic analyses were analyzed after the maximum holding time mandated by the NYSDEC had expired, but were within the maximum holding time prescribed by the EPA:

Sample	Holding Time
MW2I	9 days
MW2I dupe	9 days
MW2S	9 days
MW1I	8 days
MW1S	8 days
MW3	8 days

According to the guidelines, any positive results for volatile organic compounds detected in these samples should be estimated and qualified with a "J".

For PCBs, the federal guidelines recommend a maximum holding time of seven days from date of collection to date of extraction. The extract must then by analyzed within forty days. This holding time applies to both soil/sediment and aqueous samples. The 1987 NYSDEC CLP protocol recommends a maximum holding time of five days from VTSR to date of extraction for aqueous samples. A review of the holding times for PCB extraction indicated that samples MW2I, MW2I (FILT), MW2S and MW2S (FILT) were extracted six (6) days from VTSR. However, these samples were extracted within federal holding time requirements and it is unlikely that the one-day exceedance of 1987 NYSDEC CLP requirements has resulted in any substantial loss of potential PCB contamination. Therefore, no qualification of the PCB data based on holding time is required.

For inorganics, the following holding times have been established under 40 CFR Part 136 (Clean Water Act). Preservation refers to aqueous samples only:

Metals: 6 months; preserved at pH < 2
Mercury: 28 days; preserved at pH < 2

An evaluation of the inorganic analytical data indicated that all ground water samples submitted for inorganic analyses were analyzed prior to expiration of the established holding times. In addition, all samples were preserved with the appropriate preservatives. Therefore, no qualification of the inorganic data based on holding time is required.

BLANKS

The purpose of assessing the results of blank analyses is to determine the existence and magnitude of contamination which may potentially be introduced during preparation of sample containers, sample collection and/or sample analysis. Many types of blanks such as laboratory/method blanks, field/equipment blanks and trip blanks are analyzed. Each type of blank will give the data user an indication of the source of the contamination, if any.

According to the guidelines, blank evaluation criteria apply to any blank associated with the samples. When more than one blank is associated with a given sample, qualification is based on a comparison with the associated blank having the highest concentration of a contaminant.

Positive results for compounds reported in the samples at a concentration of less than ten (10) times the associated blank contamination value, [five (5) times for less common contaminants], are qualified as not detected (ND) and the method detection limit (MDL) set equal to the value detected in the sample. The MDL is then qualified with a "B".

As part of this sampling program, trip blanks and an equipment blank were collected. In addition, the laboratory analyzed method blanks. An evaluation of all blank data for inorganic analyses indicated that no inorganic contaminants were detected in any of the blanks. An evaluation of the blank data for organic analyses indicated the following volatile organic contamination:

Blank Identification	Analyte	Concentration (ug/l)
Equipment Blank 5/1	1,2-dichloroethane 1,1,1-trichloroethane tetrachloroethene chloroform methylene chloride	0.82 0.56 0.38 0.72 10
Trip Blank 5/1	1,1,1-trichloroethane 1,1,2-trichloroethane tetrachloroethene methylene chloride	0.40 0.64 0.54 12
Trip Blank 5/2	tetrachloroethene methylene chloride	0.51 7.5
Intra-lab Blank 5/13	1,1,2-trichloroethane 1,1,2,2-tetrachloroethane tetrachloroethene methylene chloride	0.65 0.74 0.57 3.3

MATRIX SPIKE/MATRIX SPIKE DUPLICATE (MS/MSD) ANALYSES

MS/MSD data are generated to determine long-term precision and accuracy of the analytical method on various matrices. Matrix spike recoveries must be within advisory limits given in the guidelines. The relative percent difference between the MS and the MSD must also be within advisory limits given in the guidelines. An evaluation of the MS/MSD data indicated that all criteria were met for the analytes of interest.

SURROGATE SPIKE RECOVERY

An evaluation of the surrogate spike recovery data indicated that all recoveries were within limits established by the laboratory.

FIELD DUPLICATE PRECISION

A field duplicate sample was collected to assess the aggregate analytical and sampling protocol precision. The results of the duplicate sample generally showed satisfactory reproducibility indicating adequate analytical and sampling protocol precision.

CHECK SAMPLE RECOVERY

As an additional evaluation of technique, methodology and calibration, check samples were analyzed for volatile organic compounds, PCBs, and inorganic elements. Each of the check samples consisted of reagent-grade water which had been spiked with the analytes of interest by an independent source.

The check sample recoveries for volatile organic compounds were within established control limits except for the recovery of chloromethane. This compound exhibited a recovery slightly less than the lower control limit established by the laboratory, indicating a potential low bias in any reported result for this compound.

A review of the inorganic check sample recovery data and the PCB check sample recovery data indicated that all recoveries were within established control limits.

CONCLUSION

Based on the above assessment, the analytical data generated for ground water samples collected at the Columbus McKinnon Site is considered to be valid and useful for the purpose of conducting the RI/FS. It is recommended that the analytical data be accepted with the specific qualifications noted herein.